DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

Effectiveness of a canteen and a behavioural worksite intervention to lower cardiometabolic risk in South Africa

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DECLARATION

I, Evonne Shanita Singh, hereby declare that the research work presented in this thesis is my original work and all the materials used are appropriately acknowledged and explicitly referenced. A reference list is attached to the thesis.

I also confirm that the thesis has not been submitted in any of its part or entirety for any degree in any other institution of higher learning locally or internationally.

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DEDICATION

I dedicate this thesis to:

My mum, Sabitha Singh and in memory of my dad, Jugdev Singh

My husband Alvin and children Caylee and Kyle

My siblings, Sharon, Julie and Reshmee

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ABSTRACT

Background: Chronic lifestyle diseases like type-2 diabetes, hypertension and dyslipidaemia are modifiable; however, these non-communicable diseases (NCDs) are set to outpace communicable diseases in South Africa. The South African population has a high prevalence of NCDs, including genetic lipid disorders, diabetes and hypertension, meaning that the risk for undiagnosed conditions, like prediabetes and prehypertension, to develop to diabetes and hypertension, respectively, is high. As employees spend much of their waking hours at work, an opportunity exists to engage with this subset of the population for targeted NCD reduction goals. This study used the worksite setting as a backdrop for the implementation of targeted interventions aimed at reducing employee cardiometabolic risk. The resulting gains have economic significance for the employee, the employer, and the country. It also has direct potential to improve employees' quality of life.

Aim: To measure the effectiveness of a canteen and behavioural intervention versus a canteen-only intervention among participants by evaluating the change in number of individuals reaching two or more cardiometabolic risk goals, namely reductions in blood pressure, triglycerides, and glycated haemoglobin (HbA1c) - the primary outcome, and through changes in secondary outcomes including rates of type-2 diabetes prevalence and regression to normoglycemia and changes in anthropometry, lipids, and glucose.

Methodology: This two-arm randomised controlled trial (RCT) featuring a canteen and behavioural arm (CB) and a canteen-only arm (CO), was structured to provide a six-week intervention to employees at two multinational companies spread across eight worksites. Prior to randomisation, all employees were informed about the pending study through information packs distributed at employee staff meetings and during promotional visits to worksites. The information packs contained details on the study, the purpose, duration, partners, expectations, and privacy clause. A two-step screening process was followed to recruit eligible employees for the study. In step one, consenting employees from the eight worksites were screened for inclusion in the study using an eight-question survey. In step two, eligible participants from step one underwent clinical tests (HbA1c, lipids and blood pressure measurements). Consenting employees who were either prediabetic or prehypertensive completed the baseline assessments, which included anthropometry, a demographic and lifestyle survey, a dietary questionnaire, the Global Physical Activity Questionnaire (GPAQ) and the 24-hour food recall. Participants were randomised to the CB and CO treatment groups. The CO group received six weeks of canteen intervention (changes to enable a healthy food environment). In comparison, the CB group received six weeks of canteen intervention along with a behavioural intervention. The CB intervention included an intense six-week lifestyle programme based on the Diabetes Prevention Programme (DPP). The lifestyle classes were held two days per week at each worksite, with three time slots per day to facilitate employee attendance. After the intervention period, a post-test was used to repeat the clinical tests (HbA1c, lipids and blood pressure measurements), measurements for anthropometry and the 24-hour food recall. Data were analysed to assess the effectiveness of the CB and the CO intervention on cardiometabolic risk factors among prediabetic and prehypertensive employees. Diet quality was assessed through the dietary quality questionnaire (DQQ) indicators, and the Framingham Risk Score was used to calculate participants' 10-year risk for developing cardiovascular disease (CVD).

Results: Out of a potential pool of 3000 employees, 797 employees participated in the screening process. After applying exclusion criteria and obtaining consent, 147 employees agreed to participate in the RCT. Of these, 72 were assigned to the CB arm, and 75 to the CO arm. In this study, success was defined by a systolic blood pressure decrease ≥ 5mmHg, a decrease in plasma triglycerides ≥0.1 mmol/L and a decrease of ≥0.5% in HbA1c. In the CO intervention arm, twenty-two participants met no improvement of cardiometabolic risk factors while 29 (19.7%) participants met one, 23 (15.6%) participants improved two; and one (0.68%) participant improved all three cardiometabolic risk factors. In the CB intervention group, 21 (14.2%) participants met no improvement of cardiometabolic risk factors, 38 (25.8%) participants improved one risk factor, 13 (8.8%) participants improved two, and none improved three cardiometabolic risk factors. To evaluate the effectiveness of the CO arm on diabetes risk, 6 (4.0%) participants met the intended intervention effect; however, 69 (46.9%) did not. From baseline (BL) to endline (EL), 2 (1.3%) participants were diagnosed as diabetic, 20 (13.6%) participants presenting with prediabetes at BL increased to 23 (15.6%) presenting with prediabetes at EL and finally, 53 (36%) participants without diabetes decreased to 50 (34%) at EL. To measure the effectiveness of a CB intervention on diabetes risk, 6 (4%) participants met the intended intervention effect however, 66 (44.8%) did not. From BL to EL, 1 (0.68%) participant was diagnosed as diabetic, 22 (14.9%) participants at BL increased to 26 (1.6%) presenting with prediabetes and finally, 49 (33.3%) participants without diabetes decreased to 45 (30.6%) at EL. To evaluate the combined effect of a CB intervention versus a CO intervention on diabetes risk, 12 (8.1%) participants met the intended intervention effect; however, 135 (95%) did not. Overall, post intervention improvements were noted for the whole group when no targeted cutoffs were applied, meaning that these participants improved their risk factors but not within projected reduction cutoffs.

Conclusion: Cardiometabolic risk factors were improved for some participants using CB or CO interventions at worksites. Given that the CB and CO interventions produced similar results, the CO intervention has the potential to have a broader reach across the entire worksite, regardless of employees' health conditions, as most employees engage with the worksite food environment (canteens, board room meals, tea stations). Promoting an enabling worksite food environment is likely to encourage healthy eating habits. Unlike the CB intervention, which is more resource-intensive, the CO intervention is more feasible to implement**.** These results were achieved under a challenging COVID-19 lock-down period through the implementation of a 6-week intervention. There is potential to improve these outcomes outside the influence of COVID-19 and by using a longer duration intervention. Collectively, improved employee health has gains for the organisation, their employees and the country. Scope also exists to improve the effectiveness of the outcome outside of a research study and through more integrated communication and support from the different role players, including human resources, shift supervisors, management, occupational health staff and through the election of employee health champions.

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Disclaimers:

This research utilises United Kingdom (UK) English intext.

Terms are provided in full, followed by abbreviations when they first appear per chapter; thereafter, the abbreviated form is used within each chapter.

LIST OF ABBREVIATIONS

AI	Adequate intake
AIDS	Acquired Immune Deficiency Syndrome
BL	Baseline
BMI	Body Mass Index
BP	Blood Pressure
CB	Canteen and Behavioural
CBHIs	Community-based Health Interventions
CDs	Communicable Diseases
CDC	Centers for Disease Control and Prevention
CMD	Cardiometabolic Disease
CO	Canteen Only
CONSORT	Consolidated Standards of Reporting Trials
COVID-19	Infectious Disease caused by the SARS-CoV-2 Virus
CV	Cardiovascular
CVD	Cardiovascular Disease
DALYs	Disability Adjusted Life Years
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
DPP	Diabetes Prevention Program
DQQ	Diet Quality Questionnaire
DUT	Durban University of Technology
EAR	Estimated Average Requirement
EER	Estimated Energy Requirement
EL	Endline
ENDS	Electronic Nicotine Delivery Systems
ESC	European Society of Cardiology
EAS	European Atherosclerosis Society
FCTC	Framework Convention on Tobacco Control
FGDS	Food Group Diversity Score
GAIN	Global Allince for Improved Nutrition
GATS	Global Adult Tobacco Survey
GBD	Global Burden of Disease
GDP	Gross Domestic Product

GDR	Global Dietary Requirement
GI	Glycaemic Index
GHI	Global Hearts Initiative
GPAQ	Global Physical Activity Questionnaire
HbA1c	Glycated Haemoglobin
HDL	High-Density Lipoprotein
HICs	High-Income Countries
HLPE	High Level Panel of Experts
HIV	Human Immunodeficiency Virus
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
IOM	International Institute of Medicine
IREC	Institutional Research And Ethical Clearance
Kg	Kilogram
LDL	Low Density Lipoprotein
LMICs	Low-and Middle-Income Countries
MDGs	Millennium Development Goals
METs	Metabolic Equivalents
MetS	Metabolic Syndrome
MDD-W	Minimum Dietary Diversity for Women
MS	Microsoft
NCD	Non-communicable Disease
NDIS	National Dietary Intake Survey
NDP	National Development Plan
OHN	Occupational Health Nurse
UB	Unilever Boksburg
UK	United Kingdom
UNILEVER (I)	Unilever Indonsa
UNILEVER (K)	Unilever Khanyisa
UNILEVER (LL)	Unilever La Lucia
UNILEVER (LV)	Unilever Lordsview
UNILEVER (MW)	Unilever Maydon Wharf
UNILEVER (P)	Unilever Phoenix
UPL	Universal Pathology Laboratory

WC	Waist Circumference
WFE	Worksite Food Environment
WHO	World Health Organisation

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The first chapter of this dissertation presents an overview of the research study, emphasising its significance and relevance. It establishes the research context, delineates the aim, objectives, assumptions, and study parameters. The conceptual framework and breakdown of the dissertation's structure are also provided.

1.2 Background to the study

The growing burden and impact of non-communicable diseases (NCDs) are amplified in low-and middle-income countries (LMICs) with cardiovascular diseases (CVDs), type-2 diabetes, cancers, and respiratory diseases accounting for 77% of mortality (World Health Organisation (WHO) 2022a: para. 1). In South Africa (SA), the concurrent and high prevalence of communicable diseases (CDs) like the Human Immunodeficiency Virus (HIV)/ Acquired Immune Deficiency Syndrome (AIDS) and Tuberculosis (TB) (Centers for Disease Control and Prevention (CDC) 2022: para. 6) compounds the burden with the increased potential for comorbidity and multimorbidity (Wong *et al.* 2021: e968). Multimorbidity, which demands complex healthcare, can overwhelm an already burdened healthcare system (Modjadji 2021: 890; Remais *et al.* 2013: 1) as it translates to a need for long-term treatment plans overseen by a team of healthcare professionals (WHO 2023a: 15). This places prolonged, higher demand and higher costs on the South African healthcare system (Kohli-Lynch *et al.* 2022*:* 1). It must be noted that the global cost of NCDs is projected to rise to $47 trillion by 2030 (Duff-Brown 2017). This places great strain on individuals, families, and communities, negatively impacting the overall economy (National Department of Health (NDoH) 2022: 67; Saeedi *et al.* 2019: 2; Juma *et al.* 2018: 2).

A mix of factors, including genetics, socioeconomic status, influence from the food production and marketing environment, rapid urbanisation, and a nutrition transition alongside low levels of physical activity (PA) is driving the global increase in the number of individuals who are overweight and obese and are direct contributors to the NCDs rapid trajectory (WHO 2023a: 13). Non-communicable diseases including ischemic heart disease, stroke and type-2 diabetes were among the top five causes of death in SA in 2019 (Institute for Health Metrics and Evaluation 2021: para. 7), thus it is essential to re-evaluate and seek interventions that can help reshape our response to NCDs and its impact.

1.3 Disease cluster

Obesity has a two-fold identity in the literature: as a chronic disease and as a risk factor for other NCDs (Global Nutrition Report 2022a: 134). Obesity can be prevented; however, over the past four decades, obesity prevalence has tripled. Globally, 39% of adults are overweight and 13% obese (WHO 2021a: para. 4). The South African country nutrition profile indicates that 67% of females and 43% of males were overweight, while 42.9% of females and 18.2% of males were obese (Global Nutrition Report 2022b: para. 9). The WHO defines overweight as having a body mass index (BMI) ≥ 25kg/m^2, while obesity is greater or equal to 30kg/m^2 (WHO 2021a: para. 2). Abdominal obesity, when present, has been linked to metabolic syndrome (MetS) (Misra and Khurana 2008: S10; Catapano et al. 2016: 42; Engin 2017: 1). When combined with an unhealthy diet, increasing age, high waist circumference (WC) and low levels of PA, obesity often co-presents with other metabolic syndrome conditions like high blood pressure, high blood glucose and high triglycerides (WHO 2022b: para. 5), and as indicated by Dobrowolski *et al*. (2022: 99), this increases a population's risk for the development of chronic lifestyle diseases like type-2 diabetes, hypertension and lipid disorders like dyslipidaemia. Alkhatib *et al.* (2021: 6) and Dobrowolski *et al.* (2022: 99), posit that modifying lifestyle risk factors can help reduce the high prevalence of MetS risk factors. South Africa, like Poland, is considered a high CVD risk country where multimorbidity is rising, and likewise would need to take a broad intervention approach to address and reduce multimorbidity risk factors, rather than isolating and focusing on one single factor (Dobrowolski *et al*. 2022: 99).

Chronic lifestyle diseases lead to impaired quality of life (NDoH 2022: 40) and a higher probability of premature death (NDoH 2022: 22; Mache *et al.* 2015: 828), i.e., death before 70 years (WHO 2013: 7). Pharmacology and palliative care are often used to treat and manage lifestyle related NCDs once diagnosed (WHO 2022a: para. 1); however, in the long term, a more cost-effective strategy for LMICs is to prevent, reduce and control the development of NCDs through screening (NDoH 2014: 8). Early detection i.e., while the disease is classified as prediabetes (Hostalek 2019: 1; Grundlingh *et al.* 2022: 1; Zwane *et al.* 2023: 4) prehypertension (Malik *et al.* 2022: 2), or before progression to dyslipidaemia (Kidwai *et al.* 2020: 1339), presents an opportunity to implement well-timed, targeted intervention programmes for lifestyle risk management, to curb the disease's natural progression to diabetes, hypertension, and lipid disorders, respectively. The South African population has a high prevalence of genetic lipid disorders, so early testing is recommended (Klug 2012: 179). South Africans also have a high prevalence of undiagnosed diabetes (Ekoru *et al.* 2019: 40) and related NCDs, meaning that early detection of the disease is not prioritised, thus the risk for undiagnosed conditions, like prediabetes to progress to type-2 diabetes, is high (CDC 2023a: para. 4). The CDC (2023a: para. 4) asserts that people with prediabetes could become diabetic within five years without timeous intervention. This has economic, personal and healthcare implications. The worldwide economic impact of overweight and obesity is predicted to reach $4.32 trillion by 2035 if timely prevention, control, and treatment are not improved (World Obesity Federation 2023: 12; NDoH 2022: 20).

The challenge is that SA's unequal and inadequate access to healthcare with its dual public-private healthcare system means the public sector, with lower resources, funds the larger proportion of the population (Gordon *et al.* 2020: 2). Thus, a large percentage of the South African population remain undiagnosed, and when people do eventually get diagnosed, they could have moved from preterm disease to full-term disease without being aware of their condition and secondly, they can miss accessing the window period, within which modifiable interventions could be used to mitigate the progression of prediabetes, prehypertension, and early lipid disorders. Critically, SA is not on track to achieve the Sustainable Development Goal (SDG) 3.4 aimed at reducing by 25%, the risk of premature mortality from NCDs by 2025 (WHO 2018a: 10). However, in recognition of the large and steadily increasing number of deaths from NCDs, the South African Department of Health launched the 5-year National Strategic Plan (NSP) for the Prevention and Control of Non-communicable Diseases 2022-2027 to help SA get closer to meeting SDG 3.4. This undertaking affirmed government's commitment collectively with other stakeholders towards the prevention and control of NCDs in SA (NDoH 2022: 67).

Lifestyle diseases including type-2 diabetes and cardiovascular diseases (CVDs) are accountable for 41 million deaths each year globally (WHO 2022a: 1), this is fuelled by the insatiable craving for energy-dense, nutrient-poor foods and beverages coupled with an increasingly sedentary lifestyle (Vorster, Kruger and Margetts 2011: 429; Popkin, Adair and Ng 2012: 3). Preventative measures like controlling fat, salt, and sugar energy intake, increasing intake of wholegrain, fruit and vegetables, the inclusion of targeted physical activity for adults and children respectively, avoiding smoking and reducing alcohol consumption can help individuals to prevent overweight and obesity and the resulting manifestation of chronic diseases (WHO 2021a: para. 8; Gottfredson 2021: 1). Numerous studies conducted in high income countries (HICs) countries speak of successful interventions to reduce NCDs, but more needs to be done in LMICs (Kolbe *et al.* 2012: 373; Allen 2016: 131; Alkhatib *et al.* 2021: 1). The adoption of interventions into practice, while required, is often fraught with challenges (Yeates *et al.* 2015: 1089) and is reflected in the persistent rise of NCDs globally. Notably, the translation of this knowledge to improve health in SA is not well established. Given that many working-aged people are affected by NCDs, this places high indirect costs on the people, the workplace, and the economy (Pheiffer *et al.* 2018: 2).

1.4 Importance of the study

Chronic lifestyle diseases are modifiable; however, diseases like type-2 diabetes, hypertension and dyslipidaemia are set to outpace communicable diseases in SA; and to concomitantly increase incidents of multimorbidity, placing a further burden on the constrained healthcare system (NDoH 2022: 67). Saeedi *et al.* (2019: 1) assert that 50.1% of the population living with type-2 diabetes have not been screened and remain unaware of their chronic disease status, meaning that afflicted individuals could move from the pre-chronic disease window period to the chronic disease status without pause to engage in interventions to identify or control and prevent the disease progression. Similar to the call by the Regional Action Framework for NCD Prevention and Control in the Western Pacific to screen for NCDs at a community level, the prevalence and impact of NCDs in SA can be mitigated by using the worksite as a community within which to screen and detect, followed with implementation of interventions aimed at improving and reducing our country’s collective NCD burden. This aligns with the WHO Global Action Plan for the Prevention and Control of NCDs (2013: 53), which has appealed to relevant stakeholders, including the private sector, to partner collectively towards health promotion and reducing NCD risk factors. Lifestyle interventions have shown success in controlling and reducing NCD related diseases, like type-2 diabetes, by 58% in the intervention group when compared to the control group (Tuomilehto *et al.* 2001: 1346). Results from a systematic review on worksite lifestyle interventions reported by Naicker *et al.* (2021: 27) indicated that multicomponent worksite interventions effectively resulted in a higher intake of fruit and vegetables, improved dietary intake, led to better health outcomes, and improved healthy food sales; these findings can help advise future canteen and other worksite-based health interventions thus permitting researchers to select and optimise high impact interventions for implementation. Simultaneously, the caution that interventions and implementation are not a one-size-fits-all (Saeedi *et al*. 2019: 1) is noted. Additionally, what works in a high-income country (HIC) cannot simply be duplicated in a LMIC (Checkley *et al.* 2014: 432). Therefore, more research is needed to adapt interventions into practice, especially in LMICs (Allen 2016: 131; NDoH 2022: 19).

This research is aimed at using a multi-component worksite canteen and a behavioural intervention to lower cardiometabolic risk at worksites in SA. Screening with early detection (Ekoru *et al.* 2019: 40; Klug *et al.* 2018: 976) and the use of multicomponent lifestyle interventions that target prediabetes, prehypertension, and lipid disorders can provide timely, effective means to prevent and control NCD-induced multimorbidity (Alkhatib *et al.* 2021: 10). Within the LMIC's, lifestyle diseases bring much strife. For example, as noted by Kengne (2013: 303), there are direct health system costs that must be absorbed by afflicted individuals, their households and families and the government; as well as indirect expenses incurred from illness-induced absenteeism, reduced productivity at work and home, and the burden of chronic disability and a dependency on others to help them cope with their illnesses and day-to-day routine. In LMICs, NCDs are projected to account for two-thirds of all years lived with disability due to blindness, paralysis, and amputation, place significant strain and demand on associated health and welfare services and carry economic burden (WHO 2013: 32). This bleak snapshot of prolonged pain, reduced quality of life and economic impact perpetuates the poverty cycle; however, this prognosis can be altered. Gottfredson (2021: 4) has flagged another area for concern, where people who are diagnosed as prediabetic, prehypertensive or having lipid disorders like dyslipidaemia are so focused on the benefits afforded with 'convenience', that they have become apathetic and show no urgency to take progressive steps to improve their health status. This reaction was also attributed to the relatively asymptomatic nature of the disease cluster in its early stages, where no outward signs indicate the continued advancement of the disease until a major complication arises once the disease has advanced. Thus, the disease advancement could lead to costly and life-altering health challenges where the person, for example, experiences a stroke, heart attack or limb amputation (Gottfredson 2021: 4).

1.4.1 Worksites as a catalyst for change in health status

According to Statista (2023a; 2023b), there are 16.273 million employees in SA, thus presenting a large segment of the population for potential engagement in worksite NCD's screening and implementation of lifestyle interventions to modify and improve personal health risks. Health interventions implemented at worksites have yielded a positive impact on employees and worksites, overcoming barriers towards healthy lifestyle choices by providing and leveraging resources at a place and time where individuals spend much of their waking hours (Li *et al.* 2008: 371; Lindström *et al.* 2006: 1673; Merrill *et al.* 2011: 782). The environment in which an individual works can influence their health-related behaviours and promote behavioural change. Employees spend a large percentage of their key waking hours at their worksite, inclusive of meal and snack times, thus creating an ideal opportunity to promote interventions relating to healthy eating and physical activity. There is also a social element to worksites, with the potential for employees to support, influence and motivate each other's eating environment and physical activity levels (Fernandez, Becerra, and Chin 2014: 225). Several intervention strategies to make worksite canteens healthier through environmental modification have been well described (Lindström *et al. 2006*: 1673; Merrill *et al.* 2011: 783). Some positive effects of these initiatives were that they decreased absenteeism, promoted a sense of community, increased productivity, and improved health behaviours (Merrill *et al*. 2011: 782). However, the range and scope of the interventions adopted at a worksite will depend on the feasibility and acceptability of the interventions and the ease of implementation based on the resources available and the support thereof.

Several researchers have implemented interventions at worksites in high-income countries (HICs), with varying levels of success (Checkley *et al*. 2014: 431). It would be beneficial for more research to be conducted within LMICs post COVID-19 to gauge employee response and uptake; and to assess the impact on individual health through comparison of pre- and post-attainment of cardiometabolic outcomes by testing blood glucose, blood pressure, lipid profile and checking WC to calculate BMI. If the intervention is successful, it would have a meaningful impact on employees, their families and communities, employers, and the economy, and the interventions could be scaled up to benefit employees at other worksites in SA and elsewhere globally.

1.5 Overview and conceptual framework of the study

Worksite intervention programmes can effectively facilitate healthy food choices, health education, and social support among employees in a targeted approach to improve prediabetic and prehypertensive employees' health outcomes and physical activity levels. The South African Pioneer Worksite Intervention Study (SAPWIS) was modelled on a diabetes intervention concept similar to what has been implemented in several other countries including India (Narayan and Prabhakaran 2016) and Nepal (Shrestha *et al.* 2019, Pyakurel *et al.* 2020). The SAPWIS is made up of four phases. It aimed to implement targeted canteen and behavioural interventions at participating worksites in SA and to measure the effect on cardiometabolic risk (Figure 1.1). Phase one, conducted by the Principal Investigator (PI), aimed to find a suitable worksite to partner for the study. Following the preliminary meetings and pitch to worksites to partner with DUT for the research study, eight worksites agreed to participate.

Phase two, led by the Masters candidate, involved the development of acceptable and feasible, contextually grounded interventions to: increase healthy eating at the worksite canteen, increase physical activity levels; and to adapt the Diabetes Prevention Programme (DPP) into lifestyle education classes suitable for use within the worksite environment. In phase two, to ensure the suitability and contextual relevance of the data findings, data were gathered from each worksite and from a range of key role-players. A variety of tools were utilised for the data collection including: structured observation of the canteen and workplace environment, semi-structured in-depth interviews and focus group discussions, assessing worksite readiness to implement change, use of an intervention rating scale to rate the canteen intervention components, a combination of theory and practical lessons on healthy cooking for canteen staff and; a review of the DPP lessons to advise lifestyle lessons for employees.

Phase three, carried out by the PhD candidate, aimed to measure the effectiveness of a multi-component worksite intervention to reduce cardiometabolic risk. This two-step intervention study represents phase three of the SAPWIS. In the first step, willing employees were screened for suitability to participate in the worksite intervention programme. In the second step, an open-masked, two-arm randomised trial was conducted by allocating half of the consenting participants to a canteen-only (CO) intervention and the remaining participants to a canteen and behavioural (CB) lifestyle intervention aimed at reducing cardiometabolic risk. The intervention implementation through a pre-post design, assessed cardiometabolic outcomes (HbA1c, lipid profile and blood pressure (BP)) at baseline (BL) and endline (EL). In this study, the added benefit of a proven individual-level dietary intervention over environmental-level changes for lowering cardiometabolic risk was estimated. In phase four, conducted by the PI, the implementation outcomes were measured for programme adoption, fidelity, feasibility and acceptability through a survey.

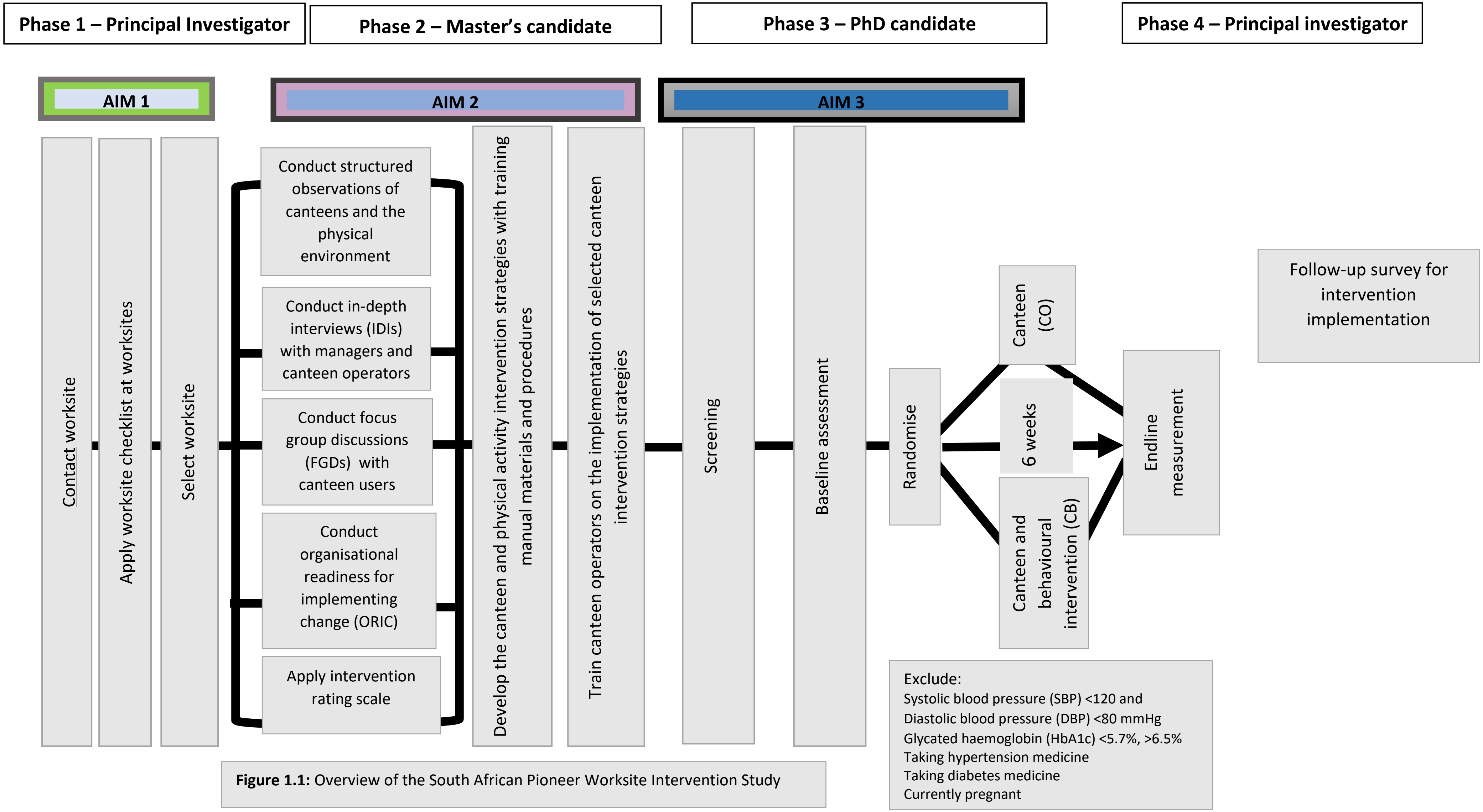

Figure 1.1: Overview of the South African Pioneer Worksite Intervention Study

The conceptual framework used in the study is provided in Figure 1.2. Strategies selected for implementation in the study were derived from the literature and findings from the formative work conducted in phase two of the research. Worksite intervention components offered in this study included strategies to facilitate healthier choices that could benefit the entire workforce, however, some components as shown in italics, were not targeted at the CO group. Initiatives aimed at improving access to nutritious food and beverages thus making healthier options more readily available, was accessible to all employees. It included among other aspects, free water, healthy snack, seed sprinkle and wholegrain options. Individual behaviour changes to encourage healthy food and beverage choices and increasing PA, which were targeted through the provisioning of information (whole workforce) using tools like table tents, posters, infographics and video graphics. Lifestyle education and physical activity classes (only CB group) were aimed at building an informed understanding of healthy food and beverage intake and how to direct change initiatives towards healthy food and beverage intake and increasing physical activity levels. Environmental conditions like access to PA and dedicated space for exercising can also influence physical activity uptake or rejection. Strategies targeting self-efficacy (perceived barriers relating to heathy consumption and engaging in physical activity) as well as social norms and support [peer support during educational classes (CB group) and during meal periods at the canteen (whole group) as well as management support (whole workforce)], may be used to initiate a positive behaviour changes. If the study demonstrates a significant effect, a scaled-up approach could produce a substantial reduction in CVD burden through environmental and individual-level prevention programmes in SA and similar worksites worldwide.

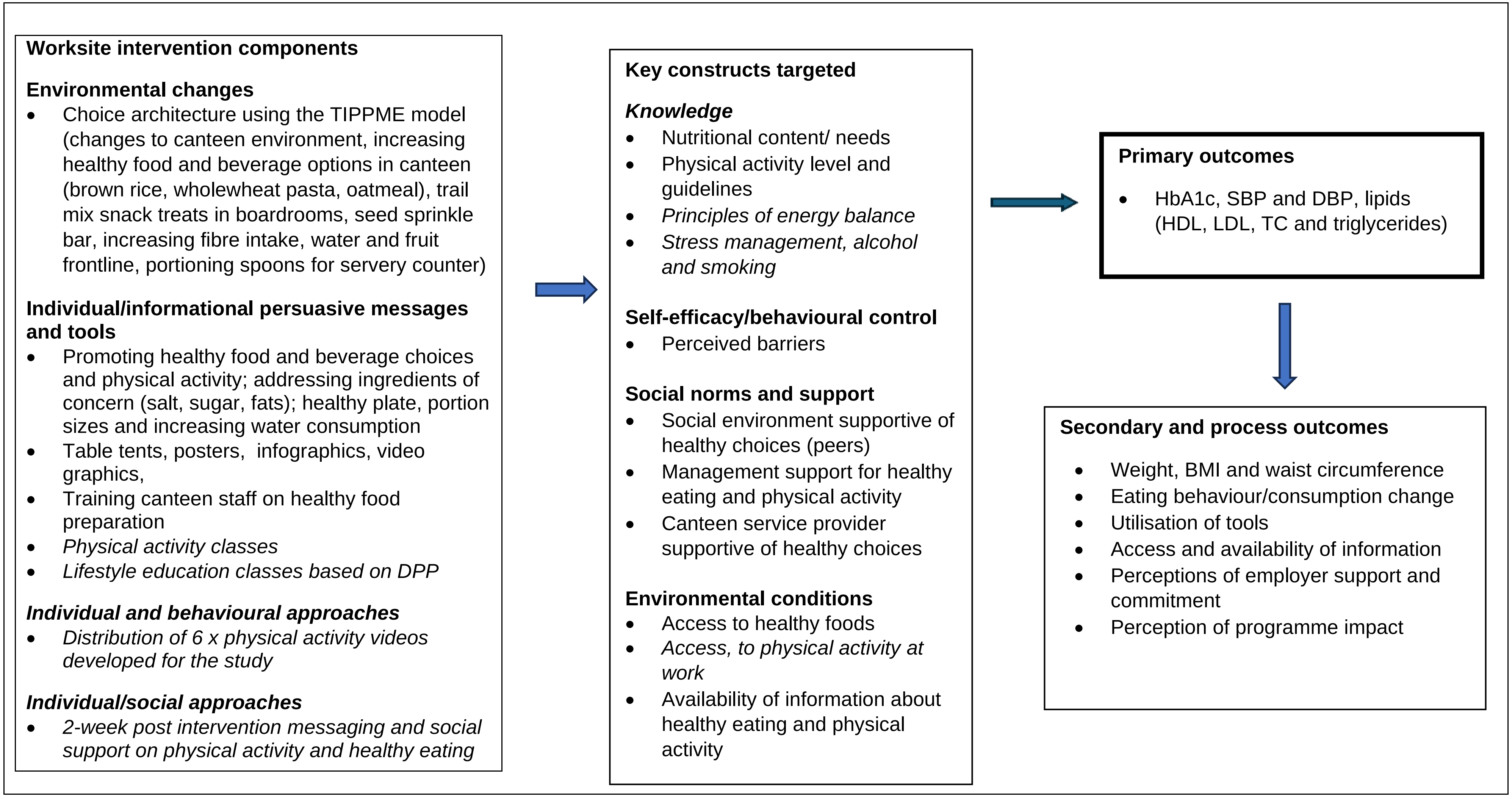

Figure 1.2: Conceptual framework for worksite canteen only (CO) and canteen and behavioural *(CB)* interventions to improve cardiometabolic risk factors, *italics non-indicative for CO group (Adapted from Anderson *et al.* 2009: 343 and LaCaille *et al.* 2016: 174)

1.6 Problem statement

The prevalence of cardiometabolic risk factors, including obesity, hypertension, and diabetes, is escalating in South Africa, posing significant public health challenges. Addressing these risks within the worksite setting offers a promising avenue for intervention. Worksite-based health interventions can be positioned to help alleviate and reduce the overall burden of NCDs on the state, employer and employee. Despite well-documented evidence supporting the effectiveness of worksite behavioural interventions, their impact may be compromised in an unhealthy worksite food environment (WFE). A notable gap in research exists on the effectiveness of canteen and canteen behavioural intervention in mitigating cardiometabolic risk among South African employees. Multi-component interventions offer increased potential for success by providing a variety of interventions and adapting to the diverse needs of individuals, as opposed to relying solely on single interventions. Therefore, there is an urgent need to investigate the effectiveness of these comprehensive interventions in promoting healthier lifestyles and reducing cardiometabolic risk factors among South African workers.

1.7 Research questions

1. What effect would the CB intervention versus a CO intervention over a six-week duration have on improving cardiometabolic risk factors among employees who are prediabetic and/or prehypertensive?

2. What effect would the CB intervention versus a CO intervention over a six-week duration have on diabetes risk among employees who are prediabetic and/or prehypertensive?

3. What effect would the CB intervention versus a CO intervention over a six-week duration have on dietary behaviour among employees who are prediabetic and/or prehypertensive?

1.8 Purpose of the study

This study aimed to measure the effectiveness of a CB versus a CO intervention among pre-diabetic and/or prehypertensive employees at two multi-national companies and to determine which intervention was more impactful. This would be determined by evaluating the change in number of participants reaching two or more cardiometabolic risk goals, namely reductions in HbA1c, blood pressure and triglycerides (the primary outcome), and through changes in secondary outcomes.

1.9 Aim of the study

To measure the effectiveness of a CB intervention versus a CO intervention among worksite employees by evaluating the change in number of employees reaching two or more cardiometabolic risk goals, namely reductions in HbA1c (the primary outcome), blood pressure and triglycerides, and through changes in secondary outcomes and regression from prediabetes to normoglycemia.

1.10 Objectives

1.10.1 To assess the effectiveness of a CB intervention on a composite score based upon improvement in cardiometabolic risk factors.

1.10.2 To measure the effectiveness of a CO intervention on a composite score based upon improvement in cardiometabolic risk factors.

1.10.3 To evaluate the effectiveness of a CB intervention versus a CO intervention on diabetes risk.

1.10.4 To examine the effectiveness of a CB intervention versus a CO intervention on dietary behaviour.

1.11 Specific objectives

In this research study, several specific objectives were set based on pre-post intervention measures:
1.11.1 To measure the effectiveness of a CO intervention on a composite score based upon improvement in cardiometabolic risk factors (0-3) with success defined by a systolic blood pressure decrease ≥ 5mmHg, a decrease in plasma triglycerides ≥0.1 mmol/L and a decrease ≥0.5% HbA1c. To determine the effect, any change in the variable scores after three months of the canteen intervention will be compared to the measurement over the baseline period.

1.11.2 To assess the effectiveness of a canteen and behavioural intervention on a composite score based upon improvement in cardiometabolic risk factors (0-3) with success defined by a systolic blood pressure decrease ≥ 5mmHg, a decrease in plasma triglycerides ≥0.1 mmol/L and a decrease ≥0.5% HbA1c to determine effect. Any change in the variable scores after three months of the behaviour intervention group will be compared to the measurement over the baseline period.

1.11.3 To evaluate the effectiveness of a CO intervention on diabetes risk by comparing the change in HbA1c of participants, after three months of canteen intervention, to the baseline measurement.

1.11.4 To measure the effectiveness of a CB intervention on diabetes risk by comparing the change in HbA1c of participants, after three months of behavioural intervention, to the baseline measurement.

1.11.5 To evaluate the combined effect of CB intervention versus a CO intervention on diabetes risk by comparing the change in HbA1c levels of the participants for the canteen plus behavioural intervention, to the change over the baseline period.

1.12 Study parameters

The study considered the following parameters:

- The study had employee participation from two multinational companies in SA.
- A total of seven Unilever and one Retailability Head Office (umbrella company for Edgars, Bronx, Legit) worksites participated in this study. Ancillary worksites (L'oreal, Unilever Head Office Johannesburg, Woolworths Cape Town, and one in East London, undisclosed company name) entered the study by default at the follow-up stage when some employees, through career movement, agreed to complete the follow-up steps at their respective new worksites.
- Seven hundred and ninety-seven employees consented to participate in step 1 of the screening phase of the study.

- COVID-19 impacted the study in two ways, firstly by delaying the screening process by one year, as access to worksites was restricted and secondly, due to the hybrid nature of the return to work after the hard lockdown where Unilever head office staff could work two days onsite and three days from home.
- The post COVID-19 return to work also impacted employee willingness to engage in the study.
- Three shift cycles at each of the six Unilever production sites impacted the flow, frequency, willingness, and continuity of employee participation. Willing employees had to, at times, sacrifice personal time to participate in the study.
- Given the shift work at each site and the hybrid work policy (Unilever head office), access to key role players (Human Resources managers, clinic staff (permanent and temporary staff), supervisors and canteen managers at each of the sites was challenging to co-ordinate.

1.13 Assumptions

The following assumptions were in place for this study:

- That a multicomponent worksite intervention designed and informed by the worksite characteristics and the views of workers, managers, healthcare staff and supervisors, on the design and format of delivery of the intervention would have a positive effect on reducing cardiometabolic risk factors of target employees.
- That participants were willing to participate in the study voluntarily without any coercion from the worksite.
- That the worksite culture and environment would be supportive of the intervention programme.
- That the worksite supervisors would co-ordinate the employee shift schedule to enable the release of those employees who volunteered to participate in the research study.
- That employees would actively engage in the worksite interventions.
- That participants in the CB intervention group would adhere to the lifestyle intervention programme
- Intervention exposure to contamination would be minimised during the study by requesting participants to agree to abide by a non-disclosure clause.
- That all key role-players would be supportive of the study and the phased steps they would be involved in, especially as all key role-players were informed at the outset about the research study and made up part of the formative interview panel for this research study.

1.14 Definition of terms

Anthropometry: a quantitative, non-invasive measurement of the body which can help to assess an individual’s health status and disease risk. Among other aspects, it can include height, weight, BMI and waist circumference (WC) (Casadei and Kiel 2023: para. 1 and 2).

Cardiometabolic diseases (CMDs): are characterised by high abdominal obesity, high fasting triglycerides, raised blood pressure and low high-density lipoproteins cholesterol (HDL-C) (Ordovs 2019: para. 2).

Cardiovascular diseases (CVDs): are characterised as a cluster of mostly preventable diseases relating to heart and blood vessel disorders which include coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolism (WHO 2021b: para. 2).

Comorbidity: "Any distinct additional clinical entity that has existed or may occur during the clinical course of a patient with the index disease under study" (Feinstein 1970: 456).

Lipogram: a blood profile test that measures an individual's triglyceride (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) and total cholesterol (TC) levels and can be used to predict cardiovascular risk (Klug 2012: 179).

Multimorbidity: is the concurrent presence of two or more chronic diseases in one person, where one is not necessarily more dominant than the other. Multimorbidity is on the increase, especially in LMICs, and is frequently associated with inequities in accessing healthcare (NDoH 2022: XI; Alkhatib *et al.* 2021: 1).

Non-communicable diseases: refer to a cluster of five main diseases, including diabetes, CVD, cancers, chronic lung disease and mental health conditions. These conditions require long-term care and are modifiable through lifestyle interventions (WHO 2022a: para. 2).

Overweight: term ascribed to indicate an adult body mass index greater than or equal to 25 kg/m^2 (WHO 2021a: para. 2).

Obesity: term ascribed to indicate an adult body mass index greater than or equal to 30kg/m^2 (WHO 2021a: para. 2).

Prediabetes: a metabolic syndrome disease where blood sugar level is within an intermediate range of 5.7- 6.4%, i.e., higher than the normal range but not yet within the range classified as diabetic (CDC 2023b: para. 1). Impaired glucose tolerance (IGT) and impaired fasting glycaemia (IFG) refer to transitionary conditions between normality and diabetes; people diagnosed with IGT and IFG are more susceptible to type-2 diabetes, although this can be changed (WHO 2023d: para. 7).

Prehypertension: is when the blood pressure reading is raised, i.e., higher than the healthy range of below 120/80mmHg but not yet within the hypertensive range (Giorgi 2022: para. 1).

Type-2 diabetes: is characterised as non-insulin dependent and attributed to excess body mass gain alongside a lack of physical activity, and genetics (WHO 2023d: para. 5).

1.15 Research plan

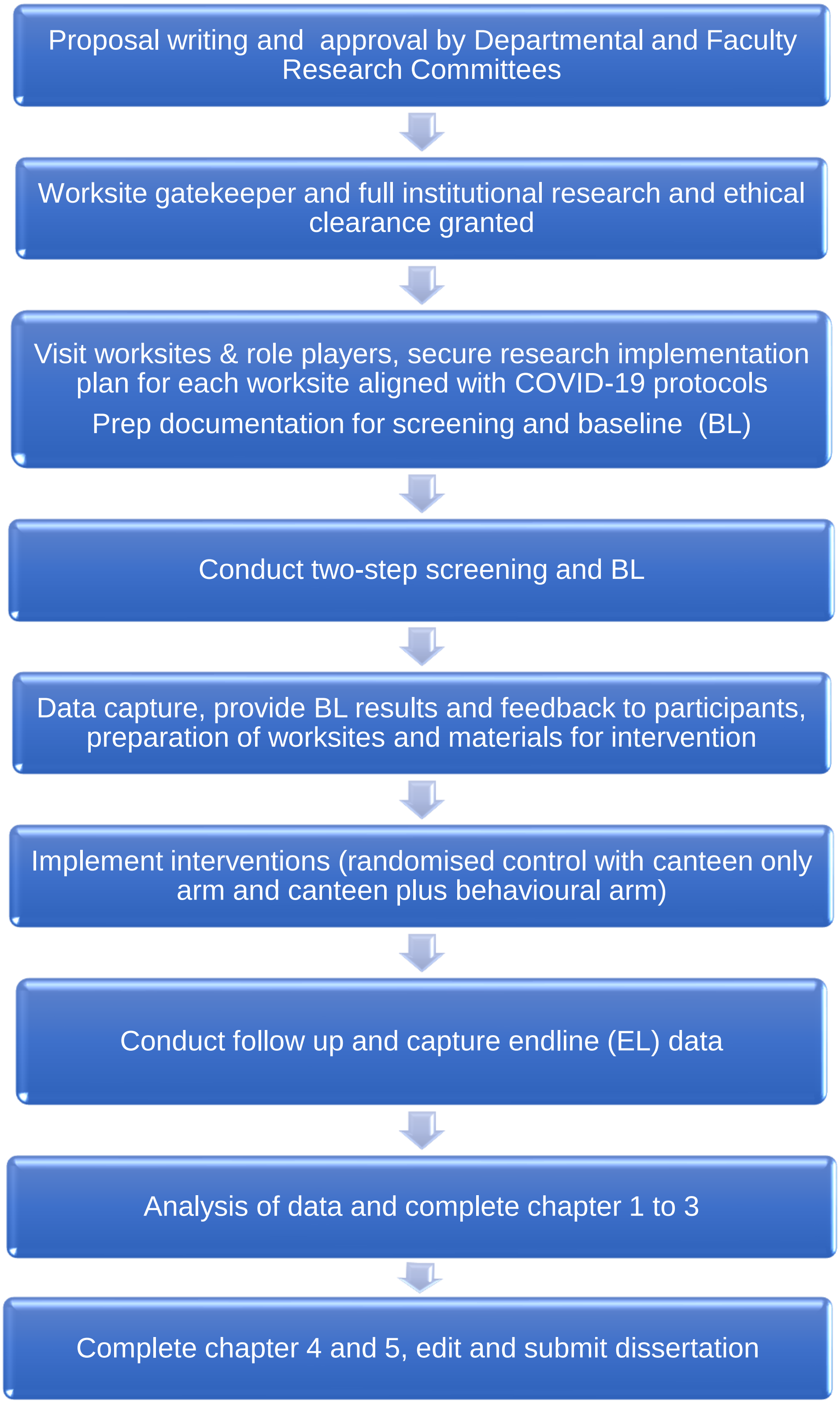

Figure 1.3: Research flow plan

1.16 Structure of the dissertation

Chapter 1: Introduction

This chapter details the background to the research, the research context, conceptual framework and the importance of the study; the aims and objectives are also set out.

Chapter 2: Literature Review

This chapter will provide a summarised review of the literature on worksite interventions to lower the prevalence impact of cardiometabolic disease. This review will provide insight into the challenges and success factors to enable a best practice model in SA.

Chapter 3: Methodology

The research design, methods and ethical considerations will be presented in this chapter.

Chapter 4: Results and Discussion

Pre-and post-intervention findings will be presented in this chapter. Results from the study will be discussed, in line with the aims, objectives and literature reviewed.

Chapter 5: Conclusion and Recommendations

Limitations of the study as well as recommendations on best practices to contextualise worksite interventions aimed at lowering cardiometabolic risk in SA will be detailed.

1.17 Referencing style

The Durban University of Technology referencing system, informed by the Harvard style, will be used for this study (Mitha, Naidoo, and Thomas: 2016).

1.18 Conclusion

While there is robust evidence that lifestyle interventions can directly impact individual health and wellness, there is an urgent need to translate this into practical applications, in real-world settings to help mitigate the projected 25% increase in the global prevalence of diabetes to 578 million by 2030 (Saeedi *et al.* 2019: 1). The effect of these practical worksite interventions has potential to impact the wellness of the entire worksite positively and in turn, the return on investment for organisations. In the long term, this would translate to a positive impact on the public health burden and help to improve the quality of life of individuals. However, the range and scope of the interventions adopted will largely depend on the feasibility and acceptability of the interventions and the ease of implementation at a worksite, based on resources available and the support thereof. This study will establish and inform a blueprint for the adoption of such interventions in SA. The background, importance and framework for the study have been provided in Chapter 1. In Chapter 2, the associated literature will be reviewed to underpin the study's relevance.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides a summarised review of the literature and the gaps identified when focussing on non-communicable diseases (NCDs), its prevalence and the risk factors impacting and contributing to NCDs. An overview of interventions to lower the prevalence of cardiometabolic disease in real-world settings is also provided and discussed.

2.2 Types of diseases: communicable and non-communicable

Individuals can be affected by various diseases as well as injuries, which may result in morbidity or mortality (National Department of Health (NDoH) 2020: 18; Wong *et al.* 2021: e968; World Health Organisation (WHO) 2023a: para. 1). 'Disease' is generally defined as a medical condition or disorder that affects the normal functioning of an organism. It can manifest as specific symptoms or abnormalities and can cause harm to the affected person (Burrows and Scarpelli 2023: para. 1). Environmental factors, genetic mutations, lifestyle choices or a combination of these, may be the underlying cause of disease and may be classified as communicable, infectious or non-communicable chronic disease, respectively (Sapkota 2022: para. 1). Communicable diseases (CDs) spread rapidly through direct contact with infected individuals, bodily fluids, contaminated food, water or surfaces, or through pests and include, among others, diseases like Tuberculosis (TB), Human Immunodeficiency Virus (HIV)/ Acquired Immunodeficiency Syndrome (AIDS), malaria, and coronavirus disease COVID-19 (Sapkota 2022: para. 1). On the other hand, NCDs develop over time due to a combination of genetic, lifestyle and environmental factors, including conditions like cardiovascular disease (CVD), diabetes, chronic obstructive pulmonary disease (COPD) and cancer (Sapkota 2022: para. 2).

2.3.1 Global prevalence of NCDs

Globally, NCDs are the leading cause of morbidity and mortality (Allen, Wigley and Holmer 2021: e1528). Forty-one million deaths per annum are due to NCDs (WHO 2022a: para. 1), with an overwhelming majority of premature deaths occurring in low-and middle-income countries (LMICs) (NDoH 2022: 22; Allen, Wigley and Holmer 2021: e1528; Juma *et al.* 2018: 4). This marks a rapid increase from 17 million NCD induced deaths in 2019 (WHO 2022b: para. 12). Concurrently, the quality of life for millions of individuals is negatively impacted as they live with at least one NCD (WHO 2022b: para. 11).

2.3.2 South Africa: NCDs and other causes of death

In 2021, life expectancy at birth in South Africa was 59.3 years for males and 64.6 years for females (Statistics South Africa (SA) 2021a: 6); significantly lower than high-income countries (HICs) like Spain, Italy, France, and Australia, where the average life expectancy in 2021 exceeded 82 years (United Nations 2022: para. 5). Non-communicable diseases contributed 38.4% to the disability-adjusted life years (DALYS), up from 27.5% in 2009 whilst the number of years lived with disability (YLDS) was 8532.39 per 100 000 (Global Burden of Disease (GBD) 2019: para. 1). To optimise population health and health service delivery globally, countries must have a sound monitoring system for CD and NCD mortality and morbidity trends to inform its strategic planning and intervention approach effectively

(WHO 2020a: para. 7). The comprehensive breakdown of the cause of death for the period 2016 to 2018 is provided in Table 2.1.

Table 2.1: Cause of death breakdown for 2016 to 2018 in SA (Statistics SA 2018: 38)

Causes of death (based on ICD-10)	2016			2017			2018		
	Rank	Number	%	Rank	Number	%	Rank	Number	%
Tuberculosis (A15-A19)	1	30 541	6,5	1	29 441	6,4	1	27 459	6,0
Diabetes mellitus (E10-E14)	2	25 857	5,5	2	25 896	5,6	2	26 880	5,9
Cerebrovascular diseases (I60-I69)	4	23 759	5,0	4	22 806	5,0	3	23 000	5,1
Other forms of heart disease (I30-I52)	3	24 611	5,2	3	23 032	5,0	4	22 956	5,1
Human immunodeficiency virus [HIV] disease (B20-B24)	5	22 571	4,8	5	22 032	4,8	5	21 872	4,8
Hypertensive diseases (I10-I15)	6	20 331	4,3	6	20 309	4,4	6	20 579	4,5
Influenza and pneumonia (J09-J18)	7	20 203	4,3	7	19 226	4,2	7	17 573	3,9
Ischaemic heart diseases (I20-I25)	9	13 295	2,8	9	13 050	2,8	8	13 598	3,0
Chronic lower respiratory diseases (J40-J47)	10	13 097	2,8	8	13 509	2,9	9	13 579	3,0
Malignant neoplasms of digestive organs (C15-C26)	-	-	-	-	-	-	10	10 808	2,4
Other viral diseases (B25-B34)	8	16 902	3,6	10	12 869	2,8	-	-	-
Other Natural		206 982	43,9		203 723	44,4		201 544	44,4
Non-natural		53 806	11,4		53 190	11,6		54 166	11,9
All causes		**471 955**	**100,0**		**459 083**	**100,0**		**454 014**	**100,0**

In 2018, SA reported 454 014 deaths (Statistics SA 2018: 47) (Table 2.1). Non-communicable diseases were responsible for 60% of fatalities while 30% was attributed to communicable diseases (CDs) (Statistics SA 2018: 69). Tuberculosis (TB) remained the leading cause of morbidity and mortality in SA; however, the number of deaths due to TB and HIV/AIDS reduced steadily from 2016 to 2018. Simultaneously, diabetes, while remaining the second highest cause of death between 2016 and 2018, a consistent increase in the total number of fatalities was noted (Statistics SA 2021b: para. 2). Diabetes, cerebrovascular diseases, and other forms of heart disease were three of the top five leading causes of death in SA. Cerebrovascular disease and ischaemic heart disease moved one place up in the ranking, and hypertensive diseases, while maintaining its position, reported higher numbers for cause of death in 2018 compared to 2016 (Statistics SA 2018: 37). The leading cause of death for the population aged 45-64 was TB with 27 459 deaths, followed closely by diabetes with 26880 deaths (Statistics SA 2018: 41). In KwaZulu-Natal (KZN), other forms of heart disease, for the first time since 1997, replaced TB as the leading cause of death. Diabetes was among the top ten leading causes of death in each of the nine provinces in SA (Statistics SA 2018: 61), alluding to the fact that the whole SA population can benefit from screening and interventions to address modifiable risk factors aimed at reducing and controlling diabetes (Statistics SA 2018: 61). However, the intervention process has a cost burden and is not so easily resolved.

Alluding to NCDs that prevail in SA i.e., cardiovascular disease, chronic respiratory disease, cancer and diabetes, the cluster of NCDs were ascribed the term “4x4 NCD agenda”. In 2018 it was revised to “5x5 NCD agenda”, when mental health conditions and air pollution were added (WHO 2022b: 11). The 5x5 NCDs and risk factors are presented in Figure 2.1.

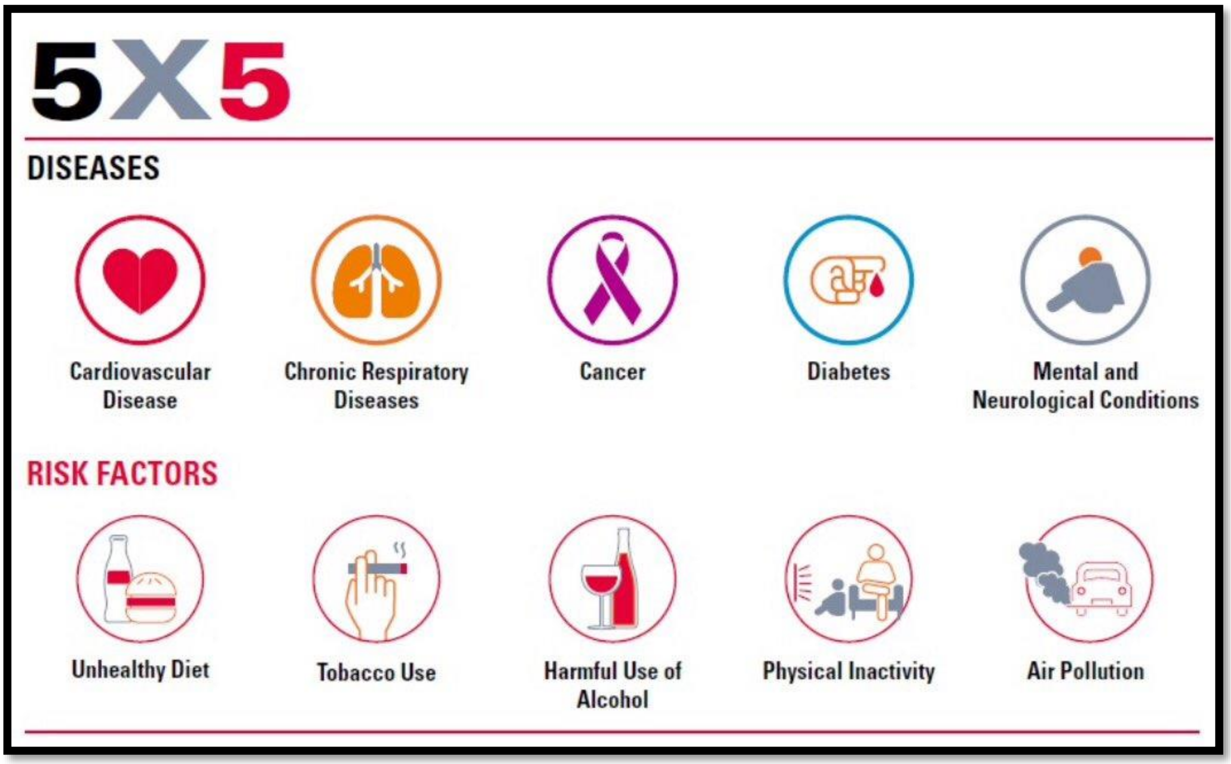

Figure 2.1: 5x5 NCDs and risk factors (NCDs, Universal Health Coverage (UHC) and Global presumptions 2020)

However, it must be noted that historically in SA, CDs have received more priority (Thomas and Gostin 2013: 18; Luna and Luyckx 2020: 5) in terms of resources, funding, implementation of preventative measures, political interest, and monitoring, than NCDs (Juma *et al.* 2018: 10). Literature indicates that in 2014 a disproportionately high percentage, 29%, of international funding was allocated to HIV while 2% was allocated to NCDs, as it was intended that each country's government should manage their own NCD funding. When this funding model is coupled with the stark inequalities between high-income countries (HICs) and LMICs, the continued and higher impact of NCDs in LMICs is not surprising (Luna and Luyckx 2020: 6). Consequently, while CDs have recorded a decline in mortality, the opposite is true for NCDs which, while preventable (Luna and Luyckx 2020: 9) are largely overlooked (Luna and Luyckx 2020: 5), and NCD related mortality has soared. Luna and Luyckx (2020: 6) have justly argued for a more equitable approach to funding for diseases, stating that CDs and NCDs must be prioritised for funding from internal and external sources. The more recent acknowledgement of this funding need, though late, is noted in the literature (WHO 2022a: para.11, WHO 2022b: 30).

Mortality and morbidity due to CDs and NCDs, and injuries, adversely impact a country, its people, resources, and its ability to respond to it effectively (Coates *et al.* 2020: e1497; Remais *et al.* 2013: 221). The ability of CDs and NCDs to afflict individuals concurrently is also well documented, thus compounding healthcare needs and the resource burden (Coates *et al.* 2020: e1497; NDoH 2020: 18; Luna and Luyckx 2020: 6; Remais *et al.* 2013: 221). For example, in SA, the high prevalence of diabetes increases the vulnerability to contracting TB, while individuals with HIV/AIDS are at higher risk of developing NCDs (Remais *et al.* 2013: 223). The COVID-19 pandemic also impacted those living with NCDs as they faced an increased probability of mortality if they contracted COVID-19 (NDoH 2022: 25).

2.4 Lifestyle diseases

This section describes the pathophysiology of lifestyle-related diseases, followed by the epidemiology, prevalence and associated risk factors, as well as the management and treatment.

2.4.1 Diabetes

Diabetes mellitus, hereon after referred to as diabetes, is a long-term illness that can present in individuals as Type 1 diabetes, Type-2 diabetes, or gestational diabetes (WHO 2023d: para. 4; The Heart and Stroke Foundation SA 2023a: para. 1; Deshmukh and Jain 2015: 224). Gestational diabetes can develop during pregnancy when blood glucose levels become too high (Deshmukh and Jain 2015: 245). Type 1 diabetes (insulin-dependent) occurs when an individual has high blood glucose due to less insulin than is needed being produced by the body, or when the insulin produced by the body cannot be used optimally, while in type-2 diabetes (non-insulin-dependent), insulin resistance leaves cells unable to utilise insulin optimally (WHO 2023d: para. 4; Deshmukh and Jain 2015: 224). The resulting high levels of blood glucose, referred to as hyperglycemia, cause damage to blood vessels, nerves and organs (Deshmukh and Jain 2015: 224; WHO 2023d: para. 2). Type-2 diabetes is the most common metabolic endocrine disorder; however, in the absence of screening and testing, type-2 diabetes often goes undiagnosed (Ekoru *et al.* 2019: 30; ElSayed *et al.* 2023: S26) as symptoms develop gradually or may be absent or are not as pronounced as in type-1 diabetes (for example, "thirst, polyuria, blurring of vision and weight loss") (WHO 2019: 6). Individuals are at risk for developing diabetes if they have an affirmative response for one or more of the following criteria: high body mass index (BMI), sedentary lifestyle, unhealthy diet, genealogy, history of diabetes during pregnancy, and ageing (Climie *et al.* 2019: 1138). Tobacco consumption, high blood pressure (BP) and serum cholesterol exacerbate diabetes (The Heart and Stroke Foundation South Africa (SA) 2023a: para. 2).

Both Type 1 and Type-2 diabetes can be managed with pharmacology. However, type-2 diabetes, as is well established in the literature, is a lifestyle-induced form of the disease that can be controlled, reduced, or prevented with lifestyle changes (The Look AHEAD Research Group 2013: 149; Deshmukh and Jain 2015: 227; Fox *et al.* 2015: 1780; Tuomilehto *et al*. 2023:1). This raises an important subcategory of type-2 diabetes (ElSayed *et al.* 2023: S25), viz., an intermediate phase referred to in the literature as prediabetes/ impaired glucose tolerance/ impaired fasting glucose/ "intermediate hyperglycaemia" (WHO 2023d: para. 7; Tabάk *et al.* 2012: 2279; Deshmukh and Jain 2015: 227; Hostalek 2019: 2). Screening for diabetes may be conducted in different ways. For example, a fasting blood glucose test may be conducted upon confirmation of nil per mouth. A glycated haemoglobin A1c (HbA1c) test, i.e., a venous blood draw, will provide an averaged blood glucose measurement for a three-month cycle and is both an accepted form of non-fasting screening (Hostalek 2019: 2; Pheiffer *et al.* 2021: 11; NDoH *et al.* 2019: 305) and a suitable test to determine undiagnosed prediabetes (Tankova *et al.* 2012: 376; Hostalek 2019: 2). HbA1c measurements ≤5.6% indicate a normal blood sugar reading while measurements of ≥6.5% are indicative for diabetes (Diabetes South Africa 2022: para. 1; NDoH *et al.* 2019: 305). Measurements ≥5.7% and ≤6.4% (6.5 - ≤7.6 mmol/L) fall within the prediabetic range

(CDC 2023b: para. 1; NDoH *et al.* 2019: 305). An oral glucose tolerance test (OGTT) can be used to assess an individual's reaction to glucose; it requires eight hours (overnight) fasting with a pre-and post-test following consumption of a 75g glucose solution (Davidson *et al.* 2021: 741). A random blood glucose (RBG) test is another form of screening, using a non-fasting finger prick test conducted at an unspecific time during the day (The Heart and Stroke Foundation SA 2023a: para. 3). A continuous blood glucose monitor is a wearable device with a sensor inserted into the skin that can measure blood glucose levels throughout the day and night and the data can be accessed on an individual's smartphone (Diabetes South Africa 2022: para. 1). Despite the range of options available to screen individuals for diabetes and increasing data pointing to the impact of no or late screening, to date, screening remains a challenge in LMICs (The Heart and Stroke Foundation SA 2023a: para. 1; Tuomilehto *et al*. 2023: 1). If an individual has prediabetes (i.e., blood glucose ≥5.7% and ≤6.4%) (6.5 – 7.6 mmol/L) and no lifestyle action is taken to address this, prediabetes is likely lead to diabetes within three to five years (Hostalek 2019: 1). Alarmingly, up to 70% of individuals classified as prediabetic will develop diabetes in their life cycle (Hostalek 2019: 1). Globally, more than 329 million prediabetic individuals are projected to develop type-2 diabetes by 2030 (Climie *et al*. 2019: 1138). The South Africa Demographic and Health Survey 2016 (2019: 297) indicated an alarming prevalence of diabetes in the population aged 15 and older, with thirteen of women and eight percent of men diagnosed as diabetic, and 64% of women and 66% of men being prediabetic (based on adjusted HbA1c levels). Individuals who present as prediabetic or diabetic are at greater risk of CVD, dementia, retina damage, and chronic kidney disease (Climie *et al*. 2019: 1138). With both microvascular (small) and macrovascular (large) blood vessels affected by type-2 diabetes, diabetics have a high prevalence of vascular disease. Dyslipidaemia, a macrovascular disorder, where plaque deposits cause atherosclerosis, is a key contributing factor for CVD. This is important as it signifies an opportunity for multimorbidity and increased risk of mortality (Climie *et al*. 2019: 1338; Ntusi 2018: 256; NDoH 2014: 33; Tuomilehto 2001: 1349). In the SA context, diabetes also has a proven correlation with communicable diseases like TB and HIV (Oni *et al.* 2017: 6), thus increasing population vulnerability and healthcare costs.

Lin *et al.* (2020: 203) estimate that by 2050, type-2 diabetes will account for most of the projected 1.31 billion individuals living with diabetes. This marks an increase of over 40% compared to the 2021 report of 537 million individuals aged 20-79 years living with diabetes globally (International Diabetes Federation 2021: para. 2). Type-2 diabetes, which is the more prevalent type of diabetes (Climie *et al*. 2019: 1138), accounted for 96% of the 2021 diabetes reporting and 95.4% of DALYs, with 52.2% of the diabetes cases in 2021 being attributed to high BMI (Lin *et al.* 2020: 203). According to the International Diabetes Federation (2021: 3), SA had 4.234 million adults aged 20-79 years with diabetes in 2021. This equates to an 11.3% prevalence of diabetes in the adult population, i.e., one in nine individuals living with diabetes thus, earning SA the dubious title of being one of the 'top five countries for the greatest number of people with diabetes in the age range 20-79', as well as being the leading country in Africa with the highest number of individuals with diabetes (International Diabetes Federation 2021: 3). However, these figures exclude adults aged 20 to 79 years who are undiagnosed and make up 45.4% of the population (International Diabetes Federation 2021: 3). The leading risk factor for both prediabetes and type-2 diabetes is overweight and obesity (Davidson *et al.* 2021: 738; Shisana *et al.*

2013: 107). Diabetes is one of the core disease clusters for metabolic syndrome (MetS) and has a debilitating influence on an individual's quality of life. It is also featured in the top ten causes of deaths nationally and internationally, with afflicted individuals having a higher risk of 'all-cause mortality' (Lin *et al.* 2020: 1). Screening, lifestyle changes, pharmacology, and regular medical check-ups are essential components of managing diabetes and reducing the risk of vascular complications; however, statistics project that for one in every ten South Africans who have diabetes, half of them are unaware of their condition due to a lack of screening and diagnosis (The Heart and Stroke Foundation SA 2023a: para. 1). Individuals diagnosed with diabetes also fare poorly as in Africa, between 60-80% of individuals being treated for diabetes cannot control their HbA1c measurements to the recommended < 7% (<8.6mmol/L) (Kok *et al.* 2021: 60).

In 2021, amidst the growing prevalence of diabetes globally, coupled with inequitable access to quality and timely healthcare to diagnose and manage the disease, the WHO launched the Global Diabetes Compact, which was aimed at decreasing the risk of diabetes (WHO 2021f: 3). Type-2 diabetes is preventable, necessitating changes to lifestyle through physical activity levels and diet (The Look Ahead Research Group 2013: 145; Fox *et al.* 2015: 1780; Saeedi *et al*. 2019: 1; Shisana *et al.* 2013: 17; Tuomilehto *et al*. 2001: 1343; DPP Research Group 2002: 2166; Pan *et al*. 1997: 537) as well as smoking cessation (WHO 2023e: para. 1). Diabetes affects all populations, ages and genders in both HICs and LMICs countries however, the latter has experienced a higher prevalence (WHO 2019: 6), with Black and Asian populations experiencing a higher prevalence (WHO 2021f: 3).

2.4.2 Lipid disorders

Dyslipidemia, when present, increases an individual's risk for CVD, thus screening is recommended to diagnose (Catapano *et al.* 2016: 16) and to initiate an action plan for improving health either through lifestyle changes or pharmacology, or a combination of lifestyle and pharmacology (Catapano *et al.* 2018: 22). A lipogram test can assess blood cholesterol and provide feedback to indicate if an individual is very high risk, high risk or low-moderate risk (Catapano *et al.* 2016: 16). A full lipogram test includes a range of tests viz. high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG) and total cholesterol (TC) and can measure the different components of lipids to enable the diagnosis of dyslipidaemia (Klug *et al*. 2018: 977). Dyslipidemia is diagnosed on the basis of one or more of the following: TC >5mmol/L, LDL-C >3.0 mmol/L, HDL-C <1.2mmol/L, triglycerides >1.7mmol/L (Reiger *et al.* 2017: 4). Screening from eight years for those with a family history of extreme dyslipidemia, or from 20 years for those with one or more risk factors, or from 40 years for all other individuals is recommended (Klug *et al.* 2018: 977).

High LDL-C can lead to plaque build-up, and narrowing and stiffening of arteries, referred to as atherosclerosis (Jin 2016: para. 1; The Heart and Stroke Foundation SA 2017: para. 2). Atherogenic dyslipidaemia results from elevated TG and a lowered HDL-C (NDoH 2014: 34). A low HDL-C level raises an individual's risk for CHD, even when TC is below 5.2mmol/l (Vermaak 2003: 392). Pharmacology and/ or modification of lifestyle risk factors can be used to control and reduce blood cholesterol, thus reducing the risk of cardiometabolic disease (Lipsy 2003: 3; Jin 2016: para. 1; The Heart and Stroke Foundation SA 2021: 4). Klug *et al.* (2018: 980) and Lipsy (2003: 3) advocate the lifestyle route; however, the inclusion of pharmacology treatment is also advocated if cholesterol targets cannot be achieved after three months of lifestyle modifications, or if the individual is categorized as high-risk i.e., having >20% chance of CHD in the next 10 years (Lipsy 2003: 3). A range of lifestyle factors can help reduce an individual's risk factors for CVD, for example, weight reduction, consumption of a healthy diet, smoking cessation, and engaging in physical activity (PA) (Lipsy 2003: 3). The Heart and Stroke Foundation SA (2017: para. 5) advocates that smoking cessation, including nil second-hand smoke inhalation, can help improve HDL and, in particular; engaging in physical activity can help increase HDL while simultaneously reducing TG. Dietary modification with a shift away from foods high in saturated fats and trans fatty acids, salt and sugary items have also proven to be beneficial (The Heart and Stroke Foundation SA 2021: para. 3; Klug *et al.* 2018: 994). Weight reduction, alcohol cessation, increasing dietary fibre and fresh food can also improve blood cholesterol levels (The Heart and Stroke Foundation SA 2021: 3; Klug *et al.* 2018: 994). However, if left unattended, the plaque or clots which may form can cause blockages to the brain or heart arteries resulting in a debilitating stroke and/or heart attack, which could be fatal (The Heart and Stroke Foundation SA 2017: para. 2).

Results from the NDoH (2014: 35), indicated that diabetic dyslipidaemia was accountable for 70% of mortality in White, Coloured and Asian populations; it was less common in the Black population. With a high prevalence of obesity, tobacco consumption, cholesterol and diabetes, the South African population have an increased probability of CVD (Klug *et al*. 2018: 976). Individuals may not know their status until they experience one or more CVD incidents. It is vital for those who have been tested to take an active role in the self-management of their condition to stop the disease's progression (The Heart and Stroke Foundation SA 2021: para. 3; Budreviciute *et al.* 2020: 8). Awareness of one's health numbers and understanding its impact on one's health and how risk factors can be mitigated to reduce an individual's risk factors can be important determinants towards improved public health (The Heart and Stroke Foundation SA 2021: para. 4). It is equally important for those who have been prescribed pharmacological treatment to ensure that they adhere to their treatment as prescribed. Research confirms that many individuals default on adhering to their treatment, resulting in both clinical and economic impact (Cherry *et al.* 2009: 489; Catapano *et al.* 2016: 3005).

2.4.3 Hypertension

Hypertension, commonly referred to as high BP (WHO 2023f: para. 2), is a precursor for a range of heart diseases (The Heart and Stroke Foundation SA 2021: para. 4; Muntner *et al.* 2019: e55). Progressive medical and scientific developments and research studies have confirmed the role of high BP in CVD events (Fuchs and Whelton 2020: 285; The Heart and Stroke Foundation SA 2021: para. 4; Muntner *et al.* 2019: e55). A BP measurement makes use of two readings: a first, top or systolic blood pressure (SBP) reading (that reveals the pressure exerted by blood on an individual's artery walls when the heart contracts) and a second, bottom or diastolic blood pressure (DBP) reading (that reveals the pressure exerted by blood on an individual's artery walls when the heart muscle rests between beats) (American Heart Association 2023: para. 3; The Heart and Stroke Foundation SA 2020: para. 2). When an individual's BP is measured, it is recorded as a SBP reading over a DBP reading and is categorised using ranges to stratify the different measurements. While SBP has been singled out as a stronger predictor of CVD incidents (Muntner *et al.* 2019: e36; The Systolic Blood Pressure Intervention Trial (SPRINT) Research Group 2015: e2104), SBP and DPB ranges have important roles in cardiovascular (CV) health. These ranges are presented in two tables, Table 2.2. and Table 2.3 and, as per the literature, some differences exist.

Table 2.2: Classification of BP ranges SA (The Heart and Stroke Foundation SA 2020: para. 3)

Stage	Systolic BP (mmHg)		Diastolic (mmHg)	Action
Normal and Optimal	Below 130	and	Below 85	Keep up the good work and stick with heart healthy habits
High Normal	130-139	or	85-89	Make lifestyle changes to lower blood pressure
Mild Hypertension	140-159	or	90-99	See a doctor or GP as soon as possible
Moderate Hypertension	160-179	or	100-109	See a doctor or GP as soon as possible
Hypertensive Emergency	Above 180	or	Above 110	Requires emergency medical attention. Go to a hospital

In SA, The Heart and Stroke Foundation classification seen in Table 2.2 has five range measurements starting with “normal and optimal” before increasing to “high normal”, “mild hypertensive”, “moderate hypertension”, and then “hypertensive emergency” (The Heart and Stroke Foundation SA 2020: para. 3).

Table 2.3 Classification of BP ranges adapted by the South African Hypertension Society (SAHS) (Rayner *et al.* 2019: 184)

BP category*	SBP		DBP
Normal	<120	and	<80
Optimal	120-129	and	<80
High normal	130-139	or	80-89
Hypertension			
Grade 1	140-159	or	90-99
Grade 2	160-179	or	100-109
Grade 3	≥ 180	or	≥110
Isolated systolic	≥140	and	<90
*Individuals with SBP and DBP in two categories should be designated to higher BP based on two or more careful readings obtained on two or more occasions.			

The South African Hypertension Society has six range measurements starting with “normal” and progressing to “optimal”, “high normal”, “grade 1 hypertension”, “grade 2 hypertension” and “grade 3 hypertension” (Rayner *et al.* 2019: 184). With both tables, when a BP measurement range is recorded at 140/90, it meets the classification range of high blood pressure (Word Health Organisation 2023f: para. 2; The Heart and Stroke Foundation SA 2020: para. 2; Seedat, Rayner and Veriava 2014: 288;

Rayner *et al*. 2019: 184). Based on empirical evidence, the measurement cutoffs in the literature have shown a correlation to CVD risk, with elevated SBP and DBP, (Rayner *et al*. 2019: 184) as well as high normal blood pressure (Vasan *et al.* 2001: 1294), respectively showing increased risk for CVD though the latter has not ruled out the possibility of influence from other risk factors.

While both The Heart and Stroke Foundation of South Africa and the American BP classification ranges have five sets of range measurements to categorise SBP and DBP readings, respectively, the measurement cutoffs to define high BP for the countries differ. This is due to country-context specific reasons such as public health priorities, differences in population characteristics, healthcare system, infrastructure, and epidemiological data. Accordingly, high BP is classified as 140/90 (Seedat, Rayner and Veriava 2014: 290; LeFevre 2018: 372) compared to Whelton *et al.* (2018: e138) with 130/80 mmHg. These days, both 140/90 (NDoH *et al.* 2019: 263; The Heart and Stroke Foundation SA 2020: para. 3) and 130/80 mmHg (Whelton *et al.* 2018: e138), are present in the literature, as per Table 2.2, Table 2.3 and Table 2.4.

Table 2.4 Classification of BP ranges American Heart Association (Whelton *et al*. 2018: e138)

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)	and/or	DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

Traditionally, the universally accepted guideline measurement: SBP ≥140 mmHg or DBP ≥90 mmHg, was used to describe high BP (WHO 2023f: para. 1); however, in 2017, informed by new research (The SPRINT Research Group 2015: 2111), The American Heart Association (AHA) revised their guideline ranges for high BP to SBP ≥130 mmHg or DBP ≥80 mmHg (Whelton *et al.* 2018: e138). To this effect, research has indicated that CVD risk increases two-fold for a BP of 115/75mmHg, respectively, for each 20-point increase in SBP or for every 10-point increase in DBP (Fuchs and Whelton 2020: 286). However, literature also advises that reducing and controlling BP to below 130/80, while correlated with reduced vascular complications, comes with a caution, particularly for diabetic individuals, as kidney functioning can be further impaired; light-headedness and dizziness can also be experienced (LeFevre 2018: 373). In support of their findings for a classification of high BP at readings from 130/80, The SPRINT Research Group (2015: e2111) stated that when using intensive control of SBP, the improvement in the number of CV events and deaths must be weighed against the noncommittal finding of adverse incidence of kidney injury. However, as an LMIC country, given the challenges already faced with healthcare and the fiscus in SA, the South African Hypertension Society opted to maintain its measurement to describe high blood pressure at SBP ≥140 mmHg or DBP ≥90 mmHg (Rayner, *et al*. 2019: 184).

Revising measurement cutoffs to classify high BP has implications for both HICs and LMICs, as it would equate to millions of 'newly diagnosed' cases with a concomitant need for healthcare (Fuchs and Whelton 2020: 286; Conlin 2021: para. 1; Unger *et al.* 2020: 1336; Rayner *et al.* 2019: 186). For LMICs, such a revision would be accompanied by a concurrent (and more pronounced) lack of resources to meet the resulting newly diagnosed cases (Unger *et al.* 2020: 1336; Rayner, *et al*. 2019: 184), healthcare budgets would also need a significant boost to meet increased population need. However, if BP measurements in the prehypertension range of SBP range ≥120-139mmHg and DBP range ≥80-89mmHg are not attended to either with low-dose pharmacology (risk dependent) and or lifestyle interventions, research indicates that the BP will continue increasing, moving from prehypertension to hypertension, in a relatively short period (Fuchs and Whelton 2020: 290); 1.7 years for 35% of Blacks (Selassie *et al.* 2011: 583) or 30% progression within four years (Vasan *et al.* 2001: 1294). Regardless of the timeline for progression from prehypertension to hypertension, afflicted individuals will already display proof of organ damage (Fuchs and Whelton 2020: 290) and thus bear the costs of pain, suffering, and economic impact.

Countries that opt out of classifying the BP range measurements to indicate prehypertension, along with guidelines and interventions to control and prevent disease progression; could double rather than weaken the disease burden inherent in the range measurement definitions as it simply pushes the disease burden downstream and escalates the severity impact for afflicted individuals and the cost burden to healthcare. Given the fact that in 2020, one in three adults in SA had high BP, with more than half of these individuals undiagnosed, (The Heart and Stroke Foundation SA 2020: para. 1) and more than 90% of hypertensives presenting as uncontrolled (Rayner *et al*. 2019: 186), concerted efforts must be made for the population to be screened followed by information advocacy to help individuals know and understand their BP measurements. This has implications for the classification ranges used to define BP ranges, which, firstly, in SA, need to be revised to have one countrywide classification. This would be in line with government "health-in-all-polices" (NDoH 2022: 19). In the revised classification category, the aim should be to make the BP classification table more population-centred, thus, range titles of "high normal", "mild hypertension", and "moderate hypertension" should not be permitted as while these descriptions are familiar to some role players e.g., medical and healthcare personnel, importantly, these descriptions are ambiguous and unclear to other role players i.e., the individuals whose BP is being measured and who need to also interact with these range categories. It is also vital that the SBP ranges ≥120-139mmHg and DBP range ≥80-89mmHg be defined as prehypertension, with clearly renamed subcategories to indicate escalating measurements for SBP and DBP. The statement by Vasan *et al.* (2001: 1291) that the blood pressure table provides a framework describing the levels of risk correlated with BP reference ranges and its use to define treatment and therapeutic intent, is noted. However, having a BP chart with clear BP range headings and a formally documented prehypertension category would add value and scaffolding towards making the BP classification chart a tool for both the population and healthcare workers' use and reference. Using the well-founded educational principles by Dewey (1938) and Vygotsky (1978), there must also be a concerted drive to get individuals more involved and empowered through a shared understanding and monitoring of their BP (Conlin 2021: para. 4); intense public awareness messaging regarding prehypertension can be adopted along with proven scale-up interventions, embracing the projected "whole-of-government" and "whole-of-society" approach (NDoH 2022: 19). This should be accompanied by guidelines to assist individuals who are within the prehypertensive range to firstly be actively aware of their BP measurements as well as how to use interventions to address modifiable risk factors, for example: diet, PA and weight reduction, so that they can actively help improve their measurements towards "normal". These Vygotskian and social learning grounded opportunities (Dewey 1938) can foster meaningful impact on public health and awareness. For example, Tucker *et al.* (2017:1), recommended that a combination of healthcare worker assistance and self-monitoring could decrease systolic BP by 6mmHg on average, resulting in significant health risk reductions. In LMICs, following the success of the HIV care models, Checkley *et al.* (2014: 436) have also recommended using health care workers to advocate, encourage and support the concept of self-regulation for risk factors at the primary health level. These and other targeted measures can be used to encourage individuals into the zone of proximal development (Vygotsky 1978: 86) and help foster shared responsibility and effectiveness, even if modest, towards individual health and awareness.

A false sense of health is created in individuals who are either unaware of their BP, or who believe that they are in a 'safe' BP range as prehypertension, which is unmarked in the classification of BP ranges (see Table 2.2 and Table 2.3), is not regarded as a cause for concern. Additionally, the BP classification table is poorly positioned for the population's use and reference. Unsuspecting individuals will not even be attuned to the uptake of lifestyle changes that could be pivotal in helping them manage, control, and change their prehypertension status and predictable progress to hypertension with its deliberating morbidity and mortality outcomes. They would also have a higher guarantee to move from prehypertension to hypertension, adding further burden to the strained healthcare system due to country-specific classification of BP. Importantly, when this happens, the fiscus will yet again be underprepared to meet this crisis. "Best buys" cannot work on those it bypasses, it's time for change!

The WHO (2023f: para. 1) states that two-thirds of the global 1.28 billion hypertensive adults between the ages of 30 and 79 reside in LMICs. Poor awareness, diagnosis, treatment, and control drive the upward trends (Unger 2020: 1335) with 46% of the adult population unaware of their hypertensive condition. Additionally, with only 21% of adults living with hypertension having it under control, there is a strong impetus to curb the prevalence by the targeted 33% by 2030 (WHO 2023f: para 1). The literature reveals mixed findings for hypertension by gender, for example, with females having a higher prevalence of hypertension than males (NDoH *et al.* 2019: 21; Ardington and Case 2013: 9). However, Shisana *et al.* (2013: 84), found that both males and females had a 35.3% prevalence for hypertension. Referred to as the silent killer, high BP is frequently undetected as it does not often present with symptoms (The Heart and Stroke Foundation SA 2021: 1), meaning that a population has to be proactive and have their BP checked to know their numbers (The Heart and Stroke Foundation SA 2021: 2). Uncontrolled hypertension can cause heart and kidney damage as well as lead to a blocked or ruptured artery (WHO 2023f: para. 4). Literature advocates making small lifestyle modifications to mitigate risk by, for example, consuming a healthy diet high in fruit, vegetables and wholegrain, and low in saturated and trans fats. Also of benefit, is WHO's recommendation of <5g salt per day for adults (less than 2000mg/day sodium) (WHO 2023g: para. 1; WHO Global database on the Implementation of Nutrition Action (GINA) 2012: para. 1; The Heart and Stroke Foundation SA 2023b: para. 5) or 3.75g salt for hypertensive individuals and the Black population due to increased risk factor (Durack, Alonso-Gomez and Wilkinson 2008: 293). Reducing weight, adopting a physically active routine, and engaging in alcohol and tobacco cessation can also enable individuals to improve their risk profile and enjoy a longer life without disease and disability (WHO 2023a: para. 4). Modifiable risk factors are discussed in greater detail elsewhere in the thesis. Non-modifiable risk factors for hypertension include family history and comorbidities, for example, high BP and diabetes (WHO 2023a: para. 3).

The Global Hearts Initiative (GHI) launched in 2016 was a joint effort by the WHO and CDC to counter the impact of high BP and decrease the prevalence of premature, CVD-induced deaths in LMICs (CDC 2017: para. 2). The initiative brought together key population-based technical packages of prevention strategies on tobacco cessation, salt reduction and promoting CVD management in primary healthcare (WHO 2023a: para. 3). The potential of the three-pronged initiative was evidenced when Barbados, which was the pilot country, registered a 14.5% improvement in BP in just one year (CDC 2017: para. 4). Based on the promising early statistics, more can be done towards early diagnosis, treatment, and intervention to improve global heart health and the associated risks and conditions. In this way, the 2030 Agenda for Sustainable Development, through the sustainable development goal (SDG) 3.4 target to reduce NCD incurred deaths by one-third, can be realised (WHO 2023a: para. 2).

Hypertensive individuals have an increased risk for other lifestyle diseases (Unger *et al*. 2020: 1339). The SA population has one of the highest risks for CVD, with almost 50% of South Africans (The Heart and Stroke Foundation SA 2021: 4) being vulnerable; and Black and Asian populations being most vulnerable (Unger 2020: 1350). In the SA context, where diabetes is a growing health concern, understanding and addressing the increased risk of vascular diseases in individuals with diabetes is crucial. The high prevalence of dyslipidaemia among diabetics also amplifies an individual's vulnerability to cardiovascular complications (Ntusi 2018: 256; NDoH 2014: 33). Preventative measures to lower BP are advocated, especially as a therapy to control lipids, while very effective, is also very expensive (Klug *et al.* 2018: 976) and access to treatment compounded by SAs' skewed private-public healthcare system. This emphasises the collective importance of comprehensive diabetes and NCD management, including blood glucose control, the management of blood pressure, lipids, and other cardiovascular risk factors (Unger *et al*. 2020: 1340; Klug *et al*. 2018: 976).

2.4.4 Obesity

Globally, obesity is categorised in accordance with the calculation of an individual's BMI, which categorises body fat levels into predetermined ranges from underweight to extreme obesity (Figure 2.2).

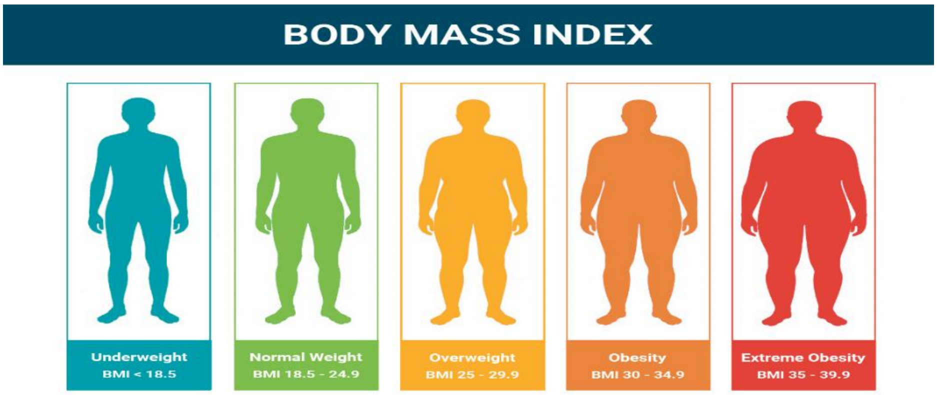

Figure 2.2 Body mass index chart available: https://www.medindia.net/patients/calculators/images/body-mass-index-bmi-chart.jpg

Malnutrition, encompassing both undernutrition and overnutrition, is a significant issue in LIMCs, contributing to a complex burden of disease (WHO 2021a: para. 1). In South Africa, undernutrition among adults, though less prevalent than overweight and obesity, remains a concern due to factors such as poverty, food insecurity, and the impact of communicable diseases like HIV/AIDS and tuberculosis (Mayosi *et al.* 2012: 2030). A BMI of less than 18.5 kg/m^2 indicates underweight, while the optimal range is 18.5 to 24.9 kg/m^2. A body mass index in the range of 30 to 34.9 kg/m^2 (obese) or a BMI greater than 35-39.9 kg/m^2 (extreme obesity), are key markers for increased health risks. There are 39% of overweight and 13% of obese adults globally (WHO 2021a: para. 4). In SA, with the gender profile of 67% female and 43% male overweight and 42.9% female and 18.2% male categorised as obese (Global Nutrition Report 2022b: para. 9); overweight and obesity are emulating the global upward trend. Both genders are affected; however, as indicated in findings by Goetjes *et al*. (2021: 7) and Global Nutrition Report (2022: para. 9), there is a disproportionately higher burden on females. Reducing weight by a modest 5% (Fruh 2017: S3) can be a stepping stone to mitigating some of the obesity-induced burden of disease and improving life expectancy by five to ten years (Fruh 2017: S4). To date, the obesity epidemic has not been reversed in any country and remains a global health challenge afflicting both HICs and LMICs; however, the former are better equipped to manage and treat those afflicted and the resulting cluster of health conditions (Juma *et al.* 2018: 2). In SA, the impact of the obesity epidemic, combined with that of communicable and non-communicable diseases, creates overwhelming challenges for the fragile healthcare system (Juma *et al*. 2018: 2). Historical influence also bears reference as, between the 1960s and late 1980s, the obesity prevalence was strengthened due to the lack of effort made by SA towards addressing obesity in the black population, as it was incorrectly perceived as “benign” (Kruger *et al.* 2005: 491) and “without consequence” (Kruger *et al.* 2005: 494). Additionally, the high prevalence of HIV/AIDS drove the obesity pandemic in parts of sub-Saharan Africa, as overweight and obesity in these regions were subsequently correlated with success, wealth, and good health (Luli *et al.* 2023: 3; Croffut *et al.* 2018: 6). Large body size was also idealised as it was perceived to shift HIV stigmatisation, and created perceptions of beauty, peace, and lack of worry (Croffut *et al.* 2018: 6). The prevailing shift to western diets alongside physical inactivity is adding more stress to the obesity statistics. Urgent action is needed to redress the status quo (NDoH 2023a: 6).

In SA, the obesity pandemic mirrors the global trend. However, when coupled with the concurrent burden of communicable diseases, the impact is more profound, leading to increased mortality, reduced quality of life, increased multimorbidity and higher associated costs (Kruger *et al.* 2005: 493; Juma *et al.* 2018: 2). South Africa, like other countries, has pledged to meet the United Nations SDGs. The NDoH Strategy for the Prevention and Management of Obesity in SA (2023a: 17) states that efforts to stem the obesity tide are a shared responsibility of the government (through regulatory impact), providers (through the food and beverage industry), and the community (through consumers). This shared responsibility has merit (Roberto *et al.* 2015: 2401). However, this can only work effectively when each of these role-players are working towards the same shared objectives. Compellingly, in the literature each of these variables has challenges, including the government with its "top-down solutions" that bypass its intended audience (Roberto *et al.* 2015: 2405), followed by providers (opportunistic food and beverage manufacturers) who present barriers through opposition to legislation relating to unhealthy food, and tobacco and alcohol use, and benefit from governments' slow bureaucratic response process (Breda 2019: 2; Thomas and Gostin 2013: 19). For example, challenges to legislation targeting food labelling (NDoH 2023b; Thomas and Gostin 2013: 19) and reduction in fats and sugar (Boachie, Thsehla and Hofman 2022: 454; Hofman *et al.* 2021: E13302). "Tobacco control, alcohol advertising, and salt reduction" policies were also opposed by industry (Juma *et al.* 2018: 9); while manufacturers continued to pursue new formulations and novel marketing strategies to drive consumption (Thomas and Gostin 2013: 20), despite it being harmful to the end user. Lastly, consumers, who experience (as a result of environmental influence and/or personal issues), difficulty with self-regulation relating to unhealthy food and beverage intake and adequate levels of PA, contribute to the worsening situation (Roberto *et al.* 2015: 2401).

The element of 'self-efficacy' in relation to NCD management and control is controversial but cannot be overlooked as it is a multi-faceted and unerringly important factor (Budreviciute 2020: 8). For example, findings from the South African Demographic Health Survey (SADHS) (NDoH *et al.* 2019: 21) indicated, firstly, that regardless of government intervention with the Health Promotion Levy, 36% of adults surveyed had consumed an average of 607ml of sugar-sweetened beverage the day before the survey. Secondly, despite 46% of females and 44% of males surveyed for the SADHS (NDoH *et al.* 2019: 20) having hypertension and 80% of hypertensive females and 87% of hypertensive males having uncontrolled hypertension, one in three surveyed, i.e., 32%, displayed apathy and were not keen to lower their salt consumption (NDoH *et al.* 2019: 21). Notably, with findings of a salt intake of 7.8g (Black), 8.5g (Coloured) and 9.5g (White) participants, Charlton *et al.* (2005: 41) evidenced that a high salt intake has persisted through time. Thirdly, it is also important to note that the average population is sometimes unaware of their health status, including an incorrect perception of their weight. For example, both males and females in the study underestimated their weight, with females displaying a higher misperception than males. A significant 44% and 65% of women who classified themselves as underweight or normal weight, were overweight and obese, respectively (NDoH *et al.* 2019: 21). Among those surveyed, 13% of females and 8% of males tested as diabetic. These are worrying findings as an individual's BMI (and abdominal fat level), and other risk factors (unhealthy diet and PA inactivity) are important determinants for health as collectively, when raised, these can result in diabetes, hypertension and/ or dyslipidaemia which contribute to MetS (Dobrowolski *et al*. 2022: 99; Lin *et al.* 2020: 1; National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) 2002: 16), and a population's increased risk for mortality and morbidity (Figure 2.3).

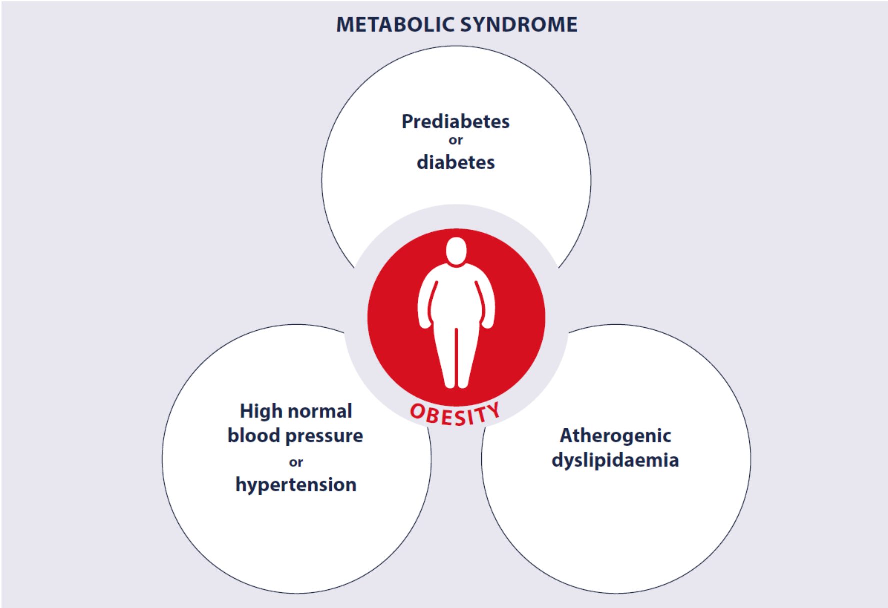

Figure 2.3: Causal factors for metabolic syndrome (Dobrowolski *et al*. 2022: 99)

Simultaneously, obesity through lifestyle changes such as a balanced diet, prescribed PA, and weight loss can positively affect blood pressure, glucose levels, and lipid profiles. This can subsequently lower an individual's overall risk for NCDs (Dobrowolski *et al*. 2022: 99). Against the backdrop of an inequitable dual public-private healthcare system and limited resources, Checkley *et al.* (2014: 432), stated that, unlike HICs, LMICs face greater complexity and diversity of challenges in mitigating diseases and their impact. Thus, better fit, "cost-effective" solutions must be found. To address and combat NCDs and the associated mortality and morbidity, the South African government, through its NSP 2022, adopted a "health-in-all-policies", "whole-of-government" and "whole-of-society" approach (NDoH NSP 2022: 19). In their suggestions for a systematic approach to NCDs in LMICs, Checkley *et al*. (2014: 432), among other aspects, justly called on individuals to take charge of their health. The element of self-regulation is not new in the literature (Koch, Jenkin and Kralik 2004: 485; Modjadji et al. 2021: 3; Tucker et al. 2017: 21) and cannot be overlooked, tiptoed around, or diluted. Simultaneously, and in agreement with Kruger *et al*. (2005: 497), this does not mean that it becomes solely the individual's responsibility to manage obesity but rather that collective efforts, called for by the researchers and mirrored in the NSP (NDoH NSP 2002: 19), will be more impactful. While multiple risk factors remain outside an individual's control (WHO 2022b: 12), ample opportunities remain for individuals to take a vested and active interest in their health, by, for example, a simple and cost-effective act of choosing whether to include or exclude added salt or added sugar in one's diet. Checkley *et al*. (2014: 432), Alkhatib *et al.* (2021: 10) and Kruger *et al*. (2005: 497) have advocated that this can be supported with decisive public health policy and legislation from government coupled with urgent public health awareness and education campaigns with simple messaging in the language of the target population, along with scalable lifestyle interventions for beneficial change (Checkley *et al*. 2014: 432). As noted previously, in SA, obesity prevalence has been increasing steadily; rapid urbanisation, along with higher energy intake from an evolving food environment rich in highly processed foods and beverages that are high in fats, sugar and salt, coupled with reduced vegetable consumption, is driving the trend (NDoH NSP 2022: 29). Bombarded by big data-devised marketing, the comfort of convenience, and the desire for a sensory-gasmic experience (global taste, aroma, textural, visual appeal), an individual's food and beverage selections may be skewed and thus negatively impact their choices. The 21st-century individual's healthy consumption decision may be doomed before gaining traction. It is more critical than ever before that accountability via self-regulation is implemented if obesity figures are to change going forward. Obesity is a complex condition and generates much debate even in its classification, resulting in it sometimes being ascribed 'disease' classification. In contrast, others have rejected the label, calling instead for support paired with individual engagement and responsibility through modifiable interventions to alter an individual's status (Quirk, 2023: para. 2).

2.5 Modifiable and non-modifiable risk factors

Risk factors linked to NCDs can be divided into those that are modifiable to improve health outcomes and those that are not modifiable. Variables like age, sex, racial group, ethnicity, and genetics are risk factors that cannot be modified by interventions (Budreviciute *et al.* 2020: 2; Department of Health NSP for the prevention and control of NCDs 2022: 67: 15). While it is not possible to modify the inherent risk that these variables bring, individuals and researchers must be cognisant of it as it has potential to influence the success or failure of interventions targeting modifiable risk factors (Singh and Bharti 2021: 86). Risk factors that can be modified for improved health include four key variables viz., tobacco use, diet, PA, and alcohol consumption (Singh and Bharti 2021: 86 and Budreviciute *et al.* 2020: 2; Luna and Luyckx 2020: 10). However, these modifiable risk factors are fraught with challenges that are magnified in LMICs (through low or no diagnosis and interventions) and is presented in the literature via references to unequal access, inequity, the duality of the private-public healthcare system (Tuomilehto *et al*. 2023: 1), disease complexity, curability (as treating long-term chronic diseases is sometimes associated with "futility" and a "perceived difficulty") and treating conditions (Luna and Luyckx 2020:8).

2.6 Behavioural Risk factors contributing to NCDs

2.6.1 Tobacco

Regardless of its form (smokable, smokeless, liquid) or source (primary versus secondary exposure), tobacco kills (WHO 2023b: para. 2) by increasing the individual's risk for NCDs (WHO 2004: 4). Both males and females are at risk, though with 6.18 million deaths, males account for a significantly higher number of smoking-related deaths (Ong *et al.* 2023 2348). Self-management efforts are poor and weakened further by the addictive nature of tobacco (WHO 2023b: para. 2; Peer *et al.* 2020: 1). Global measures to mitigate the tobacco epidemic have made some gains through introducing the WHO Framework Convention on Tobacco Control (WHO FCTC) in 2003 and the successive alignment with the WHO MPOWER criteria and the United Nations (UN) SDGs. MPOWER is an acronym derived from one letter for each of the six broad strategies set by the WHO to combat the widespread tobacco epidemic. This is as follows: “Monitoring tobacco use and prevention policies; Protect people from tobacco smoke; Offer help to quit tobacco use; Warn people about the dangers of tobacco; Enforce bans on tobacco advertising, promotion and sponsorship; and Raise taxes on tobacco” (WHO 2021d: para. 2). From inception to date, one hundred and eighty-two countries have pledged their commitment towards adopting MPOWER policies to address and reduce the tobacco-induced public health threat (WHO 2023b: para. 1).

However, progress towards adopting the seven best practices measures detailed in the MPOWER policy, while steady, has been slow (WHO 2021d: 6) and inconsistent (Juma *et al*. 2018: 1). As indicated by Figure 2.4, for example, mass media, advertising bans and taxation should be relatively easier for countries to adopt; however, only the following number of countries: 45 (for mass media), 57 (for advertising bans) and 40 (for taxation) have complete policies on these best practices. It is also concerning that the following countries, 103 (for mass media), 40 (for advertising bans) and 23 (for taxation), have no, or weak policies, with 78 countries indicating complete policies with moderate success, followed by 67 countries complying with smoke-free environments. The most successful measure adopted was for pack warnings, with 101 countries complying with complete policies, while, with only 26 countries, cessation programs had the least success. Collectively, there is potential for much higher uptake for each of the seven best practice measures, given the health burden and socioeconomic impact generated from a population’s tobacco use (Peer *et al.* 2020: 2). This reality is further compromised when aligned with the tobacco industry’s well-resourced and rapid ability to respond to and keep ahead of demand trends and the government’s inability to respond when challenged (Thomas and Gostin 2013: 22). The tobacco industry’s diversification to electronic nicotine delivery systems (ENDS) is a case in point, and its exploitation of misinformation to promote ENDS as “clean, smoke-free and safer”, while governments grapple with the mere emergence of these novel products, needs urgent addressing (WHO 2021d: 7). Emerging information points to gaps in regulating ENDS (WHO 2021d: 7), and unlike the protracted government-led duel with the tobacco industry to curb the public health impact caused by smoking tobacco (Sandford 2003: 7), governments must act more swiftly and decisively with regard to ENDS, failing which, the tobacco industry’s novel nicotine delivery systems will continue to capture new users. Currently, in SA, the Tobacco Products and Electronic Delivery Systems Control Bill was first published in 2018 (WHO 2018b: para. 2) and has yet to be presented to the National Council of Provinces; it is thus dated and long overdue (Parliamentary Monitoring Group 2023: para. 1).

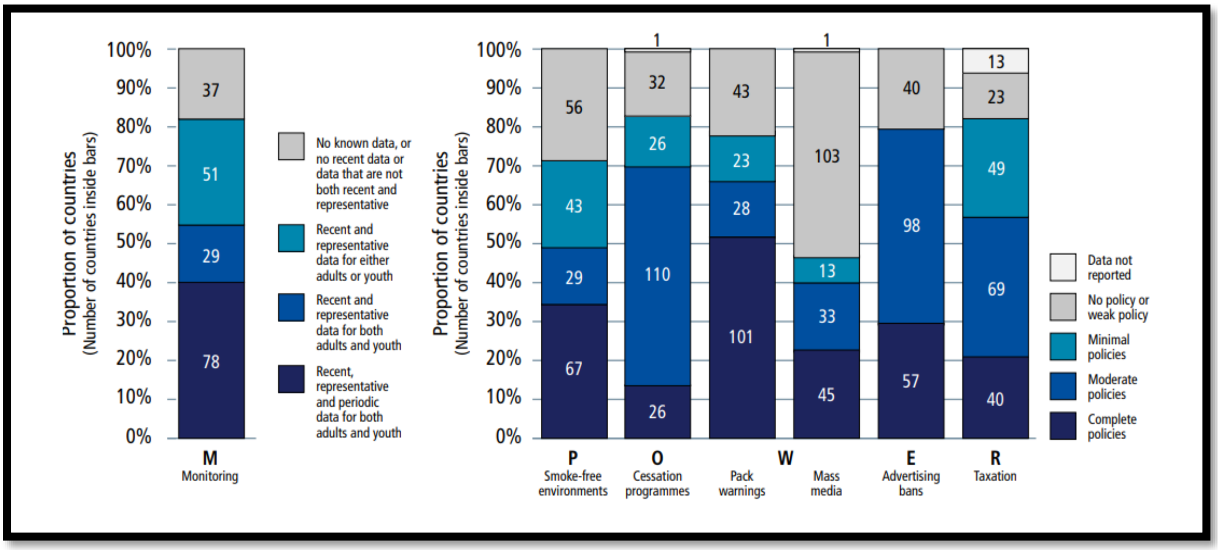

Figure 2.4: Breakdown of WHO MPOWER measures adopted by member countries (World Health 2021d: 6)

Research affirms that despite measures aimed at cessation of tobacco products, in 2019, there were 1.14 billion current smokers globally, with 155 million smokers aged 15 to 24 years. The impact is profound, with 7.69 million deaths and 200 million DALYs attributed to tobacco use globally (Ong *et al.* 2023: 2337). However, these figures belie the actual number of tobacco users as the study excluded data on passive smoking and forms of tobacco other than “smoked tobacco products” (Ong *et al.* 2023: 2351). The highest number of deaths due to smoking tobacco are reported as being the result of ischaemic heart disease (1.68 million), chronic obstructive pulmonary disease (1·59 million), tracheal, bronchus, and lung cancer (1·31 million); and stroke (0·931 million) (Ong *et al.* 2023: 2348). In SA, findings from the SADHS 2016 (NDoH *et al.* 2019: 19) indicated that tobacco (any type) was used by 13% of females and 38% of males, respectively. With the WHO’s acknowledgement of 1.3 billion tobacco users in 2023, the number of users is set to continue its trajectory both nationally and internationally (WHO 2023b: para. 1).

Under the auspices of WHO FCTC and MPOWER, SA conducted its first Global Adult Tobacco Survey (GATS) in 2021 to monitor and track tobacco control initiatives implemented (Global Adult Tobacco Survey (GATS) 2021: para. 1). Data findings highlighted 12.7 million adult tobacco users, with male and female users mimicking the current global male dominant user trend at 41.7% and 17.9%, respectively. Data on second-hand smoke intake was also found, with exposure experienced at worksites (11.2%), homes (18%) and restaurants (10.8%) (GATS 2021: Table 1). These findings carry inherent economic, healthcare, productivity, individual and community costs and hardship (WHO 2023b: para. 2; Peer *et al.* 2020: 2) but are unfolding against a risk factor that is modifiable and preventable. However, there is hope, as 65.7% of current SA smokers have considered quitting smoking (GATS 2021: Table 1), this is promising. It alludes to the potential for change in the high numbers of prevailing tobacco users and the potential to gain commiserate health and quality of life benefits upon quitting, regardless of how long the individual has been smoking (though quitting earlier in life is advocated) (CDC 2020: 1). More strategic, collective, and coordinated efforts must be made to get ahead of the tobacco industry and to cut back the impact of tobacco use (Juma *et al*. 2018: 11). Literature also calls for a deliberate strategy to safeguard the gains realised from increasing smoking cessation by providing these individuals with obesity prevention measures as smoking cessation is linked to a concomitant increase in obesity prevalence thus it would be counterproductive to swop one risk factor for another (Cois and Day 2015: 8; Catapano *et al.* 2016: 20). Regardless of the documented challenges and slow pace of opportunities to prevent, delay or reduce the increase of NCDs and its impact, momentum must not be lost (Thomas and Gostin 2013: 25). Budreviciute *et al.* (2020: 8) advocates that collective and co-ordinated efforts can be used against NCDs on a global level, for example, via development of national policies and plans led by WHO and United Nations; at country level, for example, via budget support in primary healthcare and engaging in collaborations between key role players like the private sector, research centres and NGOs; at societal level, for example, via provisioning of healthy food and PA at worksites, schools, and universities; and at an individual level: by maximising self-regulation geared towards a healthy lifestyle (Budreviciute *et al.* 2020: 8). Member countries must also heed the call for more decisive and urgent action to accelerate efforts towards cessation of tobacco use and its resulting harmful impact (Budreviciute *et al.* 2020: 7*;* Thomas and Gostin 2013: 19). These actions will also enable efforts towards SDG 3.a and inter alia, other linked SDGs (WHO 2021d: 6).

2.6.2 Alcohol consumption

The use of alcohol has health, social, mortality and economic consequences. With its psychoactive and dependence-inducing ability, alcohol consumption, regardless of its quality and price, results in a high burden of disease when compared to other health risk factors globally. Alcohol consumption has been linked to an excess of 200 health conditions, including several NCDs, for example, cirrhosis, cancers, cardiovascular disease, as well as communicable diseases, for example, TB and HIV (WHO 2022a: para. 1). Globally, 3 million annual deaths and 132.6 million DALYs are attributed to the use of alcohol (WHO 2018c: 141). Thus, an important acknowledgement was finally made based on empirical evidence (Griswold *et al.* 2018: 1015). The previous seemingly innocuous term 'harmful use of alcohol' was acknowledged as a misnomer and seen as detrimental to many individuals as research has increasingly shown that *all* alcohol intake carries with it a high negative impact on health. Research corroborates this basis with "light" and "moderate" alcohol intake accountable for fifty percent of alcohol-induced cancers in the WHO European Region, which is home to the highest consumption and number of alcohol consumers globally (WHO 2023c: para. 2). The burden of disease arising from alcohol consumption was proportionally higher in developing than developed countries (WHO 2008: 18). This strengthens the higher health, socioeconomic, and mortality impact of alcohol on vulnerable populations between and within countries. Those in LMICs are especially vulnerable as the ability to respond effectively and timely to control and manage alcohol-induced disease and strife is compromised (WHO 2018c: 141). The SADHS 2016 (NDoH *et al.* 2019: 19) indicated that alcohol was consumed by 26% of females and 61% of males, respectively, with 5% of females and 28% of males indicating that they consumed five or more drinks at one time in the month preceding the survey.

The Global Strategy to Reduce the Harmful Use of Alcohol saw 193 WHO member states pledging their support (WHO 2010a: para. 1). With flexibility for national and contextual fit, it was envisioned that adopted measures from the global strategy would reduce the impact of alcohol use and result in reduced morbidity and mortality, with improved social and economic impact (WHO 2010b: vii); however, it was weakly received by member countries (WHO 2010a: 12, Burci 2021: 510). To improve the status, the Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020 was implemented (WHO 2013: 7). This action plan included "best buys", inter alia, higher tax on alcohol-containing beverages, and restrictions on advertising and availability of alcohol (WHO 2018c: 120). It is critical that efforts towards curbing and controlling access to and availability of alcohol are successful, and like tobacco, it needs an international regulatory framework (WHO 2018c: 24) to realise the achievement of the SDGs. The Global Status Report on Alcohol and Health proclaimed that despite low levels of alcohol control persisting, effective interventions could be implemented to reduce alcohol use and its resulting harmful reach and impact (WHO 2018c: vii). Similar to the tobacco industry, governments must act decisively and with a unified approach (Juma *et al*. 2018: 4) towards the alcohol industry, which is focused on self-serving needs despite mounting evidence of the ensuing negative public health impact (Savell, Fooks and Gilmore, 2016: 18).

2.6.3 Physical activity

Physical activity (PA) can be used as a vital public health strategy to reduce the burden of NCDs and to support well-being through its ability to impact weight, mental health, and blood pressure (BP) positively (WHO 2022c: para. 2; Fox *et al*. 2015: 1780). The whole population, i.e., from under one year to 65 years and above, can benefit from engaging in a wide range of PA, including walking, running, and cycling, to help individuals meet their individual PA goals (WHO 2022c: para. 4). However, changing a population's PA level is a slow process (WHO 2022c: para. 6). Global statistics indicate that 1.4 billion adults are physically inactive, i.e., they do not achieve the globally recommended minimum of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity PA per week (WHO 2022c: para. 5). Economic growth, while positive, is one side of a coin with the flip side negatively aligned with higher levels of inactivity (WHO 2022c: para. 1), thus compounding the prevalence of overweight, obesity and related NCDs (Nglazi and Ataguba, 2022: 2). This is cause for concern, as even those who become physically active later in life can still reap the associated health benefits (WHO 2022c: para. 5). Physically inactive individuals have a 20 to 30% higher risk of NCD-induced mortality than those who are physically active (WHO 2022c: para. 2). Globally, one out of three women and one out of four men lack the requisite level of PA to achieve and maintain health (WHO 2022c: para. 5). The higher prevalence of inactivity in women correlates with obesity findings for females in the literature (Nglazi and Ataguba 2022: 2; Kruger *et al*. 2005: 492). To enable countries to, inter alia, identify and evaluate risk factors relating to PA levels, the WHO developed the Global Physical Activity Questionnaire (GPAQ). Embedded in the WHO STEPwise approach to surveillance (STEPS), it is also one of the methods aimed at creating a standardised means of data collection on NCDs (WHO 2022b: para. 7). Globally, there is a correlation between the steady increase in physical inactivity, the concurrent rise in NCDs and a country's overall population health and well-being (WHO 2022b: para. 5). A 20-year study in Tehran showed that both moderate and high PA were correlated to a decreased risk of MetS in both adolescence and adulthood (Sheikholeslami, Ghanbarian and Azizi 2018: e84740), indicating the potential for intervention-driven change. Clinical results from the longitudinal Action for Health in Diabetes (The Look AHEAD) study, conducted between 2001 and 2012, demonstrated that improved physical fitness (intervention arm), resulted in a reduction of weight, A1c, and WC and had a causal impact on reducing medication needed to control blood pressure and blood glucose (The Look Ahead Research Group 2013: 149). Importantly, more than 45% of the study population was able to maintain the weight loss achieved (Wadden *et al*. 2011: 1994). The Look AHEAD study, an intensive lifestyle intervention, that used calorie restriction and increased PA to engender weight loss, demonstrated other benefits than weight loss, including a reduction in depression, an improvement in quality of life and physical functioning, among other factors (The Look AHEAD research group 2013: 152); however, it is noteworthy that this did not decrease the adult participants' rate of cardiovascular events (The Look Ahead Research Group 2013: 145). Despite the reported success of The Look AHEAD study, a post-hoc study by the researchers has found that a weight loss equal to or greater than 10% may be more beneficial to lower mortality rate, as while no significant difference in mortality was shown between the control and intervention groups, a subgroup from the intervention cohort who achieved a weight loss higher than 10% showed a significantly lower risk of mortality. The researchers have cautioned that the potential risks that higher weight loss brings must be assessed against a populations' sample characteristics in future interventions (The Look AHEAD Research Group 2016: 918).

The Global Action Plan on Physical Activity 2018-2030 (GAPPA), more active people for a healthier world, was launched to help countries increase PA. The aim was to lower physical inactivity by 15% by 2030 (WHO 2022d: 1). Post GAPPA, the first Global Status report on PA, was released in 2022. Data for SA indicated that physical inactivity was prevalent across multiple age categories, with the trend predicted to continue. Twenty-nine percent of males and 47 percent of females aged 18+ were physically inactive, and 41% of males and 64% of females, aged 70+, were physically inactive (WHO 2022e: 331). Between 2020 and 2030, it is projected that close to half a billion new avoidable NCD cases, with 47% of cases attributed to hypertension and 43% to depression, will add to the burden of disease if the prevailing level of physical inactivity is not addressed. This would necessitate healthcare costing over US$300 billion (WHO 2022d: 1). With SA and much of the world off course in meeting multiple SDGs, much scope remains to implement PA interventions both nationally and internationally, to help accelerate change to the projected statistics from this single variable (WHO 2022c: para 7). The call by Kohl *et al.* (2012: 302) for all role players to invest in PA for global health is overdue but apt as employers, government, the private sector, and the media can collectively contribute towards implementing initiatives to support individuals towards achieving PA targets. Importantly, Kohl *et al*. (2012: 295) advocated that PA, like diet, tobacco, and alcohol use, must be given due consideration and treated as an important and health-determining variable in the cluster of modifiable risk factors aimed at reshaping the current NCD landscape.

2.6.4 Unhealthy diets

With a healthy diet, an individual's food and beverage intake brings necessary kilojoules (energy intake) with a balanced nutrient breakdown to enable bodily functions, growth and development, and aid health and well-being (WHO 2020b: para. 1). Kilojoules are also used for bodily functioning and PA resulting in energy expenditure (Hills, Mokhtar and Byrne 2014: 1). However, when more energy is taken in than expended, or if there is an imbalance in the type and quantity of nutrients consumed, it will lead to the start of unhealthy weight gain, and if not addressed, can compound towards overweight and the associated long-term health problems inherent with a raised BMI leading to NCDs (WHO 2020c: para. 1). Conversely, undernutrition can occur when less energy is taken in than needed or if there is an imbalance in the nutrient type and quantity required by the body to meet bodily functions, growth, development, and well-being. Both under- and over-nutrition are forms of malnutrition (WHO 2021d: para. 1). South Africa is burdened by both under- and overnutrition; this is reflected in the population's CDs and NCDs profile (Faber and Wenhold 2007: 393; Ardington and Case 2013: 14).

Diet is not static; global and national dietary intake patterns are evolving as populations interact with an ever-increasing number of variables (Lin *et al. 2020*: 9; WHO 2020b Healthy diet: para. 2). For example, increasingly, populations aspire towards rural-urban migration (Mchiza *et al.* 2015: 8243; Remais *et al*. 2013: 222; Swart *et al.* 2022: 19), western rather than traditional diets (Budreviciute *et al.* 2020: 4; Kruger *et al.* 2005: 492), food and beverage trends (like taste above nutrition, convenience rather than from-scratch and slow cooking, global food and beverages, and food fads) and these factors influence food and drink intake. Macro factors also influence diet: for example, socioeconomic, environmental and climatic, technological, and political (including warfare) factors (Breda 2019: 2). Individual factors like age, ethnicity, genetics, culture, and gender are other contributing factors (Budreviciute *et al.* 2020: 2). These variables are reflected in the shifting global diet patterns. Diets have increasingly shifted from being high in fruit, vegetables, and whole grains alongside being low in salt, sugar, and fat towards suboptimal diets (Budreviciute *et al.* 2020: 6) that are high in fat, sugar, and salt but low in whole grains fruit and vegetables (Lin *et al*. 2020: 9; Mchiza *et al.* 2015: 8243; WHO 2020b: para. 2). Globally, there is a detrimental shift from a nutrient-dense diet to one that is energy-dense but nutrient-poor (Roberto 2015: 2400). This reality is magnified in LMICs (Roberto 2015: 2404; Budreviciute *et al.* 2020: 4; Lin *et al.* 2020: 8). Dietary diversity also impacts health with a more varied diet linked to nutrient adequacy and better health outcomes (Labadarios, Steyn and Nel 2011: 6). However, a cross-sectional study by Labadarios, Steyn and Nel (2011: 1) concluded that the South African diet could be improved as it lacked dietary diversity with close to 40% of those surveyed consuming foods from between one to three food groups i.e., cereal, meat/chicken and a non-vitamin A rich vegetable (Labadarios, Steyn and Nel 2011: 8). Moreover, differences in inter-race dietary diversity were noted with the Black population group recording the lowest dietary diversity score and the White population group scoring the highest mean dietary diversity score (Labadarios, Steyn and Nel 2011: 4).

While some implementation interventions towards unhealthy diets are acknowledged (Juma *et al*. 2018: 4), addressing unhealthy diets is complex, resource intense, and requires planning, cooperation, and collaboration between many sectors (Micha 2021: para. 4), and this increases the challenge to reverse prevailing consumption trends. Assessing up-to-date information on the South African population's food and drink intake is both necessary and important in relation to informing its National Development Plan (NDP) and advising its National Strategic Plan (NSP), thus shaping policies to enable more informed management of diseases, health, and nutrition status (National Dietary Intake Survey (NDIS) 2022a: para. 3). National dietary intake data on a population also helps to advise optimal interventions aimed at combating the impact of malnutrition, CDs and NCDs (Mchiza *et al.* 2015: 8228). In SA, a long overdue national dietary intake survey (NDIS) was undertaken in 2022 by the University of the Western Cape in collaboration with other Universities and key role players (NDIS 2022a: para. 1). Before this, South Africa did not have any national dietary intake data for adults and only a dated dietary intake from 1999 for 1–9-year-old children was available (Mchiza *et al.* 2015: 8228). However, a recent desktop review undertaken by Swart *et al.* (2022: 1) has provided data on the South African population's food and beverage consumption patterns and provides insight into the factors influencing intake. The baseline data from the desktop review is a precursor to publication of the NDIS 2022, which was conducted in 446 enumeration areas, and will provide current data on dietary intake, BMI, and general health of the South African population (NDIS 2022a: para. 2). The NDIS data will be stratified across income bands, age and gender, and offer insight into the factors influencing food and drink selection and consumption (NDIS 2022b: para. 2).

2.7 Food environment

Food environments refer to the physical, economic, political, and socio-cultural contexts in which people interact with the food system (High Level Panel of Experts (HLPE) 2017: 10). This includes where food is produced, processed, distributed, marketed, purchased, and consumed. Food environments can vary greatly depending on factors such as geographical location, socioeconomic status, cultural practices, and government regulations. This environment comprises various components: the physical locations where food is procured (termed "food entry points"), the infrastructure facilitating access to these locations, individual factors affecting food preferences (such as income, education, values, and skills), and the overarching political, social, and cultural norms shaping these dynamics. These variables are central to understanding the food environment's impact on food choices, its acceptability, and dietary patterns: the accessibility and affordability of food (both physically and economically), the influence of food promotion, advertising, and informational cues, and considerations of food quality and safety (HLPE 2017: 12).

An obesogenic environment may encourage excessive food consumption beyond the recommended energy needs, leading to weight gain, obesity, and other NCDs (Martínez-García *et al.* 2019: 1414). Understanding food environments is crucial for addressing issues related to food access, nutrition, and public health. For example, in some communities, access to fresh, healthy foods may be limited, leading to higher rates of diet-related diseases such as obesity and diabetes. Conversely, in other areas, there may be an abundance of unhealthy food options, contributing to poor dietary habits. Overall, food environments play a significant role in shaping individual and population-level dietary patterns and health outcomes, making this a critical focus area for public health efforts aimed at improving nutrition and reducing the burden of diet-related diseases.

2.7 Policies underpinning the SA context (nutrition environment)

Good nutrition with a healthy diet is central to a country enabling its population's health and development and thus overturning the plethora of challenges brought on by malnutrition and diet induced NCDs (Micha 2021: para. 2; Global Nutrition Report 2022a: 3). As a United Nations member, SA was one of 189 countries that committed to the Millennium Development Goals (MDGs), which were a set of eight global goals focused on poverty reduction and social development between 2000 to 2015 (Sachs 2014: 2206). While all the MDGs were not fully realised within the target period (Mensah and Ricart 2019: 11), these provided a much-needed foundation towards poverty eradication and provided a springboard for the introduction of the 2030 Agenda for Sustainable Development to continue work on any gains realised by the MDGs (Mensah and Ricart 2019: 11). The SDGs, consisting of 17 goals, aim to address global challenges by 2030, and embrace four core areas: "inclusive social development, inclusive economic development, environmental sustainability, and peace and security" (United Nations 2012: 1). South Africa pledged commitment to the SDGs, marking its intent to strive towards addressing and meeting the targets set to optimise the nutrition and wellbeing of its population. To fulfil its global responsibility towards addressing and meeting the SDGs, SA integrated the SDGs into its national development agenda and introduced several policies and strategies to enable its obligations and targets. The SDGs are embedded in the SAs NDP 2030, which serves as the country's blueprint for poverty eradication, reducing inequality and addressing socioeconomic challenges (Francis and Webster 2019: 733). The comprehensive five-year NSP is used by the government to guide multi-sectoral actions that must be undertaken to address challenges brought on by NCDs; it incorporates the WHO "best buys" (NSP for the prevention and control of NCDs 2020-2025: 13). In 2022, the government introduced an update of the 2020-2025 plan with The NSP for the Prevention and Control of NCDs 2022-2027.

Given South Africa's pre-post-apartheid system and its prevailing unequal public-private healthcare system (NDoH 2015: 13), the National Health Insurance (NHI) bill, published on 12 June 2023, is an integral component of its NDP, and a move towards SA's transformative approach to healthcare. The NHI aims to create a publicly funded, single healthcare system to ensure that all individuals, regardless of their socioeconomic status, have equal access to quality healthcare services (NDoH 2015: 9). Several measures have been implemented in SA towards the prevention and control of NCDs and to meeting nutrition targets. For example, the adoption of the Health Promotion Levy (Taxation of Sugar-Sweetened Beverages Policy Paper 2016 (South African Government Department of Treasury 2016: 3), regulations relating to the Reduction of Sodium (South African Government 2017), Tobacco Products Control (South African Government 2008), Alcohol Control (South African Government 2023a), and regulations relating to the Advertising and Labelling of Foodstuffs (South African Government 2023b). However, like several other countries on the African continent, SA is not on track to meet all its global nutrition targets (Figure 2.5). For example, SA is off course towards meeting targets for diabetes (men and women), obesity (men and women), and raised BP (men and women). South Africa also presented notably worse statistics for childhood stunting, anaemia, and low birth weight; but was on course for childhood overweight and childhood wasting. Importantly, no monitoring data were available on the key area of exclusive breastfeeding (Global Nutrition Report 2022b: para. 2).

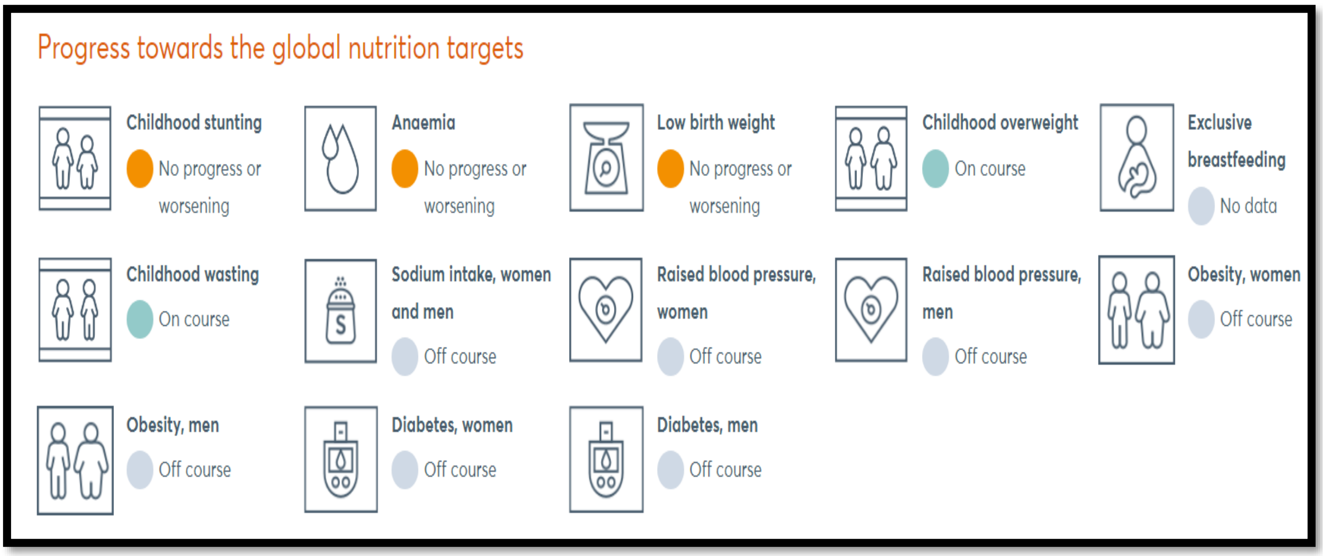

Figure 2.5: Overview of South Africa's progress towards the global nutrition targets (Global Nutrition Report 2022b: para. 2)

The 2022 Global Nutrition Report (2022c: para. 2) indicates that SA is not unique in failing to meet its nutrition targets. It is alarming that, collectively, a large majority of countries are off course to meet multiple targets. For example, 190 countries are off course for obesity (for both women and men), 171 and 182 are off course for diabetes (women and men, respectively), 145 and 167 are off course for raised BP (women and men respectively), and 184 countries are off course for sodium intake (women and men); 50 countries are off course for childhood overweight. These figures exclude those countries with no data, those on course, and those that have made some progress towards meeting targets. While the current national and global statistics are poor, some improvement is noted. For example, the number of countries on course to meet targets are: 45 and 23 for raised BP (women and men respectively), and 19 and 8 for diabetes (women and men respectively); 105 countries for childhood overweight; 53 countries on course. and 74 countries with some progress for childhood stunting, are among other targets that were met. There is, however, a need for more progress as worryingly, only one country is on course to overcome anaemia among women aged 15 to 49 (Global Nutrition Report 2022c: para. 1). The government's commitment towards the SGDs is thus welcome and continues with the launch of the National Strategic Plan for the Prevention and Control of Non-communicable Diseases, 2022-2027 (NSP). With lessons learnt from the successful 90-90-90-tiered approach for HIV/AIDS (Remais 2013: 224), a similar approach has been set out for NCDs in this NSP, and if the correct support is provided (Basu 2022: 67), it can help shift SA closer towards SGD 3.4. As urged by Micha (2021: para. 4), there is scope and economic incentive for businesses to make concerted efforts to join the government in efforts to realise optimum nutrition for the people of SA.

2.7.1 The South African Food-Based Dietary Guidelines (SAFBDGs)

Since the initial publication in 2002, South African Food-Based Dietary Guidelines (SAFBDGs) have undergone revisions and updates to incorporate new scientific evidence, address emerging health concerns, and reflect changing dietary patterns and cultural norms. The SAFBDGs are a set of recommendations developed by the South African Department of Health to promote healthy eating habits and prevent nutrition-related diseases. These guidelines provide practical advice on what to eat to maintain good health and well-being (Vorster, Badham and Venter 2013: S7).

The SAFBDG include the following recommendations:

- Enjoy a variety of foods.
- Be active!
- Make starchy foods part of most meals.
- Eat plenty of vegetables and fruit every day.
- Eat dry beans, split peas, lentils and soya regularly.
- Have milk, *maas* or yoghurt every day.
- Fish, chicken, lean meat or eggs can be eaten daily.
- Drink lots of clean, safe water.
- Use fats sparingly. Choose vegetable oils, rather than hard fats.
- Use sugar and foods and drinks high in sugar sparingly.
- Use salt and food high in salt sparingly.

Overall, South Africa's FBDGs were designed to be culturally sensitive and relevant, acknowledging the importance of cultural eating habits in shaping dietary choices, promoting uptake of PA, health and well-being within the population. While national FBDGs from one country to another are different, these are essentially designed to promote healthy consumption and wellbeing. Compellingly, international studies like the European Prospective Investigation into Cancer and Nutrition study (EPIC-Granada study) (Molina-Montes *et al.* 2014: 2426) and the Danish Cohort study (Markanti, 2021: 841) indicated how higher conformance to the FBDGs in each country was inversely associated with lower risk for NCDs. However, in SA, Jacob *et al.* (2022: 2818) found that the general population is largely unaware of the SAFBDGs, thus resulting in low adherence and a higher prevalence of NCD related diseases. Globally, SA has one of the lowest adherence to the SAFBDGs (Springmann *et al.* 2020: 374), thus the SAFBDGs can be used in lifestyle education classes to create awareness of and promote healthy consumption, increase uptake of PA and lead to higher adherence to the SAFBDGs with potential to mitigate NCD risk.

2.8 Interventions

Globally, the spiralling growth and impact of NCDs, including its associated impact on mental health and wellness, is documented, and must be addressed (NDoH 2022: 10). Preventative strategies like the use of strategic interventions can be a powerful resource to facilitate meaningful behaviour change and thus help reduce and control a population’s current and future disease and well-being profile (WHO 2010b: vii; Budreviciute 2020: 1). The WHO International Classification of Health Interventions (ICHI) defines a health intervention as “an act performed for, with or on behalf of a person or population whose purpose is to assess, improve, maintain, promote, or modify health, functioning or health conditions” (WHO 2021: para. 1). Interventions, while certainly not a one-size-fits-all solution (Breda 209: 3), can yield an intervention effect with positive, nil or negative results. Monitoring implementation and outcomes of interventions present important learning opportunities to assess and review the success of interventions. It can also provide insights to modify interventions to fit: context, purpose, increased opportunity for success, resources available and timelines. White (2013: 31) recommends assessing intervention findings for “impact evaluation”, i.e., a “with versus without” intervention result, as an important step to determine if the intervention made any difference. Additionally, White advocates that a baseline measurement be conducted before the intervention implementation and at the end of the study, as this pre-post intervention measurement approach enables calculation for a double difference estimate. i.e., the difference in the change-over time between two groups (White 2019: 31). This is an important indicator of an intervention’s viability.

Rather than focusing efforts and strained resources (especially in the case of LMICs) on treating the outcomes of NCDs (for example, strokes, heart disease, cancers, and kidney damage), more strategic, responsive, and collective action must be taken to implement interventions to control and prevent disease clusters from gaining a foothold in a country’s population (Breda 2019: 3). For example, obesity awareness and preventative measures must be implemented from childhood to inculcate and naturalise the consumption of healthy food and beverages, and improved uptake of PA practices, to enable a healthier population (NDoH 2023: 5; Checkley *et al.* 2014: 432; Kruger *et al.* 2005: 495). Evidence-based tools like the “NOURISHING framework” (World Cancer Research Fund 2014: para. 4) and the WHO GINA (2023: para. 1), can be used to inform and support actions and policies aimed at enabling a healthier population, for example, the Sodium Country Score Card and the Trans-fatty Acids TFA Country Score Card which aim to encourage individuals to make healthy choices (WHO GINA 2023: 1). Calls for strategic intervention opportunities to be utilised, including combining individual and environmental level interventions to break the cycle that perpetuates the intake of unhealthy foods and beverages, are thus recommended (Roberto *et al.* 2015: 2401).

2.8.1 Embedding wellness interventions within worksites, challenging but also rewarding

The WHO (2004: 15) advocated that civil society, government, and nongovernmental organisations (NGOs) have a shared responsibility towards promoting individual behaviour changes. With approximately 3.32 billion people (globally) and 16.273 million (SA) in employment in 2022 (Statista 2023a: para.1, Statista 2023b: para.1), there is much scope for worksites to contribute towards this collective goal. Worksites provide a valuable setting to leverage wellness strategies by providing employees access to nutritious food and beverages, PA resources, and smoking cessation initiatives. These strategies can provide an enabling environment for individuals to make healthier choices (Song and Baicker 2019: 1492. Mattke *et al.* (2009: 31) have also highlighted that worksite intervention programmes could be aimed at different levels. I.e., primary prevention, to prevent the onset of diseases, or secondary prevention, aimed at diagnosing and treating diseases during the early stages (prediabetes and prehypertension). Alternately, programmes could be pitched at disease control by promoting adherence to prescribed pharmacology and behaviour change. Importantly, and for optimal impact, these interventions can be tailored to fit specific as well as more than one level at a given worksite (Mattke *et al.* 2009: 60).

The recent call by the government for public service worksites to unite in combating obesity is welcome (NDoH 2023: 33). However, with 1 230 835 employees in the public sector (Gabara 2022: para. 1), it is essential that this call to action be expanded to include public *and* private worksites, as both categories of worksites can be used to enable interventions aimed at reducing prevalence of NCDs (Fernandez, Becerra and Chin 2014: 223). Collectively there is scope for both public and private worksite wellness intervention programmes to help drive a more pronounced and positive impact on a country's Gross Domestic Product (GDP), worksite productivity, and employee health and productivity, and reduction in the prevalence of NCDs. However, some organisations may prefer to focus on employee safety, which is perceived as a responsibility, rather than worksite health programs, and thus not be willing to commit to the latter (Dickson-Swift 2014: 145). Time constraints, both within and after working hours, may also hinder the uptake and/ or regular participation in worksite health programs (Dickson-Swift 2014: 145). Additionally, since multi-level management commitment is critical to the success of worksite health programs, employee motivation to participate is proportional to management support (Dickson-Swift 2014: 146; Mattke *et al.* 2009: 24). It could also be argued that while employee well-being is indeed a worthy cause, in the busy work world, beset with performance targets, competing priorities and limited resources, organisations also need transparent and profit-driven motivators to incentivise their buy-in towards employee well-being (Krekel, Ward and De Neve 2019: 94). However, a large body of literature indicates that there are diverse gains for different role players within worksite wellness programmes. For example, employee wellbeing correlates with productivity and organisational performance (Krekel, Ward and De Neve 2019: 94) and improved employee engagement in PA, increased intake of fruit and vegetable consumption, and an increase in smoking cessation (Matkke *et al.* 2009: 17), alluding to high potential returns on wellness investment.

Krekel, Ward and De Neve (2019: 94) used longitudinal data to show that employee engagement and an organisation's improved financial performance positively impact each other. Gubler, Larkin and Pierces' longitudinal data (2017: 2) also affirmed that investment in worksite wellness efforts has multiple benefits, including a reduction in insurance costs, a decrease in employee absenteeism and improved employee productivity. While the authors cautioned against their small sample size, increased productivity was attributed to lifestyle improvements in PA, nutrition, and reduction of stress. Importantly, *all* employees, i.e., those with and without health problems, showed promising potential for significant growth in productivity through lifestyle changes (Gubler, Larkin and Pierce 2017: 19).

Fernandez, Berrucca and Chin (2014: 225) have also advocated for worksites as an optimal site for implementation of interventions targeting employee health. However, Fernandez, Berrucca and Chin (2014: 225) and Mattke *et al.* (2009: 25) have cautioned that employee participation may not always be forthcoming if left to voluntary choice; thus, incentives or, as highlighted in the scoping review by Forberger *et al.* (2019: 2), nudging may be needed. Strategic worksite wellness interventions that leverage individual and environmental factors can be used, with incentives, to nudge employees towards participation. Incentives can be varied and used effectively to fit the context and resources available, for example, healthier food choices with healthy canteen menu options (*Roberto et al.* 2015: 2400) can be introduced. Song and Baicker (2019: 1492) offered a $25 gift card to participants in their wellness modules, up to a maximum of $250, while Glanz *et al.* (2021: e2124134) offered their incentive group $3.00 per day for either maintaining or losing more weight, with groups earning a maximum of $300 by the end of the study (Glanz *et al.*: e2124142). In their research, Mattke *et al*. (2009: 100) also reported on discounting of gym fees and the provision of t-shirts and gift cards to reward employees. Another possible option can be incentivising employee wellness uptake through key performance indicators (Lee 2019: 15). This can be structured to allow employees to participate or not participate voluntarily. Participating in the wellness programme, for example, can be structured to meet a predetermined percentage of one's key performance outcomes. As noted by Mattke *et al.* (2009: 25), even modest incentives can garner improved employee participation rates in worksite-based wellness programs. By adopting such a system, employee productivity and earning potential, including self-health, can be optimised. Through this, the organisation has the potential to improve human resource costs, retain a more satisfied workforce, and improve productivity (Lee 2019: 14). It must be noted that based on research by Mattke *et al*. (2009: 26) and the findings by Song and Baicker (2019: 1500), from their randomised clustered trial, the researchers have cautioned employers and readers to avoid disappointment by noting upfront that benefits associated with wellness programmes have a long-term rather than a short-term return on investment. Coupled with this caution, Mattke *et al.* (2013: 134) have stated that while incentivising employees to participate in wellness programmes has proven effective for employees and employers, the intended and unintended impact of offering incentives to participate in health-oriented programs can benefit from further research.

To help stem the tide of NCD-related burdens, modifiable risk factors must be purposely interwoven into real-life settings and the communities embedded within them. Several lifestyle intervention studies have demonstrated viable applications in real-world settings with varying levels of success. The "Lifestyle Balance" programme, which was developed by the Diabetes Prevention Programme (DPP) Lifestyle Resource Core, was a landmark clinical trial that demonstrated the long-term ability to improve the health outcomes of participants. It was aimed at modifying and maintaining physical activity and weight loss, targeted at 150 minutes of moderate physical activity and 7% of initial body mass, respectively (The Diabetes Prevention Program Research Group 2002: 2166). The programme comprised a 16-session curriculum plan focused on goals targeting weight loss through energy intake and expenditure to create and maintain energy balance, followed by support (psychological, social, and motivational) to help participants maintain goals. The first eight sessions were goal-orientated, and the second eight sessions were support-orientated (The Diabetes Prevention Program Research Group 2002: 2167). The lifestyle intervention study reported a 58% reduced risk of developing diabetes over a 3-year period (The Diabetes Prevention Program Research Group 2002: 2171). Other research intervention studies using diet, physical activity, and weight loss have proven successful, achieving a reduction in diabetes risk by 58% (Tuomilehto *et al.* 2001: 1348); while the Da Qing study by Pan *et al.* (1997: 537) found the following reduction in the risk of developing diabetes in each of their three treatment groups: diet only 31% ($p < 0.03$), exercise only 46% ($p < 0.0005$), and diet and exercise 42% ($p < 0.005$).

To counter the growing prevalence of diabetes, SA also developed and piloted a country-specific, culturally relevant lifestyle intervention, titled the SA Diabetes Prevention Program (SADPP), to target and improve awareness, diet and physical activity (Hill *et al.* 2023: 2). Collaborative efforts with representatives from the population and input from both literature and (local and international) experts in the field were used to model the SA programme content (Hill *et al.* 2023: 1). The pilot programme, which utilised a fast-tracked 6-session adaptation of the 16-week programme (Hill *et al.* 2023: 11), was well received with participants demonstrating efficacy of the programme content through their shared experiences when the lessons learnt were applied in real-world settings (Hill *et al.* 2023: 12). In another South African study, Kolbe-Alexander *et al.* (2012: 375) made use of a detailed wellness intervention programme to target employees identified at risk for CVD. The researchers used interventions targeted at increasing participants PA, as well as fruit and vegetable intake. Multicomponent interventions have been hailed as more valuable than singular interventions (White 2013: 37), thus alluding to the potential to adopt more than one scalable intervention adapted to context, to improve disease management and control. While some countries lack the capacity and resources to scale up and implement health interventions (Breda 2019: 1), steps towards realising even partial achievements, for example, lowering the concurrent increase in blood pressure (BP) with ageing (Fuchs and Whelton 2020: 290), can provide beneficial start-up efforts for countries grappling with the impact of diseases. Measures to prevent and reduce the impact of NCDs also contribute towards attaining SDGs, for example, interventions based on the WHO "Best Buys" (WHO 2013: 7) targeting physical activity, diet, and alcohol; as well as smoking cessation (Budreviciute *et al*. 2020: 1; Uwimana-Nicol, Hendricks and Young 2021: 3).

In their narrative review, Philip, Kannan and Parambil concluded that the use of community-based health interventions (CBHIs), that were adapted to fit a target community's needs (Philip, Kannan and Parambil 2018: 9), were helpful in achieving intervention success. They also attributed their intervention success to "teamwork", the "natural contact" inherent within communities, and the use of multiple activities at regular intervals to engage the target population (Philip, Kannan and Parambil 2018: 4). Mache *et al.* (2023: 827) also indicated that social motivation, like group affiliation, was successful in achieving and maintaining weight loss and was ideal for the worksite lifestyle programme. Thankappan *et al*. (2017: 18) also evidenced improvements in CV risk using community-based lifestyle interventions, with longer-term follow-up envisioned to track additional health benefits. This alludes to how interventions coupled with Dewey's (1938) and Vygotsky's (1978) approach can help accelerate and realise targeted NCD risk reduction goals within communities. There is also opportunity for these types of gains to be exported to other community settings. For example, in early childhood development centres, schools, tertiary education settings, worksites, frail care facilities, primary healthcare facilities, local communities (unemployed and elderly), prayer groups, and more. If targeted interventions pitched at each community setting contribute even a 5% improvement to a community's health, for example via weight loss or diet improvement as evidenced by Pan *et al.* (1997: 538), the DPP Research Group (2001: 2166), Tuomilehto *et al.* (2001: 1349), Mache *et al.* (2015: 834), Fruh (2017: S3) and Catapano *et al.* (2016: 25), then collectively, there is excellent opportunity for meaningful change in long-term population health.

While all individuals have potential for health improvement through wellness and lifestyle programmes, the importance of pharmacological interventions in NCD control and risk management; is acknowledged. Simultaneously, these interventions are criticised for not always being economical (Catapano *et al.* 2016: 3005), nor always being tolerable (Lipsy 2003: 4). These findings contribute to the reasons that lead to pharmacological non-adherence (Third Report of the National Cholesterol Education Program (NCEP) 2002: 3274). Depending on the risk profile of an individual, an optimal intervention may necessitate lifestyle changes only, pharmacology only or a combination of pharmacology and lifestyle programmes (Lipsy 2023: 3; Catapano *et al*. 2016: 3005; Klug *et al.* 2018: 980). The polypill, a cost-effective single pill, with a combination treatment for CVD, warrants mention as it provides a treatment shift from conventional pharmacology (Muñoz *et al.* 2019: 1115). It has claimed to effectively prevent over 80% of CVD events (Wald and Law 2003: 1421) and can help to improve adherence to pharmacology (Catapano 2016: 56). On the negative side, the polypill has been criticised due to it not being so readily possible to adjust the fixed-dose and combination of treatment. Wald and Law (2003: 1422) and Catapano (2016: 3005) have indicated that generic drugs can help to mitigate the cost of pharmacology treatment when available; however, Catapano *et al.* (2016: 3005) have concurred that population-based lifestyle changes can be more cost-effective.

2.9 Coronavirus impact

It must be noted that this research study was impacted by the Coronavirus disease (COVID-19) caused by the SARS-CoV-2 virus, an infectious disease that captured the world's attention on 31 December 2019 and compounded the reach and impact of NCD's. The virus source was traced to a form of viral pneumonia in Wuhan, Peoples Republic of China (WHO Coronavirus 2023b: para.1). Infection symptoms from the virus ranged from mild to moderate respiratory illness for some people; however, others could become extremely ill and require medical assistance (WHO 2023b: para. 1). People who had pre-existing medical conditions became higher risk for premature mortality, including all those living with CDs and NCDs. Given the high prevalence of CDs and NCDs in SA, this translated to an increased need for acute care and resulted in a high mortality rate. With its rapid spread, COVID-19 quickly reached pandemic status and brought widespread disruption to health services, as healthcare priorities were switched up in response to the pandemic. This effectively meant that service delivery for screening, referral, continuity of treatment, and dispensing of medication, were adversely impacted, generating added cost, distress, pain and suffering for patients and their families. Insufficient healthcare resources to attend to both the severity of the COVID-19 pandemic and the traditional day-to-day health services that were needed also meant that some patients who were dependent on in-hospital care for non-COVID-19 related illnesses, were turned away (WHO 2020a: 9). Feedback from a rapid assessment of 163 participating member states on the impact of the COVID-19 pandemic on NCD resources and services, provided a broad snapshot of service delivery during the COVID-19 pandemic and indicated that 50% of low-income countries reported disruptions to cardiovascular health services, 58% for disrupted cancer treatment care and 71% for disruption to rehabilitation services. The disruption figures were higher for low-income countries (LIC) than HIC, indicating the latter's superior access to undisrupted levels of healthcare during the pandemic compared to lower-income countries (WHO 2020a: 15). It was within a COVID-19 context that this research study unfolded.

2.10 Conclusion

South Africa is besieged by both CDs and NCDs, with NCDs rapidly outpacing CDs. The ready availability of foods and beverages that support an obesogenic environment when paired with a more sedentary population, compounds the burden. Prevailing unequal social determinants of health exacerbates the burden. This chapter presented a review of the literature on diseases with a focus on lifestyle-related NCDs and the associated risk factors. Modifiable risk factors can be strategically manipulated to help target and lower risk factors associated with cardiometabolic diseases. National and global challenges and efforts to respond to NCDs were also explored and discussed. Challenges and facilitators for worksites to act as a catalyst for implementing interventions aimed at lowering cardiometabolic risk were presented. With a global increase in non-communicable diseases (NCDs), preventative measures must be urgently implemented, especially in LMICs, to diagnose, control and reduce the prevalence of chronic lifestyle diseases. This RCT set out to compare the change in outcomes for CO and CB interventions in a worksite environment. These findings will contribute valuable insghts and add to the limited literature available from LMICs. While other studies have focussed on lifestyle interventions this study includes the added value of integrating canteen interventions to improve health outcomes. In the next chapter, the research design, methods, data collection methods and ethical considerations are presented and discussed.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research design and methodology used for the study. The data collection tools, and the methods used to collect and verify the data are detailed. This study aimed to use a canteen and behavioural (CB) and canteen only (CO) intervention to lower cardiometabolic risk at worksites in South Africa (SA).

3.1.1 South Africa, country context and social determinants of health

South Africa is among the low- and middle-income countries (LMIC), but is listed as an upper-middle-income country. It is still adjusting to democracy and remains burdened with an apartheid legacy, which has widened the inequality gap between its people and has left an indelible imprint (Francis and Webster 2019: 733). With a population of 60.1 million (Statistics SA 2021a: para. 2), it has a gender breakdown of 48.9% males and 51.1% females (Statistics SA 2021a: para. 7). Post-COVID-19, life expectancy for 2021 dropped from 62.4 to 59.3 years for males and 68.4 to 64.6 years for females (Statistics SA 2021a: para. 22). South Africa has a diverse population mix with a majority of Black African descent (80.9%) including the Zulu, Xhosa, Ndebele, Sotho, Pedi, Tswana, Tsonga, and Venda groups (Nel *et al.* 2023: para. 10); followed by Coloured (8.8%), White (7.8%) and Indian/Asian (2.6%) (Statistics SA 2021a: para. 8). The 2020 rural-urban population mix was 32.6% and 67.4%, respectively (Britannica 2023: para.1), whilst two decades ago this was 42% and 58%, respectively (The World Bank Group 2023: para. 1). At 32.9%, SA has the highest unemployment rate globally (Statistics SA 2023: para. 1). Unsurprisingly, in its 2015 Income and Expenditure Survey, SA had a GINI coefficient of 65%, indicating a large disparity between the wealthiest and the poorest citizens (Statistics SA 2022: para. 8). The gap in annual earnings between female (R98 911) and male (R165 853) headed households also remains pronounced (Statistics SA 2022: para. 6). The Income and Expenditure Survey also sampled households to determine consumer spending patterns on goods and services. The 2015 survey noted that White-headed households had an annual income that was triple the national average; this gave them a spend power of R350 937, which was much higher than Black households that had a spend power of R67 828 (Statistics SA 2022: para. 7). With the new Income and Expenditure Survey underway and due for publication in 2025, the government is aiming to reduce the GINI coefficient to 60 (Statistics SA 2022: para. 5). However, this ‘reduced’ target maintains the status quo that exists between the rich and the poor in SA. In turn, this influences multiple health outcomes of a population including the daily conditions under which people live, work, grow and age (WHO 2024: para. 1). Thus, impacting among other aspects, education level attained, physical activity (PA) levels, vulnerability to diseases (Goetjes *et al.* 2021: 1), unhealthy diet (Goetjes *et al.* 2021: 6; Xu *et al.* 2020: 532) and level of dietary knowledge and understanding (Xu *et al.* 2020: 532). Post COVID-19 measurements on social determinants of health have shown a marked increase in inequalities with the health and well-being of poor individuals and communities being most negatively impacted. As advocated by WHO (2024: para. 4), this calls for a multisectoral approach to address the variables associated with social well-being and health.

3.2 Study design

An experimental research approach was used in this research study. This type of research allows researchers to randomly assign participants to a group while the variables impacting any group are controlled to check and document participant responses in relation to a stimulus (Mitchell 2015: 2). In this randomised controlled trial (RCT), a pre-post-test design was used to assess the effectiveness of a canteen and behavioural intervention on cardiometabolic risk factors among pre-diabetic and pre-hypertensive employees at two multinational worksites.

3.3 Participating worksites

South Africa, made up of nine provinces, is a country on the southern tip of Africa (South Africa's provinces 2023: para. 1). This study was conducted across two provinces, i.e., KwaZulu-Natal (KZN) and Gauteng, at two worksites viz Unilever and Retailability in SA (Figure 3.1). Seven Unilever worksites, i.e., four KZN-based and three Gauteng-based, and one Retailability worksite, KZN-based, participated in the study. The four KZN-based Unilever sites included Unilever Phoenix (P) (Aerosols), Unilever Indonsa (I) (Savoury dry food plant for Knorr, Robertsons and Rajah), Unilever Maydon Wharf (MW) (Personal and home care), and Unilever La Lucia (LL) (Head office). The three Gauteng sites were Unilever Boksburg (BB) (Home care), Unilever Khanyisa (K) (Home care), and Unilever Lordsview (LV) (Ice cream). A total of eight worksites participated in the research study: five coastal, and three inland. Collectively, these organisations employ a combined total 2741 staff, with 2294 employed by Unilever and 447 by Retailability. Two of the sites were administrative (Unilever LL and Retailability) while the remaining sites were production-based.

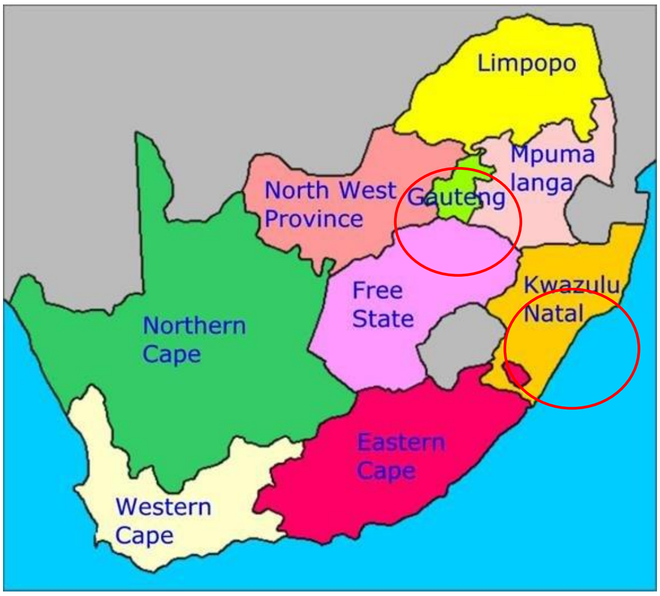

Figure 3.1: Map of SA indicating the nine provinces (https://www.southafrica.to/provinces/provinces.php)

3.3.1 Unilever

Unilever is a multinational, fast-moving consumer goods company providing a range of food and beverages, home care, beauty, and personal care items in over 190 countries. It is home to over 400 brands, including popular brands like Lifebuoy, Omo, Surf, Dove, Knorr, Joko, and Ola and recorded a turnover of €60.1 billion in 2022. Globally, the organisation employs 148000 individuals and has a gender balance of 52% females and 48% males (https://www.unilever.co.za/our-company/: para. 1).

3.3.2 Retailability

Retailability, based in La Lucia, KZN, is the umbrella company for various retail fashion and clothing brands like Edgars, Style, Keedo, Legit and Beaver Canoe. It has over 600 stores in Southern Africa (https://www.retailability.co.za/: para. 1) and employs over 10001 employees (https://za.linkedin.com/company/retailability-pty-ltd: para. 1).

3.3.3 Inclusion and exclusion criteria

Once gatekeeper permission (Appendix A) and DUT institutional research and ethical clearance (IREC) were secured (Appendix B), Unilever and Retailability employees were informed about the worksite research study through a PowerPoint presentation (Appendix C1), and an information pack that was shared at departmental general meetings (Appendix C2). An infographic advising about the study was also designed for use at the different sites so all employees within the participating worksites would be aware of and informed about the impending study, and to allow sufficient time for employees to consider if they would be interested in participating in a study of this nature (Appendix D). In-person information was provided to employees by the researcher and research assistants (RAs) at each site to recruit employees for the research. The researcher and RAs approached staff at the worksites once they entered the premises and advised them of the impending research study, aims and research process to ascertain if they were keen to participate. Interested employees were provided with a letter of information on the two-step screening process (Appendix E). They were invited to participate in the "Know your numbers" diabetes and hypertension prevention programme. Willing employees completed an informed consent for pre-screening (Appendix F) before participating in the screening criteria questionnaire (Appendix G). Inclusion and exclusion criteria were used to screen employees for eligibility in the study. Employees were eligible if they: (1) were working full-time or on a long-term contract; (2) were ≥18y of age; (3) were not pregnant or breastfeeding, (4) self-reported eating at the canteen, (5) were overweight or obese using WHO cutoff points; or had prediabetes (HbA1c of 5.7-6.4%) {not currently taking any diabetes medication} or had blood pressure (BP) ≥120 mmHg systolic or diastolic pressure ≥80 mmHg {not currently taking any medication for hypertension}.

Exclusion criteria included (1) pregnant women, (2) employees on diabetes medication; (3) employees on hypertensive medication, or (4) screened individuals identified as diabetic or hypertensive. Screening step 1: employees presenting with random capillary glucose (RCG test >5.6mmol) or 2 blood pressure measurements (≥120 mmHg or diastolic pressure ≥80 mmHg) were invited to participate in screening step 2. Post step 2 screening, participants who presented with an HbA1c of 5.7-6.4% and or BP (≥120 mmHg systolic or diastolic pressure ≥80 mmHg), were invited to participate further in the research study and provided with a follow-up letter of information (Appendix H) and a consent form for further participation in the study (Appendix I). A visual overview of the research process is provided in Figure 3.2.

- Obtained gatekeeper permission (Unilever and Retailability) and DUT IREC clearance
- PowerPoint and letter used to inform employees about the pending DUT research study, its value, and to invite employees to participate
- In-person site visits conducted to inform and invite employees to participate in the resrearch study
- Interested employees invited via letter of information and informed consent, to participate in the two step screening process
- Inclusion and exclusion criteria applied to preselect employees for the research study
- Two- step screening, eligible employees invited to participate further in the research study using follow-up letter of information and informed consent to particpate further

Figure 3.2: Visual overview of the initialising the research process

3.3.4 Sample size and randomisation

Seven hundred and ninety-seven employees participated in the step 1 screening for potential inclusion in the study. A comprehensive flow diagram presented in Figure 3.3, using the Consolidated Standards of Reporting Trials CONSORT flow diagram (Schulz, Altman, and Moher 2010: 5), to illustrate sequential progress during this parallel randomised intervention provides clear detail on the phases of this research study. The first phase of the CONSORT flow diagram details the 797-employees that participated in the screening process. Once exclusions were accounted for, 395 eligible employees were invited to participate further in the research, of whom 188 declined the opportunity to participate further, while 207 agreed to participate. At the LV worksite, twenty of these willing participants had to be removed from the study due to an unexpected incident outside the control of the research study and the gatekeeper agreement. During the unforeseen incident, the LV worksite was temporarily closed. When the LV worksite reopened, due to production backlogs, employees were not released from their jobs to participate in the intervention. Production targets negatively impacted by the unplanned shutdown had to be met, and the DUT research team was not granted approval to re-enter the site for the intervention implementation phase of the research.

For objectives 1 and 2, Cochrane's formula: $n_0 = (1.96)^2 * p * (1-p) / d^2$; from a population of 187 willing participants, assuming an alpha level of .05 and a margin of error of .05 (5%), a minimum sample size of 65 in the CO group was needed to identify significant improvements in at least 2 out of 3 measures from baseline to 3 months (p (probability of success/improvement) =.143 [1-p=.857]) and 67 (p=.286) [1-p=.714] in the CB group. The measures assessed were HbA1c, systolic BP and TG. To identify changes in HbA1c from baseline to 3 months endline assuming an alpha value of 0.05 with 80% power, a sample size of 70 was needed for the CO and CB groups. The formula: SQRT ((N-n)/(N-1)) was used as an adjustment factor to the standard deviation (SD) value. This resulted in a sample size of 70 in each group to adequately detect a difference between the CO and CB groups in the change from baseline to 3 months with 95% confidence and 80% power.

$$n_0 = \frac{(1.96)^2 \cdot p \cdot (1-p)}{d^2} \qquad \sqrt{\frac{N-n}{N-1}}$$

Worksite production challenges and demand, high workload, and lack of time resulted in a pool of 187 participants forming the study population for this intervention study. To avoid selection bias, randomisation was applied (White 2013: 34). A randomised control trial (RCT) approach is valued in research as it helps to ensure that any observed differences in outcomes can be attributed to the programme itself rather than other factors. For this to occur, participants must be randomly assigned to either the control or intervention groups respectively (White 2013: 30). To ensure that each of the 187 participants had an equal chance to participate in the research study, they were assigned to the CO intervention group or the CB intervention group using the principles for simple random sampling (Bhardwaj 2019: 159; White 2013: 40). For this research study, the envelope method (Bhardwaj 2019: 159) was used, where the numbers of participant at each site were written on slips of paper, up to the maximum number of participants at a site e.g., 40 participants equated to use of numbering from 1 to 40 and so forth. The numbered slips of paper were randomly picked and placed alternately into one of two envelopes until all the numbered slips of paper were ascribed. Any envelope could be selected for either the CO or CB arms of the study; this process helped to minimise bias (Renjith 2017: 45; Noor, Tajik and Golzar 2022: 81) and to increase the probability to generalise findings (Noor, Tajik and Golzar 2022: 80). The allocation method was repeated for each site until all participants were allocated. Each envelope was randomly issued with a title, with one being CO and the other CB. This resulted in 93 participants being assigned to the CB arm and 94 to the CO arm, respectively. The participants were not privy to which participants were in the control vs intervention group. Instead, they were told, if they asked, that they would be picked randomly to participate in the lifestyle programme. Participants were also asked not to share information from the classes with other employees in the organisation until after the programme was completed. This research was ‘unmasked’ between the researcher and the participants but between the control and experiment, it was ‘single blind’. After randomisation, when the 93 CB participants were provided with a reminder message advising on the start of the lifestyle intervention classes, five willing participants cited work demands to withdraw from the CB intervention and were defaulted to the CO arm of the study. No replacement was sought for these five CB participants, resulting in 88 participants in the CB arm and 99 participants in the CO arm of the study. During the intervention phase, nine participants were non-responsive. They did not attend any of the lessons in the CB arm of the study, thus further reducing the CB group population to 79. In the CO arm of the study, 3 participants left the worksite, thus reducing the participating population to 96.

The randomised trial proceeded to the follow-up phase, during which the EL laboratory process, i.e., HbA1c, full lipid profile and BP measurements were collected along with participant weight, waist circumference (WC) and a 24-hour food recall. A further 27 participants (i.e., 7 CB arm and 21 CO arm respectively) were eliminated from the research analysis as, despite several attempts to invite and encourage participation, they did not complete the full laboratory process. When the laboratory process was incomplete for any participant in this research study, it nullified the opportunity to conduct a pre-post-intervention impact evaluation. This included one participant who completed the EL laboratory process but did not complete the required paperwork. Hence, at EL, data from 147 participants were analysed, 72 from the CB arm and 75 from the CO arm, respectively. The data were analysed to enable analysis and comparison of results between the two groups, to draw conclusions and to make recommendations.

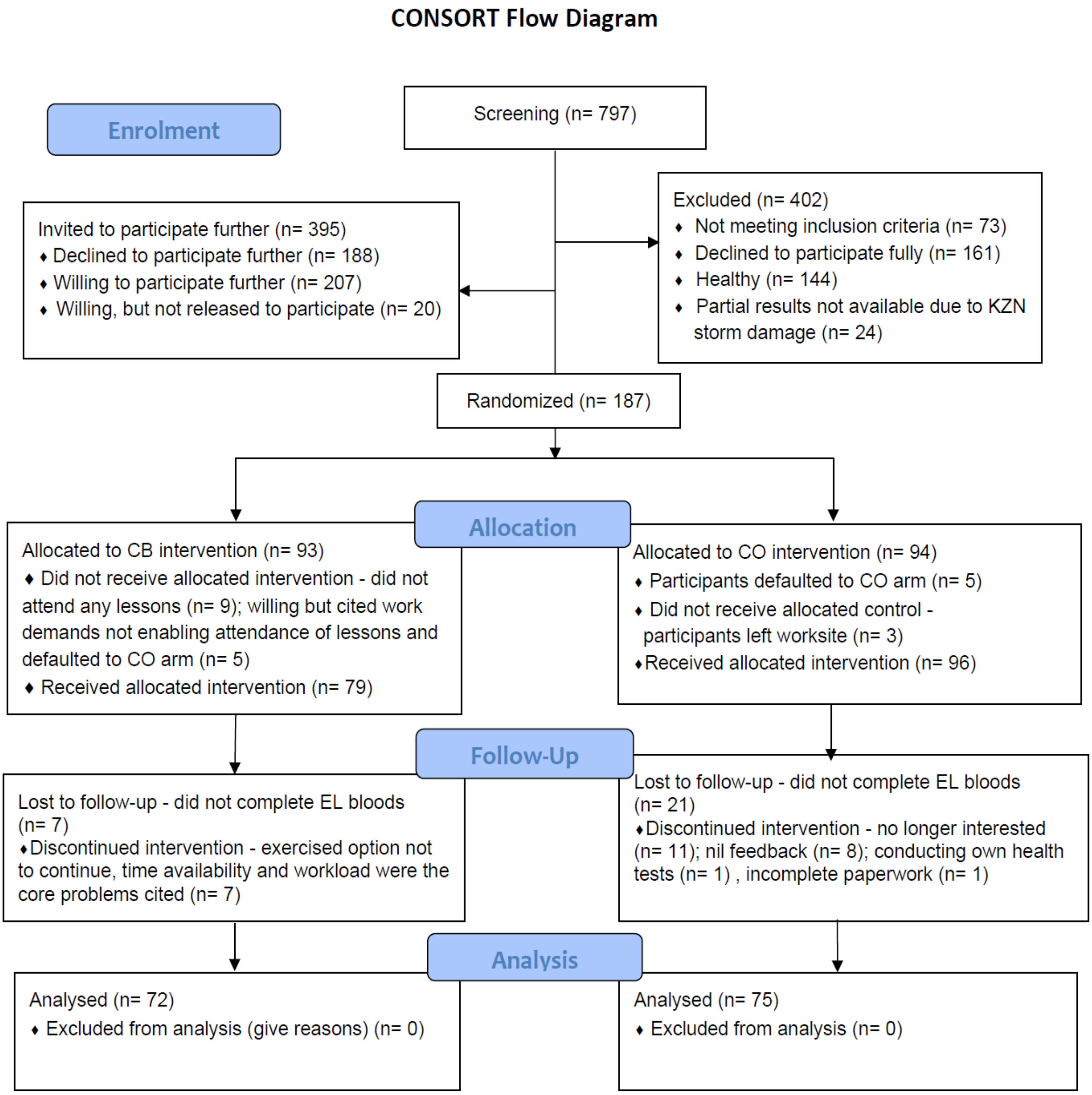

Figure 3.3: CONSORT diagram detailing the research participation flow (Schulz, Altman, and Moher 2010: 5)

3.3.5 Contamination of results

Both unintentional and intentional efforts helped to minimise contamination between the CO and CB groups during the RCT phase of the study. Controlled trials involving multiple sites have been challenged in the literature when they were perceived to lack due diligence to minimise contamination effect (Kaushal 2014: 790). While it was unintentional, the spread of participants across several worksites helped to keep the control and intervention groups at each of the sites in the study separate, with sufficient distance between the sites to reduce the probability of inter-site contamination. However, potential for intergroup contamination existed at the participant level, i.e., between the CO and CB participants at each site and necessitated a design step to help control for contamination. To this effect, participants in the CB were asked to adhere to a non-disclosure clause designed for the study (Appendix J), to discourage them from sharing information, advice and resources about the study intervention with other employees at the worksite; this was effective for the duration of the intervention. Potential for contamination was also assessed by randomly asking the CO participants if they had received any information regarding diet and lifestyle changes from any of their work colleagues; if they had, the name and contact information of the colleague would have been collected for follow-up. If any significant contamination was found, we would have had to make the necessary adjustment during analysis. However, there were no affirmative reports that necessitated follow up and adjusting.

3.4 Measurement instruments

A range of measuring instruments was used to gather data and provide a detailed description and summary of the participants' pre- and post-intervention findings in this RCT. Initially, data collection for questionnaires were conducted face-to-face; however, COVID-19 measures influenced and hindered data collection, necessitating a shift to a hybrid mode to improve the low response rate and to achieve more complete and timely data collection for the different tools used. Thus, questionnaire data collection shifted from only face-to-face to include email, WhatsApp, and MS Teams engagement. Some participants could be reached in this multimodal way as they had access to either a work email or MS Teams platform while at work, or personal WhatsApp. Participants who lacked these access options were targeted for face-to-face interactions with assistance from the clinic administration assistant where available. After the pre-screening step, eligible and willing participants, i.e., those who had completed the laboratory samples (HbA1c, lipid profile and 2 x blood pressure (BP) readings) and met the inclusion criteria, were invited via informed consent and a letter of information to participate further in the study. With assistance from the RAs and the researcher, participants completed a questionnaire pack comprising a baseline socioeconomic and lifestyle questionnaire, a dietary questionnaire, 2 x 24-hour food recalls, a global physical activity questionnaire (GPAQ), and anthropometric measurements.

3.4.1 Socioeconomic and lifestyle questionnaire

At baseline, participants' socioeconomic characteristics were collected through a socioeconomic and lifestyle questionnaire (Appendix K). This was a validated questionnaire, used to collect similar data in a worksite study in Nepal (Shrestha *et al.* 2019: 4), and was adapted and piloted for use in this research study. The first section of the questionnaire included demographic and job-related information about the participants' age, gender, race, marital status, job designation, monthly income, education, and language. The second part of the questionnaire enquired about the participants' quality of life and medical history. Participants were asked about their overall health status and weight and answered specific questions relating to their health conditions and medication. The last section covered lifestyle factors, including smoking, alcohol intake and stress levels. The questionnaire was printed for face-to-face use and later adapted for online use via MS Forms.

3.4.2 Dietary questionnaire

A validated dietary questionnaire (Narayan and Prabhakaran 2016: 9), was used to establish a diet overview and breakdown of participant dietary choices (Appendix L). It included questions that gathered participant information on the number of meals purchased weekly for breakfast/ lunch/ dinner respectively, dietary preference type, type of fats and starches consumed, type of vitamins/ minerals/ supplements consumed, daily salt consumption and the addition of salt to cooked meals.

3.4.3 24-hour food recall

The 24-hour food recall is regarded as one of the most thorough and complete dietary assessment tools available for use in nutrition epidemiology and is useful for establishing individual dietary intake in studies targeting interventions to improve dietary intake (Castell, Serra-Majem and Ribas-Barba 2015: 46). The 24-hour food recall is a valid data collection tool (Castell, Serra-Majem and Ribas-Barba 2015: 47) enabling the researcher to collect data on participants' food and beverage intake for a 24-hour cycle. This food and beverage recall may be provided based on consumption for any day of the week; it is simple and quick to complete. Data logging involved the person stating the day of the week that they were providing the 24-hour food recall for, then advising if this was part of their usual eating pattern or not. In this quantified 24-hour food recall, participants were asked to explain if their consumption differed from their usual eating and drinking patterns. Thereafter, the participant provided data starting from the time they consumed the first food and beverage for the day until the last items were consumed before they went to bed. Without direct observations of the items that participants consumed, a dietary tool kit was used to guide participants in estimating the portion sizes consumed as correctly as possible without over-or under-reporting of dietary intake. The dietary toolkit contained measuring cups, spoons, and models of food samples to support this activity. Food models were used to gauge participants' portion sizes. Interacting with the samples and utensils during the data collection helped participants accurately indicate portions consumed. Probing was also used to capture as much detail as possible, such as, cooking methods, type of starch, for example: white versus brown rice, or bread. However, a drawback of using a 24-hour food recall is that the responses rely on a person's ability to correctly recall all the items consumed and to fully disclose their intake. Connor (2020: 1) found that obese individuals, especially women, underreported their consumption of energy-dense foods as they may feel judged based on their consumption disclosure. Under-reporting was attributed to conscious or unconscious processes, literacy issues and reporting tool features (Connor 2020: 1). To counter this, the research team used subtle probing to elicit details on food and drinks consumed with emphasis on drinks, snacks, and confectionary, which is what was found to be under-reported on (Connor 2020: 7).

This study aimed to collect dietary data for three 24-hour food recalls per participant. Two interviewer-administered 24-hour food recalls (Appendix M) were conducted at BL to measure daily dietary intake. The first 24-hour recall was administered face-to-face during the step 2 data collection process; it was anticipated that the second food recall would be completed within a week of the initial food recall via either face-to-face, email, or WhatsApp or over MS Teams. However, the second food recall took up to 5 months to complete due to a lack of participant availability to complete the data input. Castell, Serra-Majem and Ribas-Barba (2015: 48) acknowledge that the challenges associated with conducting multiple 24-hour recalls are not new and require planning and tenacity to accomplish. While two to five 24-hour food recalls are ideal, many research studies conduct two to three recalls to get a more informed understanding of an individual's dietary intake (Castell, Serra-Majem and Ribas-Barba 2015:47). For this research study, a third food recall was conducted at EL to assess for post-intervention dietary changes between the BL and EL. Some food recall data was collected online due to lack of participant availability and timelines. Participants whose online forms lacked any detail, were contacted via WhatsApp for more detail and clarity, and if that proved insufficient, it was followed up with a call to extract full data if this was omitted in any way. Importantly, with all participants having completed a minimum of one to two food recalls face-to-face while using the food models, they had a more informed idea of food portion estimates and reference in relation to their consumption. Photos of the food models for portion sizes (Appendix N) as well as the infographic guide on portion sizes, were shared with these participants to remind them of portion sizes to aid with the online completion of the 24-hour food recall. As noted by Gibson, (2016: 10), the food models had estimated food weights, and this was useful to establish portion sizes consumed. The use of household measures (cups, teaspoons, tablespoons), ball sizes (golf and tennis ball size) as well as the Helping Hand for Health Infographic (National Nutrition Week) were also used as a reference and helped participants report on their consumption patterns.

3.4.3.1 Dietary analysis

The food recall data were collected by the researcher and trained RAs. An RA captured the participant food recall data using the FoodFinder 3® software for SA. Excel reports with mean nutrient values were generated as per CO and CB groups and then by gender and compared against the Estimated Average Requirement (EAR), Average Intake (AI) and estimated energy requirements (EER) to establish the prevalence of inadequacy for males and females. The data were analysed to establish consumption patterns and to identify the potential for modification to mitigate against NCD risk factors.

3.4.4 Diet Quality Questionnaire

Diet quality has ability to impact population health, the environment and the economy therefore monitoring of diets is essential (Global Diet Quality Project 2022: 6). The online Diet Quality Questionnaire (DQQ), an effective internationally standardised, low-cost survey tool, was developed by Gallup, Harvard University, and the Global Alliance for Improved Nutrition (GAIN), to enable monitoring of diets globally (Global Alliance for Improved Nutrition (GAIN), Gallup and Harvard 2022: 2; Global Diet Quality Project 2022: 6). South Africa was one of the thirty-seven LMICs that participated in the Gallup World Poll in 2021 (Global Diet Quality Project 2022: 2). The DQQ uses closed-ended questions to enable a rapid calculation of an individual's diet score using inputs from 29 food groups based on their relationship with nutrition and health (Global Diet Quality Project. 2022: 13). While the data obtained from the DQQ does not collect information on consumption quantities, the data sets obtained are useful to assess and provide insight to a target population's consumption patterns, including dietary and diversity (GAIN, Gallup and Harvard 2022: 2: 2; Global Diet Quality Project 2022: 17). This is beneficial as apart from facilitating global dietary monitoring, it helps to foster accountability towards global nutrition and health targets (Global Diet Quality Project. 2022: 6).

The DQQ was used to score participant's diet in this research study based on their endline (EL) 24-hour food recall so their diet quality and patterns could be further evaluated (Global Alliance for Improved Nutrition (GAIN), Gallup and Harvard 2022: 2). Data from the DQQ can provide information on the minimum dietary diversity for women (MDD-W), based on the number of childbearing women in LMICs, aged 15-49 years, who have a consumption of at least five of ten food groups as set out in the DQQ (Global Diet Quality Project 2023: para. 1). Target population individuals who do not meet the minimum dietary diversity groups are also likely to have an inadequate micronutrient intake (Global Diet Quality Project 2022: 11). The DQQ also provides data scores from nine health promoting food groups which when consumed can protect against NCDs; this score is tallied and referred to as the NCD-Protect. While there is no set cut-off score (between 0-9) for lower or higher risk of NCDs, higher scores are indicative that more healthy foods have been consumed (Global Diet Quality Project 2022: 11). Similarly, unhealthy food and beverage items consumed contribute a risk towards NCDs and are tallied using scores (0-9) ascribed to eight food and beverage groups (with processed meat ascribed a score of 2) and are referred to as the NCD-Risk. There is no ideal cut-off value; however, a lower NCD-Risk score is regarded as optimal as it indicates that a larger number of WHO recommendations have been met (Global Diet Quality Project 2022: 12). The global dietary requirement (GDR) score, which ranges from 0-18, can be calculated to indicate if an individual's consumption is meeting the global dietary requirements; with higher scores being better. Higher scores, up to 18, reflect a higher certainty of a healthy diet (lower scores reflect a high likelihood of a poor diet quality) and are derived from a simple calculation of: NCD-Protect - NCD-Risk + 9 (Uyar *et al.* 2023: 342). Diet evaluation by urban and rural breakdown, and gender breakdown is also enabled through the DQQ tool (Global Diet Quality Project 2022: 6). Based on input data, scores were calculated for GDR, NCD protect, NCD risk and FGDS and exported to Excel. The mean and SD values were calculated for each category and used to assess dietary intake patterns. Data findings can be used to determine the diet quality and to make recommendations for diet improvement as well as targeting gender-led and rural-urban dietary influences and short comings.

3.4.5 Framingham Risk Score

The Framingham Risk Assessment Score, derived from the Framingham Heart Study, was used to estimate participants' risk for the development of CHD in a ten-year period (D'Agostino *et al*. 2001: 180). Several risk indicators can be used to calculate the score using a Framingham Risk calculator to input data including an individual's age, gender, TC, HDL, BP, smoking behaviour, and diabetes finding

(D'Agostino *et al*. 2001: 180). An online version of the 'hard' coronary Framingham outcomes model by Zaborowska (2023: para. 1) was used to calculate the Framingham Risk Score in this research study. The total risk scores and the ten-year projected risk of death due to CVD were captured on Excel® and correlated with risk levels adapted by Klug *et al.* (2018: 922) to categorise individuals' risk as per Table 3.1. An important limitation of the Framingham Risk Assessment Score noted by Klug *et al.* (2018: 993) was that these future risk projections did not include other key risk factors for CVD like prediabetes, abdominal obesity, and lipoprotein (a). The lack of inclusion of data on family history has also been cited in the literature as an oversight, given that family history is a validated variable that correlates with coronary heart disease across genders (Catapano *et al*. 2016: 36; Klug *et al*. 2018: 993; D'Agostino 2008: 751).

Table 3.1: Framingham CVD risk percentage and classification (Klug *et al.* 2018: 979)

Total Framingham CVD risk (%)	ESC/EAS risk classification	ESC/EAS LDL-C target
<3	Low risk	<3.0 mmol/L
3-15	Moderate risk	<3.0 mmol/L
15-30	High risk	<2.5 mmol/L **and** a reduction of at least 50% if the baseline* is between 2.5 and 5.2 mmol/L
>30	Very high risk	<1.8 mmol/L **and** a reduction of at least 50% if the baseline*is between 1.8 and 3.5 mmol/L
CVD= Cardiovascular disease, ESC= European Society of Cardiology; EAS European Atherosclerosis Society (EAS) *Baseline LDL- C refers to the level in a subject who is not taking any lipid lowering therapy		

Table 3.1 shows the four risk classification categories using the calculated Framingham CVD risk percentage. Classification started at low risk and moved successively higher for moderate risk, high risk and very high risk. Targets for LDL-C are provided and are risk based so higher risks have a lower LDL-C target than lower risk values. The scores and discussion for this research study are presented and discussed in chapter 4.

Table 3.2: *Recommended intervention strategies as a function of Framingham total CVD risk score and LDL-C levels (Adapted by Klug *et al.* 2018: 980 from Catapano *et al.* 2016)

Total CVD risk score*	**LDL-C levels (mmol/L)**			
	<1.8	**1.8 - <2.5**	**2.5 – 4.9**	**>4.9**
<3% Low risk	No lipid intervention	No lipid intervention	Lifestyle intervention	Lifestyle intervention consider drug if uncontrolled
3-15% Moderate risk	Lifestyle intervention	Lifestyle intervention	Lifestyle intervention consider drug if uncontrolled	Lifestyle intervention consider drug if uncontrolled
15-30 High risk	Lifestyle intervention consider drug‡	Lifestyle intervention consider drug‡	Lifestyle intervention and immediate drug intervention	Lifestyle intervention and immediate drug intervention

Total CVD risk score*	LDL-C levels (mmol/L)			
	<1.8	1.8 - <2.5	2.5 – 4.9	>4.9
>30% Very high risk	Lifestyle intervention consider drug[ǂ]	Lifestyle intervention and immediate drug intervention	Lifestyle intervention and immediate drug intervention	Lifestyle intervention and immediate drug intervention

CVD = cardiovascular disease; LDL-C = low-density lipoprotein cholesterol
* Based on the Framingham CVD risk tables
ǂ In patients with myocardial infarction, statin therapy should be considered regardless of LDL-C levels

Table 3.2 underscores the role and importance of intervention strategies as per risk score when correlated with LDL-C level. Using the LDL-C in combination with the calculated Framingham risk score can help to provide more strategically targeted interventions for individuals. The use of pharmacology is also advocated to mitigate against CVD risk.

3.4.6 Global Physical Activity Questionnaire (GPAQ)

The GPAQ version 2 (Appendix O) is a 16-question validated, physical activity (PA) questionnaire that was developed by WHO to enable researchers to survey and measure individuals' PA participation levels (WHO 2021f: 3) and is recommended as part of the WHO Stepwise programme (WHO 2005: 179). The suitability and acceptability of the GPAQ instrument for monitoring a population's PA has been documented in the literature (Bull, Maslin and Armstrong 2009: 790). During the BL data collection, the researcher and the RAs, who were trained to use the GPAQ for data collection, utilised contextualised showcards for the GPAQ (Appendix P) to enable optimal participant responses to the photo prompts. Data collection included information on sedentary activity and across three domains viz., activity at work, during travel to and from places, and for recreational activities. Participants could be physically inactive or active for any of the three domains (WHO 2021f: 3). The GPAQ questionnaire design also enabled the researcher to capture information on the intensity level of the PA engaged in by participants i.e., vigorous versus moderate intensity, which is expressed as metabolic equivalents (METs). The data were coded, cleaned and the recommended formulae i.e., four METs for moderate and eight METs for vigorous activity, were used together with the total time spent on each activity to calculate each participant's total MET minutes for the week (WHO 2021f: 3). The WHO's recommended PA MET-minute totals were used to identify participants who either met or did not meet WHO's recommended PA value for health (WHO 2021f: 15).

3.4.7 Anthropometry

Body weight, height, and WC were measured for each participant and captured on the anthropometric measurements data sheet (Appendix Q) by the researcher and trained RAs, using standardised techniques to minimise potential bias or errors. At the start of each session, instruments were checked for reliability to ensure accuracy and consistency in results. Anthropometry and WC were measured during the step 2 data collection process for BL and, after the laboratory work, during the EL process. Participants' body weight and height were recorded while the person was barefoot, wearing lightweight clothing and with pockets free from cell phone, keys and other items that could potentially nullify measurement. A one-kilogram weight was used during the fieldwork to verify the electronic scale at each session. For weight measurement, the SECA 874 calibrated digital scale was placed on a flat surface and zeroed, participants were prompted to stand on the scale with their hands at their sides, looking straight ahead. Two measurements were recorded per participant, with the participant stepping off the scale after the first reading; the scale was allowed to zero, and the participant repeated the process to enable the second weight reading. The weights were recorded directly as per the scale, using two decimal points, and then averaged to provide a final reading. A portable SECA 213 stadiometer was used to measure participant height for this research. The fixed foot piece of the stadiometer was placed on a hard, flat and level surface (Wenhold, Nel and van den Berg 2021: 46) while the rigid vertical measuring arm of the stadiometer was propped level against a straight wall (Wenhold, Nel and van den Berg 2021: 27). The reliability and validity of portable stadiometers have been noted (Baharudin *et al.* 2017: 675). Using the height measurement guidelines for adults, by Wenhold, Nel and van den Berg (2021: 15), height was measured in the upright position while standing. To measure height, barefoot participants were prompted to stand straight and still, with feet together on the fixed foot piece of the stadiometer and their heels against the heel positioner, arms at their sides and to look straight ahead. The head, shoulders and buttocks were additional contact points with the vertical measuring arm of the stadiometer (Wenhold, Nel and van den Berg 2021: 43). The head slider was adjusted to rest on top of the participants' head, and the measurement was read at eye level using the indicator arrow (Wenhold, Nel and van den Berg 2021: 44). This process was repeated to obtain two measurements, which were averaged to produce the final measurement.

Participant WC was measured by the researcher and trained RAs, using a SECA 201 mechanical non-stretch measuring tape. The participants were advised to relax, expose their waist, and stand with their arms lightly at their sides, the WC was measured at the midpoint, i.e., between the "lowest edge of the lowest rib" and "the highest point of the hip bone" (Wenhold, Nel and Van den Berg 2022: 65). The measurement was repeated and then averaged to get the final measurement. Participants' final measurements were assessed against the recommended average WC per gender in South African, as reflected in Table 3.3.

Table 3.3: Waist circumference guide per gender and risk factor National Department of Health (NDoH) *et al.* 2019: 300)

Category	Risk level	
	Increased risk of metabolic complications	Substantially increased risk of metabolic complications
Women	≥80 cm and <88 cm	≥88 cm
Men	≥94 cm and <102 cm	≥102 cm

Measuring and documenting a population's WC provides data on abdominal fat, and when categorised, the independent risk that these readings carry. When coupled with, for example, overweight, obesity, and other risk factors, it can contribute towards the development of NCDs and MetS (Ordovs 2019:

para. 2). In SA, the measured WC correlating with an increased metabolic risk for women is 80cm to 87cm and 94cm to 101cm for men while a substantially high risk is correlated at equal to or above 88cm for women and equal to above 102cm for men, respectively. Optimally, a WC with no risk is desired and should be targeted at under 94cm for men and under 80cm for women (NDoH *et al.* 2019: 300).

3.5 Clinical blood analysis

Universal Pathology Laboratory (UPL), a South African National Accreditation System (SANAS) accredited laboratory, was the preferred provider appointed by DUT to conduct the BP measurements and blood draws, and to analyse blood samples drawn for this research study.

3.5.1 Research study – clinical practice and the processes

Blood samples were drawn, 2 x BP measurements, anthropometric measurements and WC (as detailed in section 3.4.5) were collected at the BL stage of the research and recorded on the laboratory measurements form (Appendix R). Anthropometric measurements were used to calculate body mass index (BMI). The data were then captured in Excel®. During the BL phase, blood draws were coordinated for each site using a three-step approach. For step one during the BL phase, the researcher liaised with the designated contact person at each site to establish optimal dates and timelines for the blood draws, BP measurements and anthropometry, and to obtain the necessary entry permits at each site for the laboratory personnel. This process required access to the worksite and the employees, as well as a private room where participating individuals could have privacy, and be relaxed, and comfortably seated during the blood draw, BP measurements and anthropometry. For step two during the BL phase, individuals were invited via WhatsApp or email to participate in the anthropometry, 2 x BP measurements and a two-vial veinous blood draw consisting of a 5ml blood draw for the HbA1c and lipid profile test, respectively. The researcher coordinated availability of facilities at each site with each participant's availability. In step three, during the BL phase, the researcher liaised with the administrative assistants from the SANAS-accredited UPL to coordinate site and participant availability with the availability of phlebotomists to conduct the blood draws. Once all three steps were completed, a WhatsApp message was sent to each of the role players to secure and confirm appointments. A day prior to the laboratory collection, all role players were sent a reminder through WhatsApp advising of the upcoming blood draw. Finally, a message was sent to the participants on the day, 10 minutes prior to the appointment, so they could make their way to the facilities booked. Participants who did not respond to the message reminders were called telephonically with verbal reminders of their appointments. The blood samples were drawn by the phlebotomists using evacuated blood collection tubes and analysed at the UPL laboratory in Durban or Gauteng (depending on the participant's worksite location) for HbA1c and the lipid profile test (LDL-C, HDL-C, TG, and TC). The HbA1c was measured using HPLC methodology (Biorad Variant Turbo 2), plasma glucose was measured using Enzymatic Hexokinase method - Beckman AU 480, LDL using enzymatic two-phase detergent reagent method - Beckman AU 480, HDL using Enzymatic colour chromogen - Beckman AU 480, Triglyceride using Enzymatic GPO-PAP-Beckman AU480, and TC- using Enzymatic Cholesterol esterase method - Beckman AU.

Two BP readings were measured and recorded for each participant on the laboratory measurements form (Appendix R). Blood pressure readings for BL and EL were measured noninvasively (Muntner *et al*. 2019: e35), on well rested participants, using an Omron blood pressure monitor. During the blood pressure measurement, participants were seated on a comfortable chair, with their cuffed arm resting on a table at chest level and feet slightly apart on the floor (CDC 2023: para. 5). The BP measurement was noted, and the first reading was recorded. This process was repeated to collect the second reading with a recommended interval of 1-2 minutes before the first and second measurements (Muntner *et al*. 2019: e39). This process was necessary to verify readings; however, it also added time to the data collection process which was not well received in the production or office environment. The two BP measurements were averaged to produce a final BP result per participant which was checked against the classification ranges approved by the SAHS (Rayner *et al.* 2019: 184) as detailed in Table 2.3 of section 2.4.3 in chapter 2, to determine each participant's BP status. All clinical test results were reported per participant and emailed by the laboratory to the researcher within 2-5 days following the bleed. Clinical laboratory results were checked against the measurement cutoffs for HbA1c as detailed in section 2.4.1 and section 2.4.2 of chapter 2 for components of lipid (LDL-C, HDL-C, TG and TC) respectively, to establish participant findings. The laboratory results, feedback on the results (Muntner *et al*. 2019: e39), and average BP readings were provided by the researcher to each participant via WhatsApp or email as per participant preference. Where needed, a set of guidelines (Appendix S), that was reviewed by the worksite occupational health nurse (2,), the study supervisors, and the researcher, was provided to support participants in three risk areas viz., BP, blood glucose and lipids. Participants could also book an appointment with the onsite occupational health nurse (OHN) to discuss their results on a one-to-one basis or with the researcher, to obtain more information and advice on healthy practices for optimum health. Participants could also schedule a booking with the onsite dietician for further support and advice. The OHN at each site had to advise the research team if any of the participants made a booking with the dietician for advice and support. This was done to ensure intervention effect and check for confounding. During the research period, there was a nil report i.e. no bookings were made by the OHNs for individuals participating in the research study.

The three-step approach that was used for the clinical practice and process during the BL steps was repeated at EL to enable follow-up consisting of: 2 x BP readings, BMI calculation, WC measurement, and a final two-vial veinous blood draw consisting of a 5ml blood draw for the HbA1c and lipid profile test, respectively. For the EL process, blood samples were analysed at the UPL laboratories in Durban, Gauteng, Cape Town and East London, depending on the participant's location. Two additional UPL laboratory sites were utilised during the EL phase to accommodate those participants who had accepted work transfers but wanted to complete the research process. The EL results were measured and analysed in the same way as per the BL. Laboratory results were reported per participant and emailed by the laboratory to the researcher within 2-5 days following the bleed. The laboratory results, feedback on the results, and BP average, were provided by the researcher to each participant via WhatsApp or email as per participant preference. Participants' results for HbA1c, TC, LDL, HDL and TG and the BP average were provided in a comparative format detailing pre-post test results to enable participants to track changes in their results from BL to EL. To further enable this, a summary of the changeover from BL to EL, for each of the risk factors, was also provided. Where needed, a set of guidelines (Appendix S), that was reviewed and approved by the worksite OHNs, the study supervisors, and the researcher, was provided to support participants in three risk areas viz., BP, blood glucose and lipids. Participants could also book an appointment with the onsite OHN to discuss their results on a one-one basis or with the researcher, to obtain more information and advice on healthy practices for optimum health. Participants could also schedule a booking with the onsite dietician for further support and advice.

3.6 Timeline for screening, BL and EL data collection

The timeline for screening, BL and EL data collection is provided in Table 3.4.

Table 3.4: Data collection activities and timeline

Activity Timeline	**Screening March 2022 – April 2022**	**Baseline May - June 2022**	**Endline November 2022- January 2023**
Screening criteria questionnaire	X		
Socioeconomic and lifestyle questionnaire		X	
Dietary questionnaire		X	
24 Hour dietary recall		X	X
Global physical activity questionnaire		X	
Body mass index		X	X
Height		X	X
Weight		X	X
Waist circumference		X	X
Blood pressure	X	X	X
Glycated hemoglobin		X	X
Fasting blood sugar	X		
High density lipoprotein		X	X
Low density lipoprotein		X	X
Triglyceride		X	X
Total cholesterol		X	X

3.7 Behavioural intervention

The lesson content for the behavioural intervention (lifestyle classes) were informed by the findings from the in-depth interviews and focus group discussions, which were conducted during the formative, phase two of the study conducted by Singh (2022), resulting in the key findings as provided in Table

3.5 and are reported in greater detail by Singh *et al.* (2024: 5). This was done to ensure relevance, contextual embedding, and a participative inclusion so the lessons could be meaningful, relevant, and impactful to the participants.

Table 3.5: Summary of lifestyle classes needs from the formative study by Singh (2022)

Lifestyle classes:
• should be supported and approved by the section supervisor to enable a willing employee to participate, • should be scheduled outside of peak production times, • should have flexibility in lesson scheduling i.e. offering of multiple sessions per lesson in order to accommodate those on leave/shift work/off duty and those who felt too physically tired to attend, • should be offered in dual medium (English and IsiZulu) facilitator, especially at production sites, • should take place in a venue that is easily accessible to employees, • should take place in a well-ventilated large venue, to enable the physical activity classes, • should be offered with an option for face to face and online access, in particular at sites with hybrid working conditions and office workers. These workers had access to laptops and data thus enabling access the online medium. • lesson content should include information on healthy eating (portion sizes, contents of a healthy plate, substitution of unhealthy for healthy food options (including snacking), optimal cooking methods) and mental health wellness, • should include physical activity exercises that could add variety to walking/running/soccer and factored personal safety/inclement weather, and did not require investment in equipment • should take into account group dynamics i.e. creation of groups consistent with similar staff hierarchy or avoid having senior management in the same class as entry and junior level staff, • should be interesting, fun and include peer input, and feedback on individual progress; incentives to participate would be welcomed, • should include direct and timely messaging to individual participants remind them of upcoming classes and inviting them to attend

Lifestyle classes for this research study were prepared in conjunction with collaborators from the Nepal Pioneer Worksite Intervention Study (2019). The South African lifestyle classes were also based on the Diabetes Prevention Program (DPP) (DPP Research Group 2002) and included goal setting for weight loss, maintaining a weekly food diary, educational classes that incorporated core learning outcomes, and completing 30 minutes of PA routines developed in collaboration with a qualified fitness instructor from Virgin Active. This internationally recognised gym promotes physical and mental wellbeing (Virgin Active 2023: para. 1). The behavioural component consisted of weekly one-hour lessons held over a six-week period. A 20-minute PA and weekly weigh-in for each participant took place at the start of each lesson, followed by the lesson. Lessons were made up of 40-minute content, based on the DPP Research Group (2022). For contextual relevance, this information was paired with findings from the formative study conducted by Singh (2022) to maximise intent and relevance to participants. Topics and content from the DPP curriculum were compressed into 6 lessons for this research study due to the practicality of meeting the revised timeline for the research study as well as the need to accommodate the post COVID-19 timelines for the search study. The lesson topics are provided in Table 3.6.

Table 3.6: Behavioural intervention, lesson topics

Lesson number	Lesson topic
1	Introduction to the diabetes and hypertension prevention programme
2	Move your muscles
3	Healthy eating and measuring portion sizes
4	Identifying fats and carbs and reducing salt intake
5	Tip the kilojoule balance, healthy ways to dine out and healthy cooking lesson
6	Stress management, alcohol and smoking and ways to stay motivated

The initial programme content for each of the six lesson modules were compiled by the PI and an RA and was reviewed by the researcher. The lesson content was created in the form of a PowerPoint slide deck for use as a teaching aid, as well as in the form of Word-formatted lesson handouts for participants (Appendix T). Three qualified food and nutrition experts were employed as lifestyle coaches to offer lessons across the site clusters that were grouped as follows: Unilever MW and Unilever I had one lifestyle coach, Retailability and Unilever LL had one lifestyle coach, and the Gauteng-based sites i.e., Unilever BB, Unilever K and Unilever LV had one lifestyle coach. In addition to this, an RA was employed for three months at each of these site clusters to provide support to the lifestyle coach and to assist with intervention implementation. Lessons were offered face-to-face at each site; however, at Unilever LL and Retailability it was also possible to offer the lessons through the online medium. The latter sites used the dual medium of face-to-face and online for ease and convenience of reaching all staff who wanted to participate. Staff access to laptops and wi-fi helped enable the multi-modal lesson offering. It also enabled staff at Unilever LL to access the lessons in real-time while they worked on a two-day onsite, three-day work-from-home hybrid mix. Online lessons were also recorded and posted on the Unilever LL and Retailability Teams groups that were set up by representatives from each of the organisation's information technology department, so participants could access the uploaded lessons at their convenience.

Face-to-face lessons were offered multiple times at each site to accommodate shift workers at the Unilever sites (MW, I, BB, K and LV) and office workers (Retailability and Unilever LL) due to individual and work commitments. Access to sites was secured through the OHN and the administration assistant (where present) at each of the Unilever sites or through the human resources manager for the

Retailability participants. There was also a central administration employee who oversaw all the Unilever worksites and, together with the OHNs, liaised with the HR manager at each Unilever site to help secure staff release for lesson attendance. A training room with an overhead projector and sufficient space for the PA segment was secured at each site to enable the training sessions for each day. Training rooms at sites were secured for three one-hour lesson slots per day. For example, three sessions on a Tuesday 11h00-12h00 or 12h00-13h00 or 13h00-14h00 with a repeat on e.g., Thursday 11h00-12h00 or 12h00-13h00 or 13h00-14h00. Thus, each site offered participants six opportunities per week to attend the classes in relation to their production or office commitments and to complete all six lessons in the program. The aim was to offer each lesson during paid working hours as per agreement with management, and for those working from home, the online uploaded recordings offered flexi-lesson attendance. For face-to-face sessions, due to differing work schedules and production demands, lessons one to six were also coordinated to enable participant lesson completion; for example, lesson two was offered at session one and lesson three could be offered at session two of the same day; this was done to accommodate participants who, for example, had completed lesson two the previous week and were now ready for lesson three. Lessons were offered in groups of up to 10 participants but included one-on-one sessions depending on participant availability and the lesson needed. The researcher coordinated with each of the participants at sites to notify them regarding training session time, venue, and lesson type. Once the participant confirmed availability for a session, the training was booked and confirmed with the site coordinator, the lifestyle coach, the RA and the participant. A reminder was sent a day prior to all the relevant role-players, as well as 10 minutes before the training advising of the upcoming training. Role-players also had to be advised of unforeseen events e.g., training room clashes as when this occurred, the lesson had to be cancelled and the booking process had to be renegotiated with all the role-players. At the end of each lesson, participants had to complete a lesson evaluation (this was part of the pack for Appendix T), however the return of these evaluations were poor across all sites.

For the PA aspect, participants were provided with six exercise workout videos, each providing a varied 10-minute PA routine that they could repeat in three sets over the course of the day, to help them meet the recommended minimum target of 150 minutes moderate PA (i.e., an intensity activity like brisk walking), per week (Diabetes Prevention Programme (DPP) Research Group 2002: 2166). The PA videos were used during the PA component of the lifestyle behavioural sessions to ease and encourage participants to use the tools created for the study. The six PA videos compiled for this research intervention were paired with each of the six lifestyle classes. The content for the first PA video was compiled by two students from the Department of Food and Nutrition and the remaining five by a qualified freelance trainer for Virgin Active. The PA videos were recorded at DUT by a student from the Video Technology Department at DUT. The recordings were edited and made into 10-minute video clips that were screened during the lifestyle classes so participants could complete one 10-minute video of the PA requirement during the lesson and the remaining two parts (10 minutes x 2) at their convenience. The videos were also shared via a link with the CB participants to enable quick access to a resource and thus encourage participants to complete three sets of the PA recording to achieve their ideal minimum target of 30 minutes of PA per day. The links to the PA videos created for this research study are provided (Appendix U). A photographic snapshot of the lifestyle intervention implemented at sites is provided (Appendix V).

For the duration of the intervention, participants were also asked to keep a food diary (Appendix W) to record their daily food and beverage intake and PA respectively. The aim was to ensure that participants received and could use the theoretical knowledge and practical skills from the lifestyle classes to enable them to effectively reduce their risk factors for diabetes and related NCDs. By addressing the key areas comprehensively and consistently throughout the programme, participants were equipped with the necessary tools, skills, and knowledge to make positive lifestyle changes and, thus, potentially reduce their cardiometabolic risk. Tracking their weekly consumption intake and PA was intended to motivate and encourage participants to persevere towards their goal achievement. Attendance of the lifestyle classes were also tracked weekly per site per participant to ensure that participants completed all six lessons and to assist with scheduling of the correct lessons per site in accordance with the lesson required. This had to be done to ensure that the correct lesson/s were offered week to week; it also enabled the lifestyle coach to prepare for sessions with the correct handouts and lesson packs as needed. A certificate was issued to acknowledge the participant completion of all the lifestyle classes (Appendix X).

3.8 Canteen only intervention

The canteen only interventions were available to all employees at the participating worksites and were based on findings from the in-depth interviews and focus group discussions, which were conducted during the formative phase of the research study by Singh (2022). A summary of the findings are provided in Table 3.7.

Table 3.7: Summary of canteen needs from formative study

Canteen intervention needed: to increase healthy food and beverage choices for meals and snacks (decrease fats/oil, salt and added sugar), to include healthy breakfast options for example offering cooked porridge as opposed to the full English, to increase wholegrain options, to increase fruit and vegetable choices to serve optimal portion sizes, to offer information on healthier options, to have meal offerings that are modelled on a typical healthy plate

Due to the canteens at the worksites being operated on a "for profit" model and the fact that the service provider had preexisting contracts in place, there were certain aspects that emerged from the formative study that though desired, could not be altered during the implementation of the canteen intervention. For example, reduction of salt and oil in the meals offered at the canteen. However, these aspects must be borne in mind for the future for example when the existing service providers contract is being renegotiated/ if a new service provider is sourced; or may be considered by any future worksite wellness interventions aimed at reducing employee cardiometabolic risk factors.

Findings from the formative study were crossed with a summary of intervention findings (Table 3.8) from a systematic review by Naicker *et al.* (2021: 5) so that proven and impactful interventions could be reviewed and those with a best fit selected for the scope and fit of this research study.

Table 3.8: Classification of intervention strategies - summary (Naicker *et al.* 2021: 5)

Interventions
Interventions targeting food quality/ quantity
Remove/reduce trans fat
Reduce saturated fat
Reduce sugar
Reduce the amount of salt during cooking
Increase fruit and vegetable choices
Reduce portion sizes of foods
Offer smaller portion size with proportionate pricing
Ready to eat healthy meals
Reduce sugar sweetened beverages
Free clean cold water
Add salad bar
Interventions targeting price
Price discounts for whole fresh fruit
Provide free fruit and/or vegetables
Healthier foods such as fruits, fresh juice, whole grains for reduced price
Fixed price for all menus
Provision of meal vouchers for healthy meals
Interventions targeting food choice at point of purchase
Traffic Light Labelling
Strategic positioning of healthier alternatives to make healthy items more accessible such as keeping fruits at the eye level
Healthy option station
Use a nutrition logo or a specific symbol on healthy food to help people recognize which foods are healthy

Interventions
Display the number of calories of a product translated into the number of minutes to perform a certain physical activity at work (e.g. 35 minutes' walk for a can of soda)
Interventions targeting improved supply
Train managers to increase the availability of healthy food choices in his/her worksite cafeteria.
Culinary workshops for cafeteria workers, chefs and kitchen assistants on preparing healthy meals, using fruit and vegetables, presentation, arrangement
Interventions targeting client's information, education or motivation
Healthy lunchtime clubs
Food workshops to discuss healthy foods and taste demonstrations of healthy food options
Informational material (e.g. nutrition quizzes, dinner mats, computer-based activities, leaflets)
Monthly news magazine with information on healthy food options
Educational materials distribution with messages encouraging fruit and vegetable consumption
A nutrition resource kiosk with trained personnel available to discuss about healthy diet and provide resources
Posters, napkins, a self-evaluation brochure
Cooking demonstrations and tasting healthy foods
Lifestyle education
Interventions targeting organization policies
Develop/ Modify organisational health policy on promotion of healthy eating
Develop a manual aimed at the cafeteria's managers on worker's food program, nutritional guidelines, importance of a balanced diet highlighting the key role of fruit and vegetables
An employee advisory board (EAB) to guide the planning and implementation of change to help make the cafeteria healthier

3.8.1 Typology of interventions in proximal physical micro-environments (TIPPME)

Concepts from the TIPPME model were applied during the canteen intervention to influence employee purchase behaviour for the canteen interventions utilised in this study. The TIPPME model refers to different strategies that can be used to influence the small-scale physical environment (Hollands *et al.* 2017: 1) where people spend most of their time, such as homes, schools and worksites. Strategic altering of these environments for example, at a worksite canteen, can have an impact on an individuals' food and beverage purchase behaviour and thus influence their health and well-being. The TIPPME model offers 18 possible combinations of intervention groupings that can be used to help facilitate behaviour change (Hollands *et al.* 2017: 4). Using a framework like this can help to improve the worksite food environment and prompt selection of healthier options.

Table 3.9: Typology of interventions in proximal physical micro-environments (TIPPME)

Simplified version for changing selection, purchase and consumption of food, alcohol and tobacco

		Intervention focus		
Class	**Intervention type**	**Product**	**Related objects**	**Wider environment**
Placement	**Availability** (Add/remove (some or all) products/ objects to increase, decrease or alter their range, variety or number	Intervention to influence behaviour by changing the product selected, purchased or consumed. Product comprises the consumable substance, and its immediate/integral packaging and table ware E.g., Added free healthy beverage option (bottled water) at exit points and in dining room. Offered hot cooked breakfast oats as option to English breakfast. Added healthier food options at the servery e.g., wholewheat pasta and brown rice, + instruction to offer healthier options first when plating; Healthier snack option offered for board room meetings Introduced healthy seed sprinkle	Interventions to influence behaviour by changing objects that are associated with the product and typically form part of its proximal surroundings. Add/remove (some or all) related objects to increase, decrease or alter their range, variety or number. E.g. added table to serve free bottled water in dining areas during meal periods to encourage quick and easy self-service. Use of table tents to prime and prompt on benefits of consuming water. Menu display to prime and prompt on availability of healthy option + to advise on health benefits of unrefined starch and breakfast options each day these were offered. Priming and prompting of healthy snacks for board room meetings and the healthy seed sprinkle	Interventions to influence behaviour by changing objects and stimuli that are external to the product and related objects and are not used to store, display, select, purchase or consume the product. Add/remove (some or all) objects from the set of objects that comprise the wider environment to increase, decrease or alter their range, variety or number.

(Hollands *et. al.* 2017: 4)

		Intervention focus		
Class	**Intervention type**	**Product**	**Related objects**	**Wider environment**
Placement	**Position** Alter the position, proximity or accessibility of products or objects	Intervention to influence behaviour by changing the product selected, purchased or consumed. Product is made up of consumable item, and its immediate/integral packaging and table ware E.g. Water placed at eye level. Healthy seed pack sprinkle Added healthier food options at the servery e.g., wholewheat pasta and brown rice, + cooked hot oats	Interventions to influence behaviour by changing objects that are associated with the product and typically form part of its proximal surroundings. Add/remove some or all) related objects to increase, decrease or alter their range, variety or number. E.g. Water was placed at eye level in the refrigerator. Seed packs were placed on display racks at prominent position near condiments to encourage uptake Altered position of healthier starch options so these could be more visible Healthy boardroom snack in large clear jars for easy access and individual packaging be offered 1st at the servery counter by the counter assistants, oats option positioned before the English breakfast	Interventions to influence behaviour by changing objects and stimuli that are external to the product and related objects and are not used to store, display, select, purchase or consume the product. (Add/remove (some or all) objects from the set of objects that comprise the wider environment to increase, decrease or alter their range, variety or number.

(Hollands *et. al.* 2017: 4)

<table>
<tr><th colspan="2"></th><th colspan="3">Intervention focus</th></tr>
<tr><td>Class</td><td>Intervention type</td><td>Product</td><td>Related objects</td><td>Wider environment</td></tr>
<tr><td></td><td>Size
Alter size or shape of products or objects</td><td>Alter the size or shape of products or objects

E.g. Changed dishing up spoons at canteen to facilitate standardisation of portions for starch and paired meals</td><td>Alter the size or shape of products or objects

E.g. introduced standardised dishing up spoons to effect portion control.</td><td rowspan="2">Within the wider environment, add, remove or change words, symbols, numbers or pictures that convey information about the product or its use
E.g., provided information as digital adverts flighted on television screens located in the wider environment at sites. Infographic posters also provided.</td></tr>
<tr><td></td><td>Information
Add, remove or change words, symbols, numbers or pictures that convey information about the product or object or its use</td><td>E.g., Ready to eat meals – posters of healthy reference plate provided to guide plate composition. Infographics to prime and prompt behaviour offered on fats, salt, sugar and carbs, information on healthy trial mix snack for board rooms</td><td>On related objects, add, remove or change words, symbols, numbers or pictures that convey information about the product or its use. E.g., health information table tents provided at servery areas, payment/ check out points and within dining areas to prime and prompt (health information on healthy snacks fats, salt, sugar and carbs</td></tr>
</table>

(Hollands *et. al.* 2017: 4)

The formative findings from phase two, were used with the classification of intervention strategies (Naicker *et al.* 2021: 5) and the TIPPME model (Hollands *et. al.* 2017: 4), to advise the canteen interventions selected for this study. The canteen interventions were implemented over a six-week period to help improve the nutritional value of food and beverage offerings within the worksite food environment (WFE). All WFE interventions were coordinated with the catering manager at each site and the central administration representative for the Unilever sites. The Retailability site shared the same canteen facilities as Unilever LL, so all communications/ decisions for canteen changes were centralised and applied to both organisations. Table 3.10 provides a breakdown of the interventions shortlisted for the study and provides detail on the tools utilised.

Table 3.10: Canteen intervention

Week	Intervention theme	Tools
1 and 2	Water	• Educational material on benefits, functions of water, ways to increase water - provided by using posters and table tents (English, isiXhosa and isiZulu); water videographic • Suggestion box (for meal recommendations and commendations) • Free bottled water was offered at the canteen to all employees
3	Lowering salt and sugar	• Educational material on the benefits of lowering salt in the diet, list of high and low sodium foods - provided by using posters and table tents (English, isiXhosa and isiZulu); salt videographic • Testing of salt in prepared dishes using salt meters and making small changes thereafter • Low sodium cooking demonstration and taste testing • Educational material on the benefits of lowering sugar in the diet, list of high sugar foods provided by using posters and table tents (English, isiXhosa and isiZulu); sugar videographic • Free bottled water was offered at the canteen to all employees
4	Lowering fat-promoting healthy fats	• Education materials on the benefits of lowering fat in the diet and tips to lower fat provided through posters and table tents • Seed sprinkle bar with educational material with benefits of chia, sesame, oat bran, flaxseeds, and sunflower seeds - infographics • Trail mix snack treats offered during meetings in boardroom • Free bottled water was offered at the canteen to all employees
5	Increasing fruit and vegetables	• Education materials on the benefits of increasing fruit and vegetables in the diet provided through posters, table tents, and healthy eating plate and fruit and vegetable videographic • Introduce highly flavoured veg dishes/salads
6	Increasing unrefined carbohydrates	• Education materials on the benefits of unrefined carbohydrates in the diet, including low Glycemic Index (GI) foods provided through posters and table tents

		• Education material on the amount of sugar and non-nutritive sweeteners in food and beverages consumed • Showcase unrefined starches (oats, brown rice and wholewheat pasta), and a pulse/ legume or indigenous food-tasting samples

A snapshot of the canteen intervention photos is included (Appendix Y). A copy of the infographics used during the intervention is provided (Appendix Z). Some interventions ran parallel to each other, and the dose of each intervention varied e.g., intervention theme one, "Water", ran for a four-week cycle, whilst another intervention, "Seed sprinkle bar", was actioned for two weeks. Implementation of the interventions were monitored weekly by the lifestyle coach and RAs for compliance and to address any challenges (e.g. water, seed and boardroom snack treat delivery times; including limiting uptake of bottled water to 1 per employee, so the offering could reach more staff). As a final check, the researcher conducted checks and audits at the research sites to ensure that all interventions were implemented as scheduled per site.

3.9 Validity

Validity refers to the extent to which a measuring tool measures what it claims to measure (Segal and Coolidge 2018: 1835). Thus, the appropriateness and accuracy of measurements must be considered in relation to the research aims. Validity in a research study can be assured in multiple ways.

3.9.1 Face and content validity

Bolarinwa (2015: 196) has noted that face validity is often utilised in LMIC countries. However, face validity, which relies on subjective review from individuals (Bolarinwa 2015: 197), has been criticised for its lack of generalisability as opinions can be influenced by varying aspects like culture, context, individual factors, or its casual nature. Thus, the potential for bias is raised. To help mitigate this effect for this research, validated questionnaires were used where possible in the data-gathering process, for example, the 24-hour food recall, GPAQ and sociodemographic questionnaire. Additionally, as advocated by Bolarinwa (2015: 196), content validity was assured by ensuring that all questionnaires, including adapted questionnaires and information sheets used in this research, were reviewed by an expert panel. The expert panel in this research study comprised full- and part-time staff members from the Department of Consumer Sciences Food and Nutrition, with the staff mix representative of the general population. With ten reviewers, the scope to mitigate the impact of bias, flow, clarity, and comprehensiveness (Bolarinwa 215: 197) and to identify other potential flaws with the questionnaires and information sheets was higher than if there was only one reviewer.

Tools selected for the research were reviewed for optimal fit with the intended research outcomes. Feedback from the review was collated and used to revise the questionnaires and information sheets; these were resent to the expert panel for final review and adjustment, until meaning saturation was reached. Thereafter, all information sheets and consent forms that needed translating into isiZulu were sent to a language translator for translation so that the documents could be offered to participants in an alternate language, and isiZulu is the second most used language in SA after English. Translated documents were sent to a second independent translator for back translation from isiZulu to English and cross-checked to avoid ambiguity and improve clarity.

3.9.2 Internal validity

As noted earlier in this research study, participants were randomised into two groups, with one group receiving the intervention while the other group was used as the control. This research design enabled the researcher to obtain a pre-and-post intervention impact that could be used to compare findings, assess the effectiveness of the interventions, and draw conclusions. Pre-intervention measurements were recorded as the BL measurements, while the post-intervention measurements were recorded as the EL measurements. This study aimed to

to ensure that the study sample is an accurate reflection of the reference population, thus strengthening the ability to generalise findings from the research to the population at large (Bolarinwa 2015: 195). Participants determine whether the interventions significantly impacted the measured outcomes. By randomising participants, potential confounding variables were minimised, thus ensuring that any differences noted could be attributed to the intervention.

3.9.3 External and ecological validity

External validity in a research study is key as it helps in this study were part of the employed population and representative of a typical workforce at a large employment organisation in SA, i.e., it embodied diversity in terms of race, gender, age, earnings, marital status, language, etc. The extensive fieldwork and intervention that was conducted in a real-world setting, i.e., including hyb

rid working conditions, high workload, pressurised timelines, production target challenges, and shift work across several worksites, lends further credence to the study findings, making it credible to generalise findings from this research to other worksites as this is the natural state (Andrade 2018: 499) of worksites in SA. This is valuable as findings from this study can be used to advise future research design, implementation and interventions at worksites to improve a populations' health risk. Simultaneously, it is acknowledged that some worksites' specific context and unique characteristics may warrant adjustments to interventions and/ or implementation methods to meet fitness for purpose.

3.10 Reliability

"Reliability refers to the consistency or stability of a measurement" (Segal and Coolidge 2018: 1835). High reliability helps to indicate that the measuring tools selected are dependable and can produce consistent outcomes. Evidence of reliability is an essential preliminary step to establishing the usefulness of a tool. Retesting enables a researcher to identify and eliminate the opportunity for errors, thereby maximising reliability (Segal and Coolidge 2018: 1835).

3.10.1 Anthropometry

Research assistants and the researcher received training from the study's principal investigator (PI) prior to undertaking the fieldwork to collect data for anthropometry. The PI, trained in conducting anthropometry measurements, provided training on standard measurement of height, weight and WC;

and the use of tools to measure each aspect. Post training the RAs and the research assistant honed their practical application by measuring and recording height, weight and WC measurements of each other. The trainer provided on-the-job feedback during the practical session, and the research team became more familiar and at ease with the anthropometry process. As advocated by Wenhold, Nel and Van den Berg (2022: 71) and Bolarinwa (2015: 198), standardisation exercises were also conducted with a group of three volunteers from the Food and Nutrition Department, who were measured twice each by the researcher and the RAs, and the measurements compared to verify test-retest reliability and inter-rater reliability. The use of standard techniques as well as calibrated equipment throughout the anthropometry data-gathering process helped to minimise potential bias and errors. Verification of the instruments used to capture measurements at the start of each session, for example, using a one-kilogram weight for the scale, helped to guarantee instrument precision. By adhering to these protocols, the researcher had confidence in the accuracy of the data obtained.

3.10.2 Piloting of the GPAQ

The GPAQ is a validated tool; however, the WHO (2021f: 3) advises that the generic showcards for the physical activities be contextualised to provide optimal prompts and examples of PA and intensity level to participants. Adapted questionnaires must be tested for validity and reliability (Bolarinwa 2015: 196). In the preliminary part of the study, the generic GPAQ showcards were contextualised for use in this study and were piloted in 2022 with senior food and nutrition students (n=15) from the advanced diploma programme to verify the relevance and appropriateness of photos to represent the PA intensity for the GPAQ domains. Ensuring content validity in a pilot study was an important validation step prior to adoption for use in the main research. A construct validity test ensures that a tool has fitness for purpose by confirming its ability to measure and meet research objectives accurately. For this study, the revised questionnaire showcards would thus enable participants to understand which activities were meant by each question in the GPAQ. It also helped distinguish between vigorous and moderate-intensity activities so that participants could clearly map their day-day activities to the correct intensity levels per the GPAQ domains. Feedback received from the pilot study was used to modify the photo prompts. A retest was conducted with the same pilot group population to reassess fitness for purpose until consensus was reached that the contextualised photos optimally showcased the PA and intensity type for the domains.

3.11 Data management and quality control

Data generated from this research study were comprised of two formats i.e., hard and online copies. To prevent unauthorised access to the research data, all hard copy data sheets were housed under lock and key with restricted access at the Department of Consumer Sciences Food and Nutrition, Steve Biko campus. Online data were stored as password-protected files with restricted access; files were only shared as needed during the research process with selected members of the research team and with the statistician for statistical analysis. Research assistants received detailed training during their induction to set boundaries relating to permission and user roles, and to ensure restricted access to the data. Training was also provided on ethics in research and on data handling to minimise data capturing errors and to prepare RAs for their role in the research process. To ensure quality, data sets were handled in a triplicate checking system with one RA entering data and a second RA verifying the entries to ensure completeness and accuracy. As a final measure, the researcher closely oversaw data collection and cleaning of each data set and conducted random checks to verify entries and eliminate any margin of error. Data files were clearly labelled, dated, and backed up to systematically track and control file edits, prevent data contamination and guard against accidental data loss. The researcher also conducted daily and weekly check-ins with the site-based RAs to ensure that each site was adhering to the weekly activities and tasks required for the intervention program. To facilitate this, tracking was conducted on Microsoft Teams.

3.12 Data and statistical analysis

Data analysis was conducted in consultation with the statistician using the Statistical Package for Social Sciences (SPSS®) version 29 IBM Corp, Armonk, NY, USA). Intention-to-treat analysis was followed for the RCT. Baseline (BL), (EL), dietary and sociodemographic data were captured on Excel™ and transferred to SPSS for analysis. The GPAQ data were captured on Excel™ by an RA and cross-checked by a second RA; the data were then checked by the researcher and cleaned manually as per the GPAQ analysis guide described previously. The hyperlink to conduct the GPAQ analysis using Epi Info™ was unavailable for the general public use. The 24-hour food recalls were captured on Food Finder3 and exported to SPSS for analysis. Descriptive statistics, including frequency tables, mean, median, mode and standard deviation were used to summarise, highlight and describe core characteristics of the pre-screening, BL and EL data. Specifically, for the DQQ, both mean and median values were used to explained the data spread. Inferential statistics were used to test the hypothesis/aims. The chi-square goodness-of-fit test was used to check categorical data sets for the distribution of responses and findings to assess if any responses and findings presented more or less frequently than others.

3.13 Reduction of bias

This process reviewed the phases in the research study that could introduce bias and describes the actions taken to counter it.

- Inter-researcher reliability: several research assistants and the researcher were involved in the data collection process. To help ensure consistency in practice and data collection, each RA was trained on the questionnaires used in the study. Post-training, the RAs completed a timed dry run of the questionnaire pack with each other and reviewed their responses with the researcher to identify, clarify and enhance reporting accuracy and fullness. This coordination process was especially important for the 24-hour food recall, where the opportunity for data collection and reporting variations could present. During the training, emphasis was placed on the importance of using standardised key prompts to probe participant consumption patterns, to verify preparation, cooking process and ingredients, and use the food models and standard measures to establish and record portion sizes. RAs also conducted random cross-checks, i.e., for every 20th 24-hour food recall to further improve consistency in the data collection and reporting. During the dry run, the timeline to complete the questionnaire pack was tested, with completion time reduced from 45 minutes to 35 minutes with increased practice, in the time leading up to data collection at the sites.

- Inter-researcher reliability several RAs participated in the screening process. To help mitigate this, RAs and the researcher received training on standard practices to gather data on weight, height, and WC. These variables, weight, height and WC measurement, were measured in duplicate, thus allowing for cross-checking and a reduction in error potential. For example, during the weight check, after recording the first measurement, the measuring instrument was zeroed before a second measurement was taken. Each measurement was recorded to two decimal points, and the two recorded measurements were averaged to get the final measurement for each aspect. A standardisation exercise was also conducted to test and assure test-retest reliability and inter-rater reliability.
- Pilot study: a pilot study, n= 15 senior students from the Consumer Sciences Food and Nutrition Department, was used to test the showcards for the GPAQ to ensure that the contextually revised cards provided an unambiguous pictorial representation of PA and the intensity levels for each domain of the GPAQ, including sedentary activity. These participants were not part of the sample population.

3.14 Research assistants

Research assistants who were students from the Department of Consumer Sciences Food and Nutrition at the Durban University of Technology (DUT) were employed on a part-time basis to assist with fieldwork and data capturing across the seven sites. Seven senior students were inducted on the research study aims and objectives to provide the research context and enable them to respond to queries during the fieldwork. They were briefed on the code of conduct and provided with training to enable them to utilise all the tools efficiently and competently for data collection (baseline questionnaire, anthropometry, dietary, 24-hour food recall and GPAQ). Training took place in the boardroom at the Department of Consumer Sciences Food and Nutrition at the Steve Biko Campus.

3.15 Ethical considerations

The IREC at the Durban University of Technology (DUT) granted full ethical approval for the research study, ethics clearance: 080/20. The researcher and the PI for this research approached industry in Phase 1 (Figure 1.1) to participate in the research study. Worksite gatekeeper permission was secured; however, the start of the study was compromised as during the COVID-19 hard lockdown access to the worksites was restricted. Once the hard lockdown eased, and with the worksite and the IREC approval granted, data collection commenced. This study had a 2-step process. In step 1, employees were briefed about the research study and provided with a letter of information, and informed consent was sought for participation in the two-step screening process. In step 2, eligible employees identified from the screening process were briefed and provided with a letter of information to participate further in the study, and informed consent was sought. All employees were advised of their voluntary participation in each step, with the option to withdraw from the study at any stage in the research. Participants were informed that their names would not be identified in the study or research publications. Data from the fieldwork will be retained for five years at the Food and Nutrition Department under lock and key with restricted access; thereafter, the data will be shredded. Online data were password protected and will be deleted after five years.

3.16 Conclusion

This chapter described the research design and methodology used for the research study, it also described the processes to enable and verify data collection and integrity and outlined the ethical considerations. In chapter 4, the pre-and post-intervention results are presented.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents the research results using tables and figures. Data explanations help to breakdown and share a more complete understanding of the results.

4.2 Data overview

Several sets of data were collected during fieldwork at multiple sites, as detailed in the section, according to the study's objectives outlined in chapter one. The data is organised and presented as per the research process, i.e., screening data with step-one and step-two, respectively, followed by the baseline and endline data.

4.3 Screening process

In this study, a two-step screening process was used to recruit participants.

4.3.1 Step-one screening

Step-one screening involved an 8-item pre-screening questionnaire, which determined the general eligibility of employees to participate in the research study, excluding diabetic and hypertensive participants. The step-one screening results are presented in Table 4.1.

Table 4.1: Step-one screening results

Variable (n)	Screening criteria	n	%
Employment type (797)	Permanent	641	80.4
	Long-term contract	100	12.5
	Short-term contract	56	7.0
Gender (790)	Male	351	44.4
	Female	439	55.6
Pregnancy status (439)	Yes	6	1.4
	No	424	96.5
	Unsure	9	2.1
Race (790)	Black	466	58.9
	Coloured	21	2.7
	Indian	213	27
	White	90	11.4
Diagnosed diabetes (797)	Yes	26	3.3
	No	765	95.9
	Prediabetes	6	0.8
Diabetes medication (797)	Yes	28	3.5
	No	769	96.5
Diagnosed HPT (797)	Yes	55	6.9
	No	736	92.3
	Pre-HPT	6	0.8
HPT medication (797)	Yes	53	6.6
	No	744	93.4
Food purchased at the canteen (797)	0	133	16.7
	1-2/week	283	35.5
	3/week	108	13.6
	4/week	33	4.1
	5/week	149	18.7
	More than 6 times/week	3	0.4
	Rarely	88	11.0

HPT-Hypertension; pre-HPT- Prehypertension

Seven hundred and ninety-seven participants agreed to participate in the step-one screening process; however, due to work commitments, seven participants who started the participation process were unable to complete it. Table 4.1 shows a breakdown of participant employment into three categories. For this study, both permanent and long-term contract employees were eligible to participate in the study. It was decided to include long-term contract employees in the study as some of them had been in employment for periods ≥5 and ≥10 years, indicating a high likelihood of them being available to participate for the entire duration of the research.

From the pool of potential participants, 3.3% (n= 26) indicated that they had been diagnosed with diabetes by a doctor, 0.8% (n= 6) were diagnosed with prediabetes, and 95.9% (n= 765) were undiagnosed. Additionally, 3.5% (n= 28) of participants indicated they were on medication to control blood glucose, suggesting that apart from the 26 diabetic participants, at least two prediabetic participants were also on diabetic medication. Participants in the diabetic range or on medication for diabetes were advised to consult with the occupational health nurse (OHN) or their doctor and were excluded from further participation in the study. Six-point nine percent (n= 55) of the participants indicated that a doctor had diagnosed them with hypertension (HPT), of whom 0.8% (n= 6) were prehypertensive and 92.3% (n= 736) were undiagnosed. Six-point six percent (n= 53) of the hypertensive participants indicated that they were on hypertension medication to manage their condition.

The majority of participants, 35.5% (n= 283), made food purchases from the canteen 1-2 times per week, 18.7% (n=149) of participants purchased food at the canteen five times a week, 16.7% (n= 133) of participants did not purchase food from the onsite canteen, 13.6% (n= 108) purchased food three times per week, while 11.0% (n= 88) participants rarely purchased (e.g., 1-2 times a month, one time in 3 months). Four-point one percent (n= 33) of participants made purchases four times a week, and the smallest number of participants, 0.4% (n= 3), purchased more than six times per week.

4.3.2 Research participation by worksite

Eight worksites participated in the research study, as detailed in section 3.3 of chapter 3. The participation by site and gender is provided in Table 4.2.

Table 4.2: Participation breakdown by worksite and gender

Participation by worksite	Male (n= 355) %	Female (n= 442) %	Total (n) %
Unilever LL	73 (32.9)	149 (67.1)	222 (27.9)
Unilever MW	68 (59.1)	47 (40.9)	115 (14.4)
Unilever I	127 (59.6)	86 (40.4)	213 (26.7)
Unilever BB	7 (53.8)	6 (46.2)	13 (1.6)
Unilever LV	15 (41.7)	21 (58.3)	36 (4.5)
Unilever K	16 (64)	9 (36)	25 (3.1)
Unilever P	8 (80)	2 (20)	10 (1.3)
Retailability	41 (25.2)	122 (74.8)	163 (20.5)
Total	355 (44.5)	442 (55.5)	797 (100)

Unilever LL- Unilever La Lucia, Unilever MW- Unilever Maydon Wharf, Unilever I- Unilever Indonsa, Unilever BB- Unilever Boksburg, Unilever K- Unilever Khanyisa, Unilever P- Phoenix, Retailability

Table 4.2 indicates that with (27.9% n= 222) participation, the Unilever LL site had the highest employee participation, followed closely by Unilever I with (26.7% n= 213), Retailability with (20.5% n= 163) and Unilever MW with (14.4% n= 115). Lower participation numbers were recorded in descending order for the following sites: Unilever LV (4.5% n= 36), Unilever K (3.1% n= 25), Unilever BB (1.6% n= 13) and Unilever P (1.3% n= 10). The female population contributed to a higher overall employee participation than males in the research.

4.3.3 Step-two screening

Eligible participants from step-one screening were invited to step-two screening, which included blood pressure (BP) measurements, an HbA1c test and a full lipogram test. The step-two screening results are presented in Table 4.3.

Table 4.3: Step-two clinical screening results by gender and race

Variable		**SBP** (mmHg) (n= 790)	**DBP** (mmHg) (n= 790)	**HbA1c %** (n= 601)	**LDL-C** (mmol/L) (n=610)	**HDL-C** (mmol/L) (n= 610)	**TG** (mmol/L) (n= 610)	**T/C** (mmol/L) (n= 610)
Gender Mean (SD)	Male	126.0 (17)	81.1 (12)	5.5 (1)	3.2 (1)	1.2 (1)	2.1 (2)	5.0 (1)
	Female	121.8 (16)	77.9 (11.3)	5.4 (0.6)	3.0 (1.1)	1.5 (0.5)	1.4 (1.0)	4.9 (1.1)
Race Mean (SD)	Black	122.5 (17.1)	78.7 (12.6)	5.4 (0.6)	2.7 (0.9)	1.3 (0.6)	1.5 (1.2)	4.6 (1.0)
	Coloured	120.7 (14.6)	76.9 (7.4)	5.2 (0.4)	3.1 (1.2)	1.9 (2.1)	1.2 (0.7)	5.1 (1.2)
	Indian	126.5 (15.4)	81.2 (11.2)	5.7 (0.8)	3.5 (1.0)	1.3 (0.5)	2.1 (1.4)	5.4 (1.0)
	White	123.9 (14.6)	78.3 (9.5)	5.5 (1.3)	3.3 (1.1)	1.5 (0.5)	1.8 (1.4)	5.4 (1.0)

SBP- systolic blood pressure; DBP - diastolic blood pressure; HbA1c - glycated haemoglobin; LDL-C - low-density lipoprotein cholesterol; HDL-C - high-density lipoprotein cholesterol; TG - triglyceride; TC- total cholesterol; Values read as mean (SD)

Seven hundred and ninety participants completed two blood pressure (BP) measurements, this was averaged to obtain participant's average BP. The mean SBP was 126.0 mmHg (17) for males versus 121.8 mmHg (16) for females, while the mean DBP was 81.1 mmHg (12) for males and 77.9 mmHg (11.3) for females. The interracial mean SBP measurement was highest for Indians 126.5 mmHg (15.4) followed by Whites 123.9 mmHg (14.6), Blacks 122.5 mmHg (17.1) and Coloureds 120.7 mmHg (14.6). The mean interracial DPB was highest for Indians 81.2 mmHg (11.2), followed by Blacks 78.7 mmHg (12.6), Whites 78.3 mmHg (9.5) and Coloureds 76.9 mmHg (7.4).

Analysis of the blood collected during the screening step indicated that a total of 601 participants completed the glycated haemoglobin (HbA1c) test. This comprised 45.1% (n= 271) males and 54.9% (n= 330) females. One hundred and ninety-six participants did not complete the HbA1c test. Some participants were not keen on doing the venous blood draw, while others, in particular, Unilever staff, indicated that they had completed the test at the onsite clinic so their results could be obtained. However, it was later established that the clinic had not done an HbA1c or lipid profile test for these participants. Blood samples and or results for 24 participants were also destroyed during the KwaZulu-Natal (KZN) storm, which took place in April 2022. Blood samples and test results, which were housed in the laboratory, were damaged following widescale flooding and a mudslide at the laboratory premises in Isipingo, Durban. All affected participants were informed about their compromised test results, and retesting was offered, however, only one participant opted to retake the tests. The mean results from participants who completed the HbA1c test were 5.5% (1) for males and 5.4% (0.6) for females. The HbA1c results showed a mean value of 5.7% (0.8) for Indians. This was the only group that had a mean value was within the prediabetic range.

Six hundred and ten participants completed the lipogram test. One hundred and eighty-seven participants did not complete the testing as some were afraid to participate in the venous blood draw, while others indicated that they had done this blood test at the worksite clinic and consented for their results to be retrieved; however, during the retrieval process, it was established that a lipogram test and HbA1c test had not been conducted thus this resulted in a nil result for these participants. As reported earlier, some results and samples were also destroyed during the KZN storm damage. Using the cutoffs for dyslipidaemia (Reiger *et al.* 2017: 4), males had a mean HDL-C ('good cholesterol') reading of (1.2 mmol/L) when compared to females with (1.5 mmol/L) thus, both males and females were within range for HDL-C targets. For the cluster of 'bad cholesterol', males, rather than females, had a higher LDL-C (3.2 versus 3 mmol/L), TG (2.1 versus 1.4 mmol/L) and TC (5.0 versus 4.9 mmol/L). While males had a higher LDL-C than females, results for both genders were higher than the recommended 1.7 mmol/L cutoffs. Results also indicate that with the highest mean LDL-C of 3.5 mmol/L, Indians were the most vulnerable to cardiovascular disease (CVD) risk, followed by Whites with 3.3 mmol/L, Coloureds with 3.1 mmol/L and Blacks with 2.7 mmol/L.

Raised TG is also accepted in the literature as an independent risk marker for CVD (Catapano *et al.* 2016: 48), these results also warranted review. The mean TG at 2.1 mmol/L for males was higher than for females at 1.4 mmol/L. The mean interracial breakdown in descending order for TG was 2.1 mmol/L for Indians, followed by 1.8 mmol/L for Whites, 1.5 mmol/L for Blacks and 1.2 mmol/L for Coloureds. Total cholesterol has been used as a factor to predict CVD risk (Manemann *et al.* 2023: 2). Total cholesterol was over the cutoff point for all race groups except for Blacks, with the highest mean for Indians (5.4 mmol/L) followed by Whites (5.3 mmol/L), Coloureds (5.1 mmol/L) and then Blacks (4.6 mmol/L).

4.3.4 Step-two screening for diabetes using HbA1c results, and by race

Participant HbA1c clinical results were categorised into normoglycaemic, prediabetic and diabetic. The results are presented in Table 4.4.

Table 4.4: Step-two screening by glucose metabolism categories and by race

Race	Glucose metabolism categories			Total n= 601
	Normoglycaemic n= 446 (74.2%)	Prediabetic n= 124 (20.6%)	Diabetic n= 31 (5.2%)	
Black	271 (79.5)	60 (17.6)	10 (2.9)	341

Race	Glucose metabolism categories			Total n= 601
	Normoglycaemic n= 446 (74.2%)	**Prediabetic n= 124 (20.6%)**	**Diabetic n= 31 (5.2%)**	
Coloured	13 (76.5)	4 (23.5)	0 (0)	17
Indian	106 (61.3)	50 (28.9) *	17 (9.8)*	173
White	56 (80.0)	10 (14.3)	4 (5.7)	70

*p<0.001

The results presented in Table 4.4 indicate that from the 601 participants' HbA1c results, 74.2% participants were categorised as normoglycaemic (n= 446), 20.6% as prediabetic (n= 124) and 5.2% as diabetic (n= 31). In this study cohort, there was a 25.8% prevalence for higher-than-normal blood glucose, with 20.6% prediabetic and 5.2% diabetic. The chi-square goodness-of-fit test was applied to test whether any glucose metabolism categories were significantly higher between race groups. Prediabetes and diabetes were most prevalent among Indians, 28.9% (n= 50) and 9.8% (n= 17), respectively, and least prevalent among Coloureds, 23.5% (n= 4) and 0% (n= 0), respectively. There was a significant relationship between race and diabetes classification, $\chi 2$ (6) = 25.700, $p<.001$. A high proportion of Blacks were classified as normal, and Indians were classified as pre-diabetic or diabetic.

4.3.5 Step-two screening – prevalence of dyslipidaemia

As per participant lipid analysis [includes LDL-C, HDL-C, TG and TC], participants were grouped as either presenting or not presenting with dyslipidaemia. The results are presented in Table 4.5.

Table 4.5: Step-two prevalence of dyslipidaemia by race

Dyslipidaemia			
Race	**No n (%)**	**Yes n (%)**	**Total n= 610 (%)**
Black	133 (38.9)*	209 (61.1)	342 (100)
Coloured	6 (31.6)	13 (68.4)	19 (100)
Indian	27 (15.2)	151 (84.8)*	178 (100)
White	14 (19.7)	57 (80.3)	71 (100)
Total	180 (29.5)	430 (70.49)	610 (100)

*p<0.001

Table 4.5 indicates the prevalence of dyslipidaemia among the 610 participants by racial breakdown. Responses to this question were recorded as “no” and “yes” based on test results. Results show that a substantial number of Indian participants i.e., 84.8% (n= 151), had dyslipidaemia. A high prevalence of dyslipidaemia was also found among the White population in this study, with 80.3% (n= 57). The Black population group, with 38.9% prevalence (n= 133), reported the highest number of participants who did not have dyslipidaemia, followed by the Coloured population, with 31.6% (n= 6). Overall, 29.5% (n= 180) in this study had blood lipid readings within the healthy range, while a large majority, 70.49% (n= 430), had higher than the recommended cutoffs for dyslipidaemia. A significant 38.9% (n= 133) of Black participants presented without dyslipidaemia, they also had 61.1% (n= 209) of the participants with dyslipidaemia. The Chi-square test noted a statistically significant relationship between race and dyslipidaemia, $\chi2$ (3) = 35.375, p<.001. A significant proportion of Indians compared to Blacks participants had dyslipidaemia.

4.3.6 Step-two screening- prevalence of hypertension

As per participant average blood pressure (BP) measurements, results were categorised within the ranges: normal, optimal, high normal, HPT G1 and HPT G2. The results are presented in Table 4.6.

Table 4.6: Prevalence of hypertension by category

BP category*	SBP mm/Hg		DBP mm/Hg	n= 790 (%)
Normal	<120	and	<80	258 (32.7)
Optimal	120-129	and	<80	108 (13.7)
High normal	130-139	or	80-89	240 (30.4)
Hypertension range				
HPT G1	140-159	or	90-99	137 (17.3)
HPT G2	160-179	or	100-109	34 (4.3)
HPT G3	≥ 180	or	≥110	13 (1.6)

HPT-Hypertension, HPT G1-Hypertension grade 1, HPT G2-Hypertension grade 2, HPT G3- Hypertension grade 3, SBP- Systolic blood pressure, DBP- Diastolic blood pressure. (Rayner *et al.* 2019: 57) *Individuals with SBP and DBP in two categories should be designated to higher BP based on two or more careful readings obtained on two or more occasions

Table 4.6 presents the hypertension results categorised as per the South African Hypertensive Society guidelines (Rayner *et al.* 2019: 57). Results accordingly indicate that 32.7% (n= 258) of participant measurements were within the normal range i.e. <120 mm/Hg <80 mm/Hg. A total of 23.3% (n= 184) participants [HPT G1+ HPT G 2 + HPT G 3] would be classified as hypertensive within the continuum however, it does not clearly identify those who are prehypertensive. With 44.0% (n= 348) [optimal + high normal] prehypertensive participants in this study, research indicates that there is a high degree of probability for these individuals to add to the existing 23.3% (n= 184) of hypertensive individuals.

4.4 Baseline (BL) results of the randomised controlled trial (RCT)

As per Figure 3.3 CONSORT diagram in chapter 3, 207 participants consented to proceed further with the research study. This initiated the next phase of data collection. Participants agreed to complete research questionnaires, conduct anthropometric and BP measurements, and agreed to participate in the interventions, regardless of the intervention assignment [canteen-only (CO) or canteen and behavioural (CB) treatment]. Participants also committed to participating until the endline clinical tests were complete. However, as detailed in section 3.4.4 (sample size and randomisation) in this thesis, only 147 participants completed all the data collection requirements. Thus, post-randomisation, there was a final total of 72 participants in the CB group and 75 participants in the CO group.

4.4.1 Participant BL demographic profile

A detailed analysis of the 147 participants follows as per the characteristics tabled in Table 4.7.

Table 4.7: Whole group BL demographic profile

Variable	Description	n= 147 (%)
Gender	Male	69 (46.9)
	Female	78 (53.1)
Race	Black	76 (51.7)
	Coloured	9 (6.1)
	Indian	49 (33.3)
	White	13 (8.8)
Age	**(Mean) age**	
20-29	27.4	25 (17.0)
30-39	34.1	52 (35.4)
40-49	44.7	38 (25.9)
50-59	54.7	25 (17.0)
60-69	61.3	7 (4.7)
Marital status	Married	73 (49.7)
	Single	66 (44.9)
	Divorced	8 (5.4)
Income	Up to R10000	21 (14.3)
	R11000 - R20000	46 (31.3)
	R21000 - R30000	26 (17.7)
	R31000 - R40000	19 (12.9)
	R41000 - R50000	14 (9.5)
	R61000 - R70000	3 (2.0)
	>R80000	3 (2.0)
	Opted not to disclose income	15 (10.2)
Education	Primary school	1.4 (2)
	Grade 12	26 (17.7)
	FET/College	15 (10.2)
	Other post-school	100 (68.0)
	Prefer not to say	4 (2.7)

FET-Further Education and Training

Table 4.7 provides an overview of the BL participant demographic characteristics. There were 147 participants, with 46.9% (n= 69) males and 53.1% (n= 78) females. The group racial breakdown in descending order was Black 51.7% (n= 76), Indian 33.3% (n= 49), White 8.8% (n= 13) and Coloured 6.1% (n= 9). Analysis of the age statistics indicated that over one third of the participants, 35.4% (n= 52), were in the age category of 30-39 years.

Almost half of the participants were married, 49.7% (n= 73), while 44.9% (n= 66) were single, and 5.4% (n= 8) were divorced. The income bracket R11000 - R20000 was the most common, while the income brackets between R61000 - R70000 and >R80000 were recorded least frequently. A notably large percentage of participants had post-school education 68% (n= 100), 17.7% (n= 26) had grade 12, 10.2% (n= 15) had an FET qualification, and only 1.4% had a primary school level education.

Participating in a research study of this nature requires interest and commitment from all role players, with special focus on the participants. Completing step-one and two of the screening showed participants' interest in their health and the research initiative however, completing the full participation by going on to the baseline (BL) and endline (EL) stages of the research, reflected participants' deep interest in personal health and a commitment to meet the requirements of the research programme.

Table 4.8 indicates the total number of participants who completed the ‘full’ participation in the research study across all participating worksites by gender.

Table 4.8: Spread of ‘full’ participation across worksites by gender at BL

Participation by site	Male n= 69 (%)	Female n= 78 (%)	Total n= 147 (%)
Unilever LL	14 (20.3)	26 (33.3)	40 (27.2)
Unilever MW	9 (13.0)	9 (11.5)	18 (12.2)
Unilever I	20 (29)	4 (5.1)	24 (16.4)
Unilever BB	5 (7.2)	4 (5.1)	9 (6.1)
Unilever K	7 (10.1)	4 (5.1)	11 (7.5)
Retailability	14 (20.3)	31 (39.7)	45 (30.6)

Unilever LL- Unilever La Lucia, Unilever MW- Unilever Maydon Wharf, Unilever I- Unilever Indonsa, Unilever BB- Unilever Boksburg, Unilever K- Unilever Khanyisa

Table 4.8 indicates that the three highest ‘full’ participations in the study was recorded from the following worksites in descending order: Retailability (30.6% n= 45), Unilever LL (27.2% n= 40), and Unilever I (16.4% n= 24). More male participation was observed at production than administrative worksites (Refer to chapter 3, 3.4).

4.4.2 Participant language use

The tool used to gather participant demographic data also collected information on participant language use. The results are presented in Table 4.9.

Table 4.9: Participant home language

Language	Frequency (n= 147)	%
isiZulu	60	40.8
English	73	49.6
isiXhosa	3	2.0
Sesotho	5	3.4
siSwati	1	0.7
Sepedi	1	0.7
Afrikaans	1	0.7

Language	Frequency (n= 147)	%
Xitsonga	1	0.7
Tshivenda	2	1.4

South Africa (SA) has 11 languages, thus, there was potential for high diversity in the languages used by the study participants. Responses recorded that a total of nine languages were used by the study cohort however, English was the dominant language, spoken by 49.6% (n= 73) of the participants. Knowing the language diversity of a population is important as training and awareness programmes can then be tailored for population fit.

4.5 Perception of health and risk behaviours

At BL, consenting participants completed a health perception and risk behaviour questionnaire, the results are presented below.

4.5.1 Participant health perceptions and risk behaviours

A questionnaire was used to gather data on participants' health and risk behaviours, the findings are presented in Table 4.10.

Table 4.10: Participant health perceptions and risk behaviours

Variable	Description	n= 147 (%)
Health	Poor	8 (5.4)
	Average	58 (39.5)
	Good	65 (44.2)
	Very good/excellent	16 (10.9)
Weight perception	Underweight	7 (4.8)
	Normal weight	59 (40.1)
	Overweight	76 (51.7)
	Unsure	5 (3.4)
Smoker	Yes	14.3 (21)
	No	85.7 (126)
	Male smokers	66.7 (14)
	Female smokers	33.3 (7)
Alcohol consumption	Yes	68 (100)
	No	32 (47)
	Males who consume alcohol	51 (34.7)
	Females who consume alcohol	49 (33.3)
Alcohol frequency	1-2 times per month	36.1 (53)
	3-4 times per month	18.4 (27)
	5-6 times per month	8.2 (12)
	>7 times per month	4.1 (6)

Variable	Description	n= 147 (%)
	0 times	33.3 (49)

Participants rated their health as good (44.2% n= 65), average (39.5% n= 58), very good/excellent (10.9% n= 16) and poor (5.4% n= 8). Weight perceptions were dominated by perceptions of overweight (51.7% n= 76), followed by normal weight (40.1% n= 59) and underweight (4.8% n= 7). A large majority of participants, (85.7% n= 126), indicated that they were non-smokers, while (14.3% n= 21) indicated that they were smokers. Alcohol was consumed by more participants, 68.0% (n= 100), than the 32% (n= 47) who did not consume alcohol. Forty-nine percent of females (n= 49) consumed alcohol compared to 51% (n= 51) of males. The frequency of alcohol consumption indicated that the largest number of participants, 36.1% (n= 53), consumed alcohol 1-2 times per month, followed by 18.4% (n= 27) consuming 3-4 times per month, 8.2 % (n= 12) consuming 5-6 times per month, and 4.1% (n= 6) consuming >7 times per month.

Table 4.11: BMI by gender for CB and CO intervention groups at BL and EL

		(n= 147) %				
		Underweight <18.5 kg/m^2	**Normal weight 18.5-24.9 kg/m^2**	**Overweight 25-29.9 kg/m^2**	**Obese 30-34.9 kg/m^2**	**Extremely obese ≥35 kg/m^2**
BL						
CB	Males n= 38(%)	0	8 (21.1)	20 (52.6)	7 (18.4)	3 (7.9)
	Females n= 34(%)	0	10 (29.4)	7 (20.6)	5 (14.7)	12 (35.3)
CO	Males n= 31(%)	0	11 (35.5)	11 (35.5)	5 (16.1)	4 (12.9)
	Females n= 44(%)	2.3 (1)	8 (18.2)	14 (31.8)	8 (18.2)	13 (29.5)
	n = 147	0.7 (1)	37 (25.2)	52 (35.4)	25 (17.0)	32 (21.8)
EL						
CB	Males n= 38(%)	0	8 (21.1)	19 (50)	8 (21.1)	3 (7.9)
	Females n= 34(%)	0	10 (29.4)	7 (20.6)	6 (17.6)	11 (32.4)
CO	Males n= 31(%)	3.2 (1)	10 (32.3)	13 (41.9)	2 (6.5)	5 (16.1)
	Females n= 44(%)	2.3 (1)	7 (15.9)	15 (34.1)	9 (20.5)	12 (27.3)
	n = 147	1.4 (2)	35 (23.8)	54 (36.7)	25 (17)	31 (21)

Group findings		
Gender	**n**	**Mean (SD)**
BL BMI Males	69	27.881 (4.98)
Females	78	31.581 (7.951)
EL BMI Males	69	27.986 (5.12)
Females	78	31.308 (7.788)

Table 4.11 indicates that an overall 74.1% (n= 109) of the participants' results at BL were concentrated in the overweight, obese and extremely obese categories, and remained constant with 74.8% (n= 110) at EL. In the normal weight category, it was 25.2% (n= 37) at BL, with a very modest shift to 23.8% (n= 35) at EL. The BMI results indicate that a very small number of participants were underweight at both BL (0.68% n= 1) and EL (1.4% n= 2). Across the categories for BMI, small changes were noted from BL to EL, however these changes were not significant. Overall, the mean BMI of males and females at both BL and EL of the study were over the normal range of 18.5-24.9 kg/m^2 with males within the overweight range of 25-29.9 kg/m^{2}and females within the obese range of 30-34.9 kg/m^2.

Table 4.12: Perceived weight at BL versus BMI at BL

BMI category	**Weight perception % versus BMI BL**				
	Underweight	**Normal weight**	**Overweight**	**Obese**	**Extremely obese**
Underweight	100*	0.0	0.0	0.0	0.0
Normal weight	13.9*	75*	11.1	0.0	0.0
Overweight	0.0	49.0	51.0	0.0	0.0
Obese	0.0	25.0	75.0*	0.0	0.0
Extremely obese	0.0	6.3	90.6*	0.0	1.6

*p<0.001

The Pearson's chi-square was used to assess the relationship between perceived weight and BMI at BL for all participants in the whole group. There was a significant relationship between perceived weight and BMI, Fisher's exact = 63.929, p<.001. A significant proportion of underweight participants perceived themselves as underweight; majority of normal weight participants perceived themselves as normal weight; and obese and extremely obese participants generally perceived themselves as overweight. Therefore, there was a strong correlation between what participants perceived and what they were (rho = .591, p<.001).

Table 4.13: Physical activity (PA) levels at BL

Variable	**Description**	**n= 147 (%)**
PA METS groups	<600	45 (30.6)
	≥600	102 (69.4)
Vigorous PA at work	No	136 (92.5)

Variable	Description	n= 147 (%)
	Yes	11 (7.5)
Moderate PA at work	No Yes	80 (54.4) 67 (45.6)
Travel to and from work PA	No Yes	105 (71.4) 42 (28.6)
Vigorous leisure PA	No Yes	105 (71.4) 42 (28.6)
Moderate leisure PA	No Yes	74 (50.3) 73 (49.7)

PA - Physical activity, METS - Metabolic equivalent of task

The World Health Organisation (2022: para. 3) recommends that all individuals, from infants to 65 years and above, participate in PA everyday, to optimise health. For those aged 18 to 64, a minimum of 150 minutes of moderate PA or 75 minutes of vigorous PA is recommended (WHO 2022c: para. 5). As detailed in section 3.4.4 of chapter 3, the Global Physical Activity Questionnaire (GPAQ) was used to gather data on an individual's physical activities and the time spent engaged in the activity. When applying the Global Physical Activity Questionnaire (GPAQ), active minutes can be calculated to provide a METS score that can indicate if an individual is meeting recommended PA levels. Results indicate that overall, 69.4% (n= 102) of individuals achieved the ≥600 METS minutes and were, therefore, within the recommended PA guideline. However, 30.6% (n= 45) of individuals achieved <600 MET minutes.

Results from the GPAQ also provided a breakdown of the activity intensity level as per vigorous and moderate intensity and indicated that most participants did not participate in vigorous-intensity PA. Most participants did not participate in vigorous PA during leisure time (71.4%), or at work (92.5%). When vigorous-intensity PA was undertaken, the uptake was higher during leisure time, with 28.6% (n= 42), than during work hours, with 7.5% (n= 11) participation. Overall, from two categories (during work and leisure time) during which participants could engage in vigorous PA i.e., a potential count of 294 times (147 x 2), vigorous PA was taken up by only 18% (n= 53) of participants.

A further response indicated that 71.4% (n= 105) of participants did not engage in PA to and from work. Only a small number of participants, 28.6% (n = 42), engaged in PA while travelling to and from work. Uptake for moderate intensity PA was higher during leisure time, 49.7% (n= 73), than during work time 45.6% (n= 67). However, it was simultaneously noted that 50.3% (n= 74) of participants did not engage in moderate-intensity activity during leisure time or during work time (54.4% n= 80). Overall, from two categories (during work and leisure time) that participants could engage in moderate PA i.e., a minimum potential count of 294 times (147 x 2), moderate PA was taken up 140 (47.6%) times.

A summary of the sedentary hours as reported by participants is provided in the table below. An independent samples t-test was applied to determine if the sedentary hours by gender were different.

Table 4.14: Mean Difference in sedentary hours stratified by gender

	Gender	n= 147	Mean (SD)	Mean difference	CI
Sedentary hours	Male	69	5.08 (2.666)	-2.288*	(-3.357; 1.291)
	Female	78	7.37 (3.699)	-2.288	(-3.334;-1.242)

*p<0.001

Males spent, on average, 5.08 hours in sedentary behaviour, while females spent 7.37 hours. When compared to males, females spent significantly more time inactive, p<0.001.

4.5.2 Participants stress levels

Data were collected to assess participant stress levels as this variable can contribute to the risk for NCDs. Table 4.15 presents the findings.

Table 4.15: Participant stress levels at BL

Variable	Description	n= 147 (%)
Stress levels	Very low	10 (6.8)
	Low	4 (16.3)
	Medium	58 (39.5)
	High	43 (29.3)
	Very high	12 (8.2)

Five categories of stress were used to classify participants' responses to stress using the baseline socioeconomic and lifestyle questionnaire. With 39.5% (n= 58), medium stress levels received the highest number of responses, followed by high stress 29.3% (n= 43), low stress 16.3% (n= 24), very high stress 8.2% (n= 12) and very low stress 6.8% (n= 10).

4.6 Dietary practices and preferences

At BL, participants completed a dietary questionnaire as described in section 3.5.2 of chapter 3. This questionnaire was administered to obtain an overview of the participant's dietary practices and preferences. Key findings are presented below.

4.6.1 Meal purchase patterns

Table 4.16 describes the participants' meal purchase patterns and frequency.

Table 4.16: Participants meal purchase frequency for breakfast, lunch, and supper meals

Meal purchase patterns	Purchase frequency per week	n=(%)
Breakfast purchase patterns	0	64 (43.5)
	1	37 (25.2)
	2	16 (10.9)
	3	7 (4.8)

Meal purchase patterns	Purchase frequency per week	n=(%)
	4	2 (1.4)
	5	18 (12.2)
	6	0 (0.0)
	7	3 (2.0)
	Total 209	**147 (100)**
Lunch purchase patterns	0	32 (21.8)
	1	32 (21.8)
	2	26 (17.7)
	3	15 (10.2)
	4	5 (3.4)
	5	34 (23.1)
	6	1 (0.6)
	7	2 (1.4)
	Total 339	**100 (147)**
Supper purchase patterns	0	60 (40.8)
	1	38 (25.9)
	2	22 (15)
	3	7 (4.8)
	4	7 (4.7)
	5	7 (4.7)
	6	0 (0.0)
	7	6 (4.1)
	Total 208	**100 (147)**

Table 4.16 outlines the weekly the frequency and type of meals purchased at worksite canteens. Overall, 756 meals spread over three meal periods, breakfast (4.8% n= 209), lunch (44.8% n= 339) and supper (27.5% n= 208), were purchased weekly by participants from the worksite canteens. With 339 purchases, lunch-type meals were the most purchased, while supper meals, with 27.5% (n= 208) purchases, were the least purchased. This therefore suggests a potential of 2205 meals (147 x 3 meals x 5 days) that could be sold at the worksite canteen per week.

4.6.2 Diet classification

The dietary questionnaire also provided information on participants' diet type, as presented in Table 4.17.

Table 4.17: Participant diet classification

Variable	Description	Male	Female	n= 147 (%)
Diet classification	Non-vegetarian	67 (46.9)	76 (53.1)	143 (96.5)
	Lacto-vegetarian	1 (0.7)	0 (0.0)	1 (0.7)
	Ovo-vegetarian	0 (0.0)	2 (1.4)	2 (1.4)
	Vegetarian	1 (0.7)	0 (0.0)	1 (0.7)

Results for Table 4.17 show that 96.5% (n= 143) of participants identified themselves as primarily non-vegetarian (omnivores), while with the remaining 3.5% (n= 4) participants, consisted of one each as vegetarian and lacto-vegetarian and two as ovo-vegetarian.

4.6.3 Consumption patterns for fats and oils, starch, supplements, and salt

The dietary questionnaire, as set out in chapter 3, section 3.4.2 elicited information on participant consumption of fats and oils, starch and salt. These results are presented in Figure 4.1 and 4.2.

4.6.3.1 Fats and oils consumption

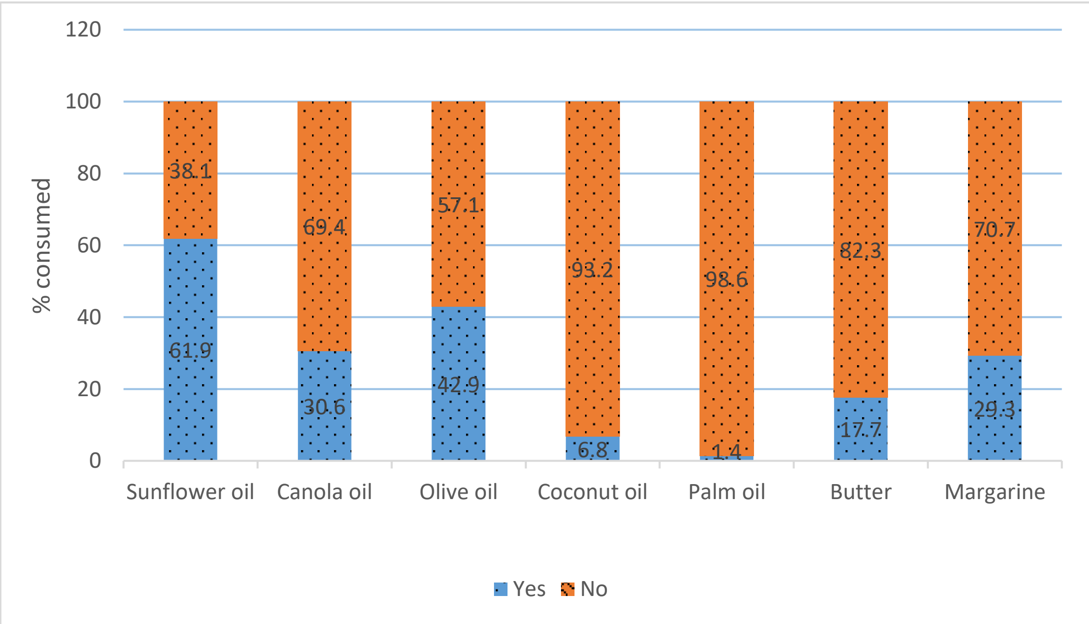

Figure 4.1: Type and frequency of fats and oils consumed

Participants used a variety of fats and oils in their meal preparation. The most used oil was sunflower oil, with an uptake of (61.9% n= 91) followed by olive oil (42.9% n= 63) and canola oil at (30.6% n= 45); while the least used oils were coconut oil (6.8% n= 10) followed by palm oil at (1.4% n= 2). With (29.3% n= 43), margarine was used more frequently in cooking than butter at (17.7% n= 26).

4.6.3.2 Types of starch consumed

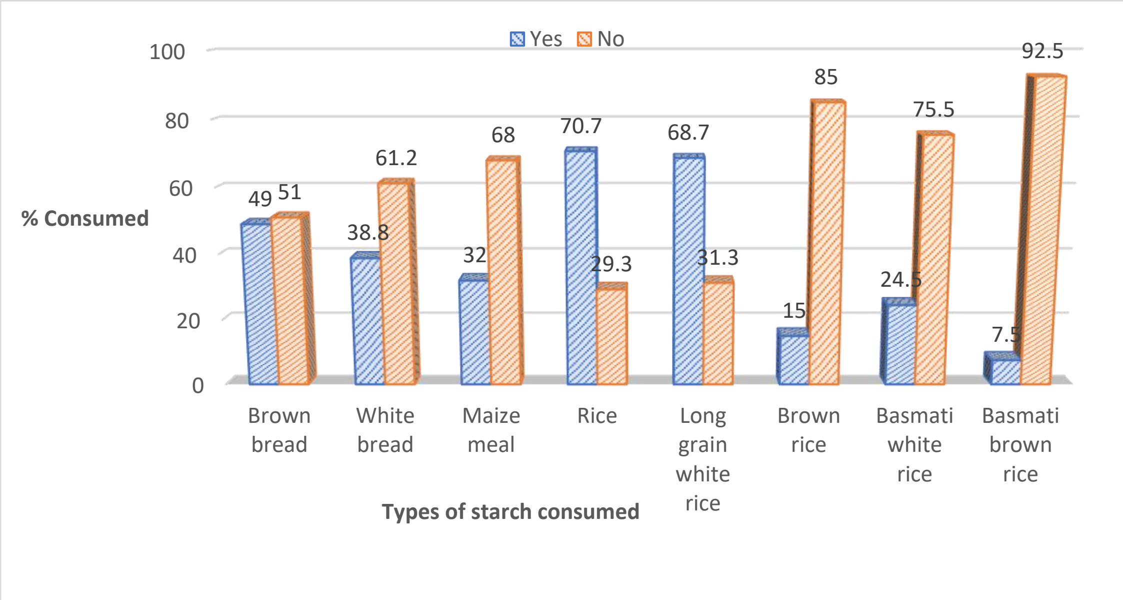

Figure 4.2: Type and frequency of starch consumed by participants at BL

The results presented in Figure 4.2 show that with 70.7% consumption, rice was the most frequently consumed starch, followed by brown bread at 49%, white bread at 38.8% and maize meal at 32%. Rice intake was further broken down to review the type of rice being consumed. Results indicate that long-grain rice, with 68.7% consumption, was consumed the most, including brands like Spekko, Aunt Caroline and Tastic. Basmati white rice was consumed by 24.5% of participants, while brown rice consumption was lowest at 15% and consumption is even lower for Basmati brown rice at 7.5%.

Table 4.18 below outlines participant responses on the consumption of dietary supplements and salt intake.

Table 4.18: Dietary supplementation and salt intake

Variable	Response	n= 147 (%)
Dietary supplementation	No	91 (61.9)
	Yes	54 (36.7)
	No response	2 (1.4)
Added salt	No	94 (63.9)
	Yes	51 (34.7)
	No response	2 (1.4)

Responses presented in Table 4.18 indicate that a minority, 36.7% (n= 54) participants, consumed dietary supplements, while majority of the participants, 61.9% (n= 91), did not supplement their diet. A small percentage, 1.4% (n= 2), opted not to disclose information on dietary supplementation. The dietary questionnaire asked participants if they added salt during their meal consumption. Table 4.18

includes the summary of participant responses, with 63.9% (n= 94) of participants indicating that they did not add salt to their meals during consumption, while 34.7% (n = 51) indicated that they did.

Table 4.19: Quantification of added salt consumed per day

Specify the quantity of added salt /day	n= 147 (%)
1 pinch per day	17 (11.6)
2 pinches per day	16 (10.9)
3 pinches per day	9 (6.1)
4 pinches per day	2 (1.4)
5 pinches per day	1 (0.7)
More than 5 pinches per day	6 (4.1)
Unsure of added salt quantity	96 (65.3)

Table 4.19 provides a summary of added salt consumed by participants per day. Participants were prompted to provide their responses in pinches or teaspoons, and they all opted to use pinches to quantify their intake. The majority of the participants, 65.3% (n= 96), were unsure of the amount of added salt they consumed per day. For those who were able to provide a response, the descending added salt consumption per day was: 11.6% (n= 17) for one pinch, 10.9 (n= 16) for 2 pinches, 6.1 (n= 9) for 3 pinches, 1.4 (n= 2) for 4 pinches, 0.7% (n= 1) for 5 pinches and 4.1 (n= 6) for more than 5 pinches per day.

4.7 Baseline (BL) and Endline (EL) clinical and anthropometric results

4.7.1 BL and EL mean anthropometry and clinical results, stratified by gender for the whole group

Table 4.20: Whole group BL to EL mean anthropometry and clinical characteristics stratified by gender

Variable	Whole group n= 147		Males n= 69		Females n= 78	
	BL Mean (SD)	EL Mean (SD)	BL Mean (SD)	EL Mean (SD)	BL Mean (SD)	EL Mean (SD)
Weight (kg)	83.22 (19.50)	83.13 (19.27)	83.52 (16.24)	83.74 (16.43)	82.95 (22.09)	82.59 (21.56)
Height (cm)	162.62 (8.52)	162.62 (8.52)	171.71 (6.310)	171.71 (6.310)	161.47 (7.291)	161.47 (7.291)
BMI (kg/m²)	29.84 (6.95)	29.75 (6.85)	27.88 (4.98)*	27.99 (5.12)	31.58 (7.95)*	31.31 (7.79)
WC (cm)	94.93 (15.36)	94.94 (15.54)	95.11 (13.22)	94.88 (13.41)	94.77 (17.11)	95.00 (17.30)
SBP (mmHg)	129.58 (13.70)	124.57 (13.60)	130.87 (12.99)	127.87 (12.84)	128.44 (14.28)	121.65 (13.66)
DBP (mmHg)	84.54 (10.36)	80.12 (11.22)	85.28 (9.78)	82.39 (11.13)	83.88 (10.85)	78.12 (10.99)
HbA1c (%)	5.45 (0.46)	5.52 (0.35)	5.44 (0.44)	5.54 (0.33)	5.47 (0.48)	5.51 (0.36)
HbA1c (mmol/L)	6.11 (0.74)	6.18 (0.61)	6.08 (0.70)	6.18 (0.65)	6.13 (.77)	6.18 (0.58)
TC (mmol/L)	5.15 (1.04)	4.76 (0.99)	5.18 (1.09)	4.79 (1.08)	5.12 (0.99)	4.74 (0.90)
LDL-C (mmol/L)	3.16 (1.01)	3.07 (0.84)	3.26 (1.03)	3.14 (0.90)	3.08 (0.98)	3.01 (0.80)
TG (mmol/L)	2.02 (1.57)	1.98 (1.41)	2.29 (1.84)*	2.24 (1.72)	1.78 (1.24)*	1.76 (1.02)
HDL-C (mmol/L)	1.31 (0.38)	1.33 (0.30)	1.19 (0.33)*	1.24 (0.29)	1.41 (0.39)*	1.41 (0.29)

*p<0.001, BMI- Body Mass Index, WC- waist circumference SBP - systolic blood pressure; DBP - diastolic blood pressure; HbA1c - glycated haemoglobin; TC- total cholesterol; LDL-C - low-density lipoprotein cholesterol; HDL-C - high-density lipoprotein cholesterol; TG – triglyceride

Table 4.20 presents a comprehensive overview of participant results, commencing with the one hundred and forty-seven individuals who completed all anthropometry (weight, height and WC measurements), clinical BP measurements, HbA1c, full lipogram, and documentation requirements for the research study. The whole group participation from BL to EL comprised of 47% (n= 69) males and 53% (n= 78) females from BL to EL.

The mean BMI for the whole group was 29.84 kg/m² (SD 6.95) for BL and 29.75 kg/m² (SD 6.85) for EL, and in both instances, the mean BMI recorded was over the normal weight cut off of 18.5-24.9 kg/m² as recommended by WHO (2010: para. 3); with the mean BMI for males at BL of 27.88 kg/m² (SD 4.98) and at EL 27.99 kg/m² (SD 5.12). The mean BMI for females in both the BL and EL was >30 kg/m² but not over 34.5 kg/m², which is classified as moderately obese (WHO 2010: para. 3). With a mean WC >94cm for the whole group, as well as for males and females, at both Bl and EL, all participants presented with a higher than optimal WC (National Department of Health (NDoH) *et al.* 2019: 300). However, with a mean WC >94cm, females presented with a higher risk as their mean readings for both BL and EL is associated with a substantial risk for metabolic complications. On the other hand, with both BL and EL mean WC measurements of >94cm and <102 cm, male participants were within range for increased risk of metabolic disease (NDoH *et al.* 2019: 300), as described in section 3.4.5 of chapter three.

The mean SBP reading for the whole group was 129.58 mmHg at BL and 124.57 mmHg at EL with males showing a higher mean SBP at both BL (130.87 mmHg) and EL (127.87 mmHg) of the study. The mean SBP reading for females was 128.44 mmHg at BL, while their EL reading was 121.65 mmHg. The mean DBP reading for the whole group at BL was 84.54 mmHg and 80.12 mmHg at EL. Similar to the SBP readings for males, the male DBP reading was also higher at both BL and EL, than for females. Females had a mean DBP reading of 83.88 mmHg at BL however, at EL, the mean female DBP reading reduced to 78.12 mmHg, and thus moved from the 'high normal' range to the 'normal' range while for males, the mean EL DBP of 82.39 mmHg, remained firmly within the 'high normal' range (Rayner *et al.* 2019: 57).

The mean HbA1c % was 5.45 (SD 0.46) at BL and 5.52 (SD 0.35) at EL. This indicates that the HbA1c increased by only a marginal 0.07 at EL and the targeted objective to reduce HbA1c by 0.5%, was not achieved. The mean HbA1c % for the whole group at BL at <5.45% was under the prediabetes and diabetes reference range (CDC 2023: para. 1), however, the mean HbA1c at EL, across all groups, while not at the prediabetes or diabetes range, showed a small increase with the highest mean recorded for males at EL with (5.54%).

At BL, the whole group, male and female mean TC was >5mmol/L, LDL-C was >3.0 mmol/L, and TG was >1.7mmol/L thus placing values within the range for dyslipidaemia (Reiger *et al.* 2017: 4). A two-fold change was noted for TC as all groups presented with both a lower mean TC at EL as well as moving to <5mmol/L. Males TC was 5.18mmol/L at BL while females was 5.12mmol/L. The mean LDL-C at BL was 3.26mmol/L for males and 3.08mmol/L for females. The mean HDL-C at both BL and EL, was within and even over the optimal range for the whole group, the male group and female group, respectively. At BL, the mean value for HDL-C for males was 1.19 mmol/L, while for females it was 1.41mmol/L. While a modest improvement was observed for TG for the whole group, male group and female group, the mean TG value exceeded the optimal range, with male participants mean at 2.29mmol/L and females at 1.78mmol/L. Thus, the post-analysis EL results summary suggests that some lipid components moved to within the healthy mean range; however, overall, lipids remained high.

Table 4.21 Equality of means for BL and EL anthropometry and clinical measurements stratified by gender

	Variable	T	Df	p	Mean diff (CI)
BL	HDL *	-3.560	1.45	0.01	-.2134 (-.3319;-0.949)
		-3.594	144.849	.001	-.2134 (-.3308; -.0961)
	TG *	1.985	145	.049	.5086 (.0023; 1.0148)
		1.940	116.791	.055	.5086 (-.0107; 1.0278)
	BMI *	-3.329	145	.001	-3.6996 (-5.8961; -1.5031)
		-3.420	131.262	.001	-3.6996 (-5.8398; -1.5594)
EL	SBP*	2.832	145	.005	6.216 (1.877; 10.554)
		2.842	144.446	.005	6.216 (1.894; 10.538)
	DBP*	2.341	145	.021	4.276 (.665; 7.887)
		2.339	142.381	.021	4.276 (.662; 7.890)
	HDL*	-3.422	145	.001	-.1636 (-.2581; -.0691)
		-3.425	143.282	.001	-.1636 (-.2580; -.0692)
	TG*	2.091	145	.038	.4804 (.0264; .9344)
		2.031	107.746	.045	.4804 (.0114; .9494)
	BMI*	-3.013	145	.003	-3.3222 (-5.5017; -1.1427)
		-3.087	134.335	.002	-3.3222 (-5.4505; -1.1939)

*p<0.001

Levene's Test for Equality of Variances was conducted to assess whether the variances of the anthropometry and clinical measurements differed across genders for BL and EL. At BL, HDL-C and BMI were significantly higher for females, while triglycerides were significantly higher for males, p<0.001. At EL, SBP, DBP and TG were significantly higher for males; HDL-C and BMI were significantly higher for females, p<0.001.

To indicate abdominal obesity, WC measurements were taken and classified according to NDoH *et al.* 2019: 300 cutoffs.

Table 4.22: Waist circumference (WC) measurements for BL to EL for CO and CB intervention groups stratified by gender

		♂<94 ♀80cm n (%)	♂94- <102 ♀80- <88cm n (%)	♂102+ ♀88+cm n (%)
BL				
CB	Males (n= 38)	19 (50)	10 (26.3)	9 (23.7)
	Females (n= 34)	9 (26.5)	4 (11.8)	21 (61.8)
CO	Male (n= 31)	16 (51.6)	8 (25.8)	7 (22.6)
	Females (n= 44)	8 (18.2)	5 (11.4)	31 (70.5)
	n = 147	52 (35.4)	27 (18.4)	68 (46.3)
EL				
CB	Males (n= 38)	19 (50)	10 (26.3)	9 (23.7)
	Females (n= 34)	10 (29.4)	0 (0)	24 (69.7)
CO	Males (n= 31)	17 (54.8)	6 (19.4)	8 (25.8)
	Females (n= 44)	9 (20.5)	4 (9.1)	31 (70.5)
	(n= 147)	55 (37.4)	20 (13.6)	72 (49.0)

Group findings		
Gender	**n**	**Mean (SD)**
BL WC Males	69	95.113 (13.221)
Females	78	94.771 (17.109)
EL WC Males	69	94.875 (13.406)
Females	78	95.003 (17.299)

The number of males who had an optimal WC of <94cm at BL, was n= 35, with n= 19 making up the CB group and n= 16 making up the CO group; a similar pattern was noted for optimal WC at the EL with n= 36 which was made up of n= 19 (CB) and n= 17 (CO) groups respectively. Seventeen females had an optimal WC of <80cm at BL, n= 9 were in the CB group and n= 8 in the CO group, respectively. However, this number rose slightly to n= 19 at EL, with n= 10 females in the CB group and n= 9 in the CO group. Overall, with a WC ≥94 cm and <102 cm, at BL, n= 18, males had an increased risk for metabolic disease (NDoH *et al.* 2019: 300), with n= 10 from the CB group and n= 8 from the CO group, respectively. At EL, this figure dropped to n= 16 overall, with n= 10 in the CB group and n= 6 in the CO groups, respectively. On the other hand, n= 9 females had a WC ≥80 cm and <88 cm, with n= 4 in the CB group and n= 5 in the CO group at BL. This number dropped to n= 4 overall, with n= 0 in the CB group and n= 4 in the CO group, however, this raised WC also placed females at an increased risk for metabolic complications (NDoH *et al.* 2019: 300). The overall number of males presenting with a WC

≥102 cm was n= 16 in the BL group with n= 9 in the CB group and n= 7 in the CO group. This number increased to n= 17 overall at EL, with n= 9 from the CB group and n= 8 from the CO group. For females, at BL, a large majority of n= 52 presented with a WC ≥88 cm, with n= 21 in the CB group and n= 31 in the CO group. At EL, this number increased to n= 55 overall, with n= 24 in the CB group and n= 31 in the EL group. A disproportionately large number of females in this study are at a substantially increased risk for metabolic disease (NDoH *et al.* 2019: 300).

Blood pressure readings taken at BL and EL were classified into categories to assess the risk associated with BP on cardiovascular health.

Table 4.23: Blood pressure categories for CO and CB stratified by BP categories at EL

				CO		CB	
BP category	**SBP mmHg**		**DBP mmHg**	**Male % n= (31)**	**Female % n= (44)**	**Male % n= (38)**	**Female % n= (34)**
Normal	<120	and	<80	1 (3.2)	4 (9.1)	1 (2.6)	3 (8.8)
Optimal	120-129	and	<80	6 (19.4)	7 (15.9)	4 (10.5)	3 (8.8)
High normal	130-139	or	80-89	13 (41.9)	19 (43.2)	17 (44.7)	16 (47.1)
Hypertension range							
HPT G1	140-159	or	90-99	10 (32.3)	10 (22.7)	12 (31.6)	9 (26.5)
HPT G2	160-179	or	100-109	1 (3.2)	3 (6.8)	4 (10.5)	3 (8.8)
HPT G3	≥ 180	or	≥110	0 (0)	1 (2.3)	0 (0)	0 (0)

HPT-Hypertension, HPT G1-Hypertension grade 1, HPT G2-Hypertension grade 2, HPT G3- Hypertension grade 3, SBP- Systolic blood pressure, DBP- Diastolic blood pressure. (Rayner *et al.* 2019: 57) *Individuals with SBP and DBP in two categories should be designated to higher BP based on two or more careful readings obtained on two or more occasions

Table 4.23 presents the hypertension results categorised as per the SAHS (Rayner *et al.* 2019: 57) stratified by gender and intervention treatment. Results indicate that 3.2% (n= 1) of males in the CO group and 9.1% (n= 4) of females were within the normal to optimal range i.e. <120 mm/Hg <80 mmHg. In the CB group, 2.6% (n= 1) of males and 8.8% (n= 3) of females were within the normal to optimal range i.e. <120 mm/Hg <80 mmHg. A total of 61.3% (n= 19) males and 59.1% (n= 26) females participants in the CO group would be classified as prehypertensive and a total of 55.2% (n= 21) males and 55.9% (n=19) females participants in the CB group would be classified as prehypertensive. However, this continuum does not clearly identify those who are prehypertensive. In the CO group, 35.5% (n= 11) of males and 31.8% (n= 14) of females were classified as hypertensive and in the CB group, 31.6% (n= 16) of males and 35.3% (n= 12) of females were classified as hypertensive.

4.7.2 Clinical differences for the whole group from BL to EL

Table 4.24: Paired clinical differences for the whole group from BL to EL

Pairs	**Mean (SD)**	**Paired difference**		
		Mean (SD)	**CI**	**P value**
BL HbA1c% EL HbA1c%	5.453 (.454) 5.520 (.349)	-.7303 (.5445)	(-.8190; -.6415)	.001
BL SBP mmHg EL SBP mmHg	129.58 (13.695) 124.57 (13.597)	5.007 (12.805)	(2.919; 7.094)	.001
BL DBP mmHg EL DBP mmHg	84.54 (10.353) 80.12 (11.222)	4.415 (10.841)	(2.648; 6.182)	.001
BL TC mmol/L EL TC mmol/L	5.146 (1.0360) 4.764 (.9857)	.3822 (.6241)	(.2804; .4839)	.001

*p< 0.001

Paired sample tests were conducted to detect clinical differences from BL to EL. Table 4.24 shows the paired mean difference from BL to EL for HbA1c % (5.453 to 5.520); SBP (129.58 to 124.57mmHg); DBP (84.54 to 80.12 mmHg) and TC (5.146 to 4.764 mmol/L), p< 0.001. The paired mean difference from BL to EL for HbA1c %, remained similar, TC reflected a decrease while the DBP and SBP reflected the highest decreases. The biggest change was noted for SBP.

4.8 24-hour food recall

This research study collected data on participants' 24-hour food recalls, as detailed in section 3.4.3 of this thesis. The data were analysed using the Medical Research Council MRC FoodFinder 3 web-based software using nutrient cutoffs as per WHO; International Institute of Medicine (IOM 2005), (IOM 2006), (IOM 2011) and the SA Food Based Dietary Guidelines Tables 4.25 to 4.28 report on the mean 24-hour food recall intake stratified by gender and EL and BL.

Table 4.25: Mean 24-hour food recall nutrient intake for the CO group for females at BL and EL

Nutrient	BL				EL				
	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	EAR/AI*/ [a-c] EER†/SAFBD♣ Female
Energy (kJ)	6887.93 (2949.51)	81	19	0.630	6224.17 (3367.96)	74	26	0.001	8465†
Total protein (g)	65.25 (23.82)	142	-	0.142	60.12 (29.60)	131	-	0.016	46
[a]Total fat (g)	76.65 (95.60)	111	-	0.694	75.93 (93.95)	110	-	0.694	≤69♣
Saturated fat (g)	19.67 (12.44)	86	14	0.449	19.73 (18.97)	86	14	0.361	≤23♣
Trans fatty acids (g)	0.74 (0.75)	37	63	0.987	1.99 (7.31)	99	-	0.991	<2
Cholesterol (mg)	261.10 (166.72)	87	13	0.597	228.17 (268.63)	76	24	0.161	<300
Mono-unsaturated fat (g)	21.43 (12.46)	82	18	0.524	19.79 (16.98)	76	24	0.059	26
Polyunsaturated fat (g)	23.58 (15.01)	131	-	0.034	20.40 (23.41)	113	-	0.586	<18
Carbohydrates (g)	185.94 (91.86)	186	-	0.046	164.37 (64.95)	164	-	0.001	100
Total sugar (g)	56.58 (51.85)	43	57	0.001	54.83 (50.25)	41	59	0.001	<132
Added sugar (g) WHO	17.25 (5.46)	72	28	0.325	19.63 (29.31)	82	18	0.429	24
Dietary fibre (g)	16.48 (8.43)	66	34	0.610	13.20 (6.72)	53	47	0.001	25
Calcium (mg)	483 (246.32)	60	40	0.001	472.86 (345.66)	59	41	0.001	800
Iron (mg)	11.72 (5.93)	145	-	0.104	9.42 (4.42)	116	-	0.120	8.1
Magnesium (mg)	171.41 (78.24)	65	35	0.831	138.76 (70.33)	52	48	0.001	265
Phosphorus (mg)	766.67 (301.11)	132	-	0.119	620.69 (335.46)	107	-	0.519	580
Potassium (mg)	1694.81 (626.10)	36	64	0.001	1417.90 (627.33)	30	70	0.001	4700*
Sodium (mg)	1300.98 (783.22)	87	13	0.563	1130.14 (952.68)	75	25	0.046	1500*
Chloride (mg)	459.33 (600.41)	20	80	0.001	446.55 (604.17)	19	81	0.001	2300*
Zinc (mg)	9.42 (4.85)	139	-	0.154	7.95 (4.85)	117	-	0.214	6.8
Selenium (µg)	51.69 (25.83)	115	-	0.282	46.34 (28.22)	103	-	0.800	45
Manganese (mcg)	1850.09 (976.26)	103	-	0.304	1450.41 (803.78)	81	19	0.027	1800*
Iodine (µg)	30.07 (20.85)	32	68	0.001	23.97 (25.05)	25	75	0.001	95
Thiamine (mg)	1.00 (0.39)	111	-	0.273	0.84 (0.41)	94	6	0.456	0.9
Riboflavin (mg)	1.21 (0.60)	134	-	0.128	1.01 (0.46)	112	-	0.202	0.9
Niacin (mg)	18.20 (7.14)	165	-	0.085	17.72 (10.70)	161	-	0.002	11
Biotin (mcg)	26.62 (8.76)	89	11	0.447	22.31 (10.01)	74	26	0.001	30*
Vitamin B_6 (mg)	1.47 (0.70)	134	-	0.126	1.22 (0.73)	111	-	0.367	1.1
Folate (µg)	72.22 (10.19)	23	77	0.001	66.76 (97.80)	21	79	0.001	320
Vitamin B_{12} (µg)	6.51 (10.67)	326	-	0.027	2.67 (2.65)	134	-	0.183	2.0
Vitamin C (mg)	73.14 (45.93)	122	-	0.151	75.24 (70.21)	125	-	0.252	60

Nutrient	BL				EL				
	Mean nutrient intake (SD)	**% of EAR/ AI***	**Prevalence of inadequacy (%)**	**p value**	**Mean nutrient intake (SD)**	**% of EAR/ AI***	**Prevalence of inadequacy (%)**	**p value**	**EAR/AI*/ [a-c] EER†/SAFBD♣ Female**
Vitamin A (µg)	962.89 (1148.77)	193	-	0.031	453.97 (303.11)	91	9	0.420	500
Vitamin D (µg)	7.15 (9.56)	71.5	28.5	0.201	4.41 (4.63)	44	56	0.001	10
Vitamin E (mg)	14.66 (7.16)	122	-	0.033	13.93 (12.55)	116	-	0.415	12
Vitamin K (µg)	100.66 (144.81)	112	-	0.562	59.28 (56.16)	66	34	0.006	90*

a Institute of Medicine 2005; b Institute of Medicine 2006; c Institute of Medicine 2011; EER- Estimated Energy Requirement, AI- Adequate Intake, EAR- Estimated Average Requirement, SAFBDG- South African Food-Based Dietary Guideline

At BL, for females in the CO group, the mean energy intake amounted to 6887.93 kJ, decreasing to 6224.17 kJ at EL, marking a small change in energy intake. The diet at BL and EL presented several dietary excesses for protein, total fat, carbohydrate, total sugar, iron, phosphorus, zinc, selenium, vitamins B6, B12 C, A, E and K. The diets at both time points demonstrated a notable inadequacy of fibre, calcium and folate. A significant decrease of various nutrients from BL to EL was observed for carbohydrates, total sugar, fibre, calcium, magnesium, potassium, iodine, folate and vitamin D, p<0.001, all of which showed a prevalence of inadequacy, except for carbohydrates which were in excess of the % adequacy. In this study, whilst an overall 77.6% of the participants results at BL were concentrated in the overweight, obese and extremely obese range, the energy intake of the CO and CB for both male and female showed a slight prevalence of indadequacy. A possible reason for this finding could be attributed to underreporting for the self-reported dietary intake.

Table 4.26: Mean 24-hour food recall nutrient intake for the CO group for males at BL and EL

	BL				EL				
Nutrient	**Mean nutrient intake (SD)**	**% of EAR/ AI***	**Prevalence of inadequacy (%)**	**p value**	**Mean nutrient intake (SD)**	**% of EAR/ AI***	**Prevalence of inadequacy (%)**	**p value**	**EAR/AI*/ [a-c] EER†/SAFBD♣ Male**
Energy (kJ)	7998.46 (2791.95)	75	25	0.001	7234.04 (4087.39)	68	32	0.001	10626†
Total protein (g)	77.913 (20.91)	139	-	0.001	68.90 (45.36)	123	-	0.177	56
[a]Total fat (g)	77.90 (36.01)	91	9	0.282	134.57 (328.39)	156	-	0.476	≤86♣
Saturated fat (g)	21.40 (10.08)	74	26	0.001	19.38 (14.40)	67	33	0.003	≤29♣
Trans fatty acids (g)	0.68 (0.57)	23	77	0.001	0.61 (0.60)	21	79	0.001	<2.9
Cholesterol (mg)	280.19 (212.59)	93	7	0.652	275.63 (262.56)	92	8	0.654	<300
Mono-unsaturated fat (g)	25.48 (11.09)	82	18	0.023	22.97 (25.30)	74	26	0.134	31
Polyunsaturated fat (g)	24.00 (17.10)	104	-	0.776	20.16 (23.22)	88	12	0.555	<23
Carbohydrates (g)	216.22 (90.07)	216	-	0.001	198.95 (70.06)	199	-	0.001	100
Total sugar (g) WHO	49.75 (26.11)	30	70	0.001	47.23 (40.78)	28	72	0.001	<166
Added sugar (g) ‡	15.43 (17.41)	43	57	0.001	8.62 (9.14)	24	76	0.001	36
Dietary fibre (g)	17.79 (8.52)	47	53	0.001	17.76 (8.10)	47	53	0.001	38
Calcium (mg)	558.75 (392.48)	70	30	0.006	554.71 (258.93)	69	31	0.001	800
Iron (mg)	14.22 (8.51)	237	-	0.001	11.27 (5.20)	188	-	0.001	6
Magnesium (mg)	196.17 (63.88)	56	44	0.001	188.04 (103.08)	54	46	0.001	350
Phosphorus (mg)	856.44 (239.70)	148	-	0.001	843.21 (499.27)	145	-	0.017	580
Potassium (mg)	1894.02 (666.07)	40	60	0.001	1706.08 (1028.42)	36	64	0.001	4700*
Sodium (mg)	1537.60 (716.18)	103	-	0.799	1377.92 (1222.99)	92	8	0.629	1500*
Chloride (mg)	504.21 (380.64)	22	78	0.001	1040.63 (1818.62)	45	55	0.003	2300*
Zinc (mg)	10.93 (5.29)	116	-	0.171	9.15 (3.75)	97	3	0.743	9.4
Selenium (µg)	65.75 (30.81)	146	-	0.003	62.82 (57.62)	140	-	0.143	45
Manganese (mcg)	1987.06 (998.54)	86	14	0.138	1988.17 (1188.10)	86	14	0.211	2300*
Iodine (µg)	33.29 (35.15)	35	65	0.001	32.92 (25.83)	35	65	0.001	95
Thiamine (mg)	1.23 (0.53)	123	-	0.041	1.05 (0.45)	105	-	0.578	1.0
Riboflavin (mg)	1.39 (0.72)	126	-	0.061	1.12 (0.47)	102	-	0.838	1.1
Niacin (mg)	22.67 (8.58)	189	-	0.001	18.60 (17.10)	155	-	0.071	12
Biotin (mcg)	26.50 (11.55)	88	12	0.151	27.59 (13.02)	92	8	0.374	30*
Vitamin B6 (mg)	1.86 (0.78)	169	-	0.001	1.52 (0.91)	138	-	0.034	1.1
Folate (µg)	79.96 (77.72)	25	75	0.001	77.67 (104.08)	24	76	0.001	320
Vitamin B12 (µg)	5.413 (10.42)	271	-	0.122	3.49 (3.39)	174	-	0.042	2.0
Vitamin C (mg)	94.21 (74.62)	126	-	0.220	64.96 (94.01)	87	13	0.606	75
Vitamin A (µg)	867.77 (1031.55)	139	-	0.261	551.54 (326.80)	88	12	0.282	625
Vitamin D (µg)	7.03 (5.76)	70	30	0.019	8.27 (11.29)	83	17	0.460	10

Nutrient	BL				EL				EAR/AI*/ [a-c] EER†/SAFBD♣ Male
	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	
Vitamin E (mg)	15.75 (12.60)	131	-	0.158	12.70 (9.37)	106	-	0.720	12
Vitamin K (µg)	90.20 (79.87)	75	25	0.081	121.46 (171.59)	101	-	0.967	120*

a Institute of Medicine 2005; b Institute of Medicine 2006; c Institute of Medicine 2011; EER- Estimated Energy Requirement, AI- Adequate Intake, EAR- Estimated Average Requirement, SAFBDG- South African Food-Based Dietary Guideline

At BL, for males in the CO group, the mean energy intake amounted to 7998.46 kJ, decreasing to 7234.04 kJ at EL, marking a decrease in energy intake. The diet at BL and EL presented several dietary excesses for protein, total fat, carbohydrate, iron, phosphorus, zinc, selenium, thiamine, riboflavin, niacin, vitamins B6, B12 C, A and E. Total fat intake for males from BL to EL, was almost double, indicating opportunity for targeted fat reduction strategies. The diets at both time points demonstrated inadequate intake of fibre, calcium, potassium, chloride, manganese, iodine, biotin, folate and vitamin D. A significant decrease of various nutrients from BL to EL was observed for total sugar, fibre, calcium, magnesium, potassium, iodine, and folate, $p<0.001$, all of which showed a prevalence of inadequacy, except for carbohydrate intakes were nearly double the EAR value.

Table 4.27: Mean 24-hour food recall nutrient intake for the CB group for females at BL and EL

	BL				EL				
Nutrient	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	EAR/AI*/ [a-c] EER†/SAFBD♣ Female
Energy (kJ)	6798.16 (2456.38)	80	20	0.001	6805.64 (3921.16)	80	20	0.034	8465†
Total protein (g)	68.86 (25.39)	150	-	0.001	67.00 (29.95)	146	-	0.001	46
[a]Total fat (g)	68.39(24.66)	99	1	0.898	72.71 (38.06)	105	-	0.610	≤69♣
Saturated fat (g)	18.92 (8.18)	82	18	0.014	22.06 (14.91)	96	4	0.742	≤23♣
Trans fatty acids (g)	0.58 (0.67)	29	71	0.001	0.73 (0.72)	36	64	0.001	<2
Cholesterol (mg)	264.89 (184.01)	88	12	0.322	278.18 (247.36)	93	7	0.644	<300
Mono-unsaturated fat (g)	21.27 (7.27)	82	18	0.002	22.04 (12.42)	85	15	0.103	26
Polyunsaturated fat (g)	23.17 (12.36)	129	-	0.036	20.64 (13.89)	115	-	0.324	<18
Carbohydrates (g)	175.93(98.24)	176	-	0.001	172.93 (151.38)	173	-	0.017	100
Total sugar (g)	54.38 (51.85)	41	59	0.001	55.27 (100.36)	42	58	0.001	<132
Added sugar (g) WHO	13.98 (14.64)	58	42	0.001	12.32 (28.01)	51	49	0.036	24
Dietary fibre (g)	17.33 (17.28)	69	31	0.027	16.77 (30.88)	67	33	0.170	25
Calcium (mg)	449.77 (356.95)	56	44	0.001	461.39 (360.01)	58	42	0.001	800
Iron (mg)	11.638 (5.65)	144	-	0.003	9.10 (8.14)	123	-	0.229	8.1
Magnesium (mg)	190.13 (150.73)	72	28	0.014	177.32 (165.27)	67	33	0.009	265
Phosphorus (mg)	789.05 (390.57)	136	-	0.009	774.68 (489.44)	134	-	0.045	580
Potassium (mg)	2254.70 (2696.66)	48	52	0.001	2152.29 (3292.19)	46	54	0.001	4700*
Sodium (mg)	1173.55 (620.17)	78	22	0.010	1266.39 (837.56)	84	12	0.152	1500*
Chloride (mg)	577.82 (530.21)	25	75	0.001	783.214 (760.41)	34	66	0.001	2300*
Zinc (mg)	8.934 (3.85)	131	-	0.007	8.12 (6.10)	119	-	0.263	6.8
Selenium (µg)	55.65 (25.82)	124	-	0.038	60.214 (33.36)	134	-	0.023	45
Manganese (mcg)	1849.02 (1262.43)	103	-	0.839	1781.11 (1972.81)	99	1	0.960	1800*
Iodine (µg)	36.21 (28.30)	38	62	0.001	42.32 (45.46)	45	55	0.001	95
Thiamine (mg)	1.02 (0.60)	114	-	0.289	0.95 (0.67)	105	-	0.704	0.9
Riboflavin (mg)	1.13 (0.45)	126	-	0.012	1.1793 (0.94)	131	-	0.127	0.9
Niacin (mg)	20.53 (11.41)	187	-	0.001	19.54 (12.32)	178	-	0.001	11

Nutrient	BL				EL				EAR/AI*/ [a-c] EER†/SAFBD♣ Female
	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	
Biotin (mcg)	46.72 (115.62)	156	-	0.451	41.07 (87.76)	137	-	0.510	30*
Vitamin B6 (mg)	1.62 (1.27)	147	-	0.039	1.67 (1.64)	152	-	0.079	1.1
Folate (µg)	83.39 (114.63)	26	74	0.001	33.39 (48.36)	10	90	0.001	320
Vitamin B12 (µg)	3.41 (3.15)	170	-	0.026	2.69 (1.60)	134	-	0.032	2.0
Vitamin C (mg)	109.36 (222.51)	182	-	0.251	97.89 (187.35)	163	-	0.294	60
Vitamin A (µg)	848.02 (893.89)	170	-	0.049	725.71 (636.83)	145	-	0.306	500
Vitamin D (µg)	4.88 (3.10)	49	51	0.001	5.13 (5.09)	51	49	0.001	10
Vitamin E (mg)	16.84 (13.12)	140	-	0.061	13.28 (10.34)	111	-	0.518	12
Vitamin K (µg)	88.14 (94.51)	98	2	0.918	139.68 (433.02)	155	-	0.549	90*

a Institute of Medicine 2005; b Institute of Medicine 2006; c Institute of Medicine 2011; EER- Estimated Energy Requirement, AI- Adequate Intake, EAR- Estimated Average Requirement, SAFBDG- South African Food-Based Dietary Guideline

At BL, for females in the CB intervention group, the mean energy intake amounted to 6798.16kJ, increasing to 6805.48kJ at EL, this indicates that the energy intake at both time points, were similar. The diet for both BL and EL presented several dietary excesses using EAR cut-offs for protein, polyunsaturated fat, carbohydrate, iron, phosphorus, zinc, selenium, thiamine, riboflavin, niacin, vitamins B6, B12, C, A, E and biotin (AI cut-off). The diets at both time points demonstrated a notable inadequacy in dietary fibre, calcium, magnesium, potassium, chloride, iodine, folate and vitamin D. A significant decrease of various nutrients from BL to EL was observed for protein, potassium and niacin, $p<0.001$, of which were in excess of the % adequacy.

Table 4.28: Mean 24-hour food recall nutrient intake for CB group for males at BL and EL

	BL				EL				
Nutrient	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	P value	Mean nutrient intake (SD)	% of EAR/ AI*	Prevalence of inadequacy (%)	p value	EAR/AI*/[a-c] EER†/SAFBDG♣ Male
Energy (kJ)	8288.93 (2484.48)	78	22	0.001	6903.46 (2746.16)	65	35	0.001	10626†
Total protein (g)	85.13 (2484.48)	152	-	0.001	65.86 (29.01)	118	-	0.08	56
[a]Total fat (g)	79.43 (25.01)	92	8	0.24	66.44 (43.04)	77	23	0.02	≤86♣
Saturated fat (g)	22.17 (29.17)	76	24	0.001	20.17 (12.32)	70	30	0.01	≤29♣
Trans fatty acids (g)	0.88 (8.80)	30	70	0.001	0.90 (0.88)	31	69	0.001	<2.9
Cholesterol (mg)	336.38 (0.64)	112	-	0.34	171.96 (139.43)	57	43	0.001	<300
Mono-unsaturated fat (g)	27.09 (197.08)	87	13	0.09	20.90 (13.25)	67	33	0.001	31
Polyunsaturated fat (g)	23.84 (18.81)	104	-	0.71	20.21 (19.68)	88	12	0.50	<23
Carbohydrates (g)	227.00 (11.75)	227	-	0.001	192.29 (78.29)	192	-	0.001	100
Total sugar (g) ‡	51.46 (76.26)	31	69	0.001	49.11 (32.08)	30	70	0.001	<166
Added sugar (g) WHO	15.96 (12.40)	44	56	0.001	13.93 (15.84)	39	61	0.001	36
Dietary fibre (g)	20.26 (8.52)	53	47	0.001	17.24 (11.05)	45	54	0.001	38
Calcium (mg)	549.41 (236.70)	69	31	0.001	417.68 (207.43)	52	48	0.001	800
Iron (mg)	14.08 (4.90)	234	-	0.001	11.16 (4.79)	186	-	0.001	6
Magnesium (mg)	227.34 (107.54)	65	35	0.001	185.96 (98.92)	53	47	0.001	350
Phosphorus (mg)	937.36 (311.40)	162	-	0.001	682.04 (292.80)	118	-	0.08	580
Potassium (mg)	1988.55 (709.80)	42	58	0.001	1568.36 (690.50)	33	67	0.001	4700*
Sodium (mg)	1499.48 (696.45)	100	-	0.10	1124.39 (665.43)	75	25	0.01	1500*
Chloride (mg)	616.70 (515.32)	27	73	0.001	457.36 (342.28)	20	80	0.001	2300*
Zinc (mg)	11.72 (4.24)	125	-	0.01	9.44 (5.03)	100	-	0.97	9.4
Selenium (µg)	80.94 (52.66)	180	-	0.001	52.33 (32.61)	116	-	0.25	45
Manganese (mcg)	2519.34 (1412.01)	110	-	0.42	2341.75 (1710.58)	102	-	0.90	2300*
Iodine (µg)	34.64 (22.00)	36	64	0.001	22.54 (17.72)	24	76	0.001	95
Thiamine (mg)	1.25 (0.42)	125	-	0.01	1.04 (0. 45)	104	-	0.62	1.0
Riboflavin (mg)	1.42 (0.53)	129	-	0.001	0.98 (0.41)	89	14	0.13	1.1
Niacin (mg)	25.20 (10.51)	210	-	0.001	19.65 (9.06)	164	-	0.001	12

	BL				EL				
Nutrient	**Mean nutrient intake (SD)**	**% of EAR/ AI***	**Prevalence of inadequacy (%)**	**P value**	**Mean nutrient intake (SD)**	**% of EAR/ AI***	**Prevalence of inadequacy (%)**	**p value**	**EAR/AI*/[a-c] EER†/SAFBDG♣ Male**
Biotin (mcg)	28.22 (10.93)	94	6	0.40	21.88 (10.50)	73	27	0.001	30*
Vitamin B6 (mg)	1.87 (0.84)	170	-	0.001	1.60 (0.97)	145	-	0.01	1.1
Folate (µg)	105.04 (98.90)	33	67	0.001	57. 04 (69.48)	18	82	0.001	320
Vitamin B12 (µg)	4.63 (3.33)	230	-	0.001	2.53 (1.67)	126	-	0.11	2.0
Vitamin C (mg)	83.18 (89.31)	111	-	0.63	55.32 (56.46)	74	26	0.08	75
Vitamin A (µg)	851.11 (588.57)	136	-	0.52	606.54 (486.82)	97	3	0.84	625
Vitamin D (µg)	6.89 (4.54)	69	31	0.001	3.54 (3.44)	35	65	0.001	10
Vitamin E (mg)	15.73 (8.33)	131	-	0.03	12.41 (11.76)	103	-	0.85	12
Vitamin K (µg)	157.23 (236.36)	131	-	0.41	133.53 (290.81)	111	-	0.81	120*

a Institute of Medicine 2005; b Institute of Medicine 2006; c Institute of Medicine 2011; EER- Estimated Energy Requirement, AI- Adequate Intake, HbA1c and EAR- Estimated Average Requirement, SAFBDG- South African Food-Based Dietary Guideline

At BL, for males in the CB intervention group, the mean energy intake amounted to 8426.53 kJ, decreasing to 6509.81 kJ at EL, marking a significant 23% prevalence of inadequacy at EL, p<0.001. The diet at both BL and EL presented several dietary excesses for EAR cut-offs for protein, total fat, polyunsaturated fat, carbohydrate, iron, phosphorus, zinc, selenium, manganese, riboflavin, niacin, vitamins B6, B12, C, A, E and biotin and vitamin K (AI cut-offs). The diets at both time points demonstrated a notable inadequacy of fibre, calcium, magnesium, potassium, folate and Vitamin D. A significant decrease of nutrients from BL to EL was observed for total protein, carbohydrates, dietary fibre, calcium, magnesium, potassium, chloride, iodine, niacin, folate and vitamin , p<0.001.

4.8.1 Diet quality questionnaire (DQQ)

The EL food recall was computed into the online DQQ as described in section 3.4.3.2 of chapter 3. The findings are presented in Table 4.29.

Table 4.29: DQQ indicators

	Mean (SD)	Median (CI)
GDR	9.30 (2.263)	9.00 (8.00; 11.00)
NCD-Protect	2.28 (1.299)	2.00 (1.00; 3.00)
NCD-Risk	2.01 (1.658)	2.00 (1.00; 3.00)
FGDS	4.47 (1.191)	4.00 (4.00; 5.00)

GDR - Global dietary requirement; NCD protect - Non-communicable disease protect; NCD risk- Non-communicable disease risk and FGDS -Food group diversity score

Results of the DQQ indicate that from a potential 0 to 18, the mean GDR score for this research cohort was 9.30. While the GDR score does not have a recommended upper and lower level, higher scores that are closest to 18 are indicative of a diet that meets global dietary requirements; thus, with a score of 9.30, there is much scope to improve the dietary requirements of this population. From a potential 0 to 9, the mean NCD protect score was 2.28, given that higher scores, e.g., a score of nine, correlate with the consumption of foods from nine health-promoting groups that offer protection against NCDs; similarly, lower scores closer to 0 are be associated with lower protection against NCDs. These individuals can be encouraged to increase consumption of 'missing' foods that can have a beneficial health impact. The NCD risk score, on a range from 0 to 9, also does not have a recommended upper and lower level, however, a lower score, i.e., a score close to 0, is associated with meeting the recommended WHO guide for avoiding unhealthy food and beverage products. Individuals who consume foods from at least five of ten food groups, as per the DQQ, are considered more likely to have a diet that meets an adequate micronutrient intake; however, with a mean FGDS of 4.47, it alludes to a dietary intake that is more likely to be lacking in nutrient intake.

Table 4.30: DQQ indicators by race

Results of DQQ by race		Mean (SD)			
Race	**n (%)**	**GDR**	**NCD-Protect**	**NCD-Risk**	**FGDS**
Black	56 (51.4)	8.89 (2.432)	2.25 (1.195)	2.36 (1.901)	4.29 (1.187)
Coloured	8 (7.34)	9.13 (1.126)	2.38 (0.916)	2.25 (1.035)	4.50 (1.414)
Indian	37 (33.9)	9.84 (1,125)	2.24 (1.480)	1.49 (1.346)	4.59 (1.117)
White	8 (7.3)	9.88 (2.031)	2.63 (1.598)	1.75 (1.035)	5.13 (1.246)

GDR - Global dietary requirement; NCD protect - Non-communicable disease protect; NCD risk- Non-communicable disease risk and FGDS -Food group diversity score

Table 4.30 Indicates that the Black population in this study, had the lowest GDR score with a mean value of 8.89 however, the remaining race groups' scores were closely distributed with mean values in descending order of 9.88 (White), 9.84 (Indian) and 9.13 (Coloured). These findings further indicate that all race groups in this research study, had below optimum GDR scores, with none of the race groups reaching a score of 10, thus alluding to an overall suboptimal measurement towards the recommended global dietary intake. Post analysis, subtle and, at other times, more pronounced dietary differences within the participants' diet intake became evident. The highest GDR score in this research study was for the White population, followed by the Indian, Coloured, and Black populations. Given that these results were for a working-class segment of the population, these findings could be magnified when considered against the general population, including those who are unemployed, alluding to potential for greater vulnerability of different race sub-sets within the population. The overall interracial NCD protect score in this research cohort, was similar i.e. low and less than optimal across the race groups, with the highest score calculated for White (2.63) followed by Coloured (2.38), Black (2.25) and then the Indian (2.24) race groups. The NCD risk score was lowest for Indian (1.49), followed by White (1.75), Coloured (2.25) and then Black (2.36) race groups. With a mean value of 5.13, the White sub-group in this research study, was the only group that met and exceeded the minimum recommended FGDS score. The remaining race groups had a mean value of 4.59 (Indian), followed by 4.50 (Coloured) and then 4.29 (Black). When the DQQ data findings across the GDR, NCD protect, NCD risk and FGDS are triangulated, the Black population is the most vulnerable while the White population result, while embedding potential for improvement, was the most optimal.

The relationship of education and income with the DQQ indicators was explored. The results are presented in Tables 4.31-4.33.

Table 4.31: DQQ indicators based on education level

Education level	n (%)	Mean (SD)			
		GDR	NCD-Protect	NCD-Risk	FGDS
Grade 8	18 (16.5)	9.33 (1.6)	2.11 (1.08)	1.78 (1.00)	4.11 (1.23)
Grade 12	1 (0.9)	9.00	1.00	1.00	5.00
FET/College	11 (10.1)	8.36 (2.73)	2.27 (1.10)	2.91 (2.21)	4.36 (0.92)
Other/post school	79 (72.5)	9.43 (2.35)	2.34 (1.38)	1.95 (1.68)	4.56 (1.22)

FET-Further Education and Training, GDR - Global dietary requirement; NCD protect - Non-communicable disease protect; NCD risk- Non- communicable disease risk and FGDS -Food group diversity score

Overall results for the four indicators of the DQQ exhibited a mixed pattern, indicating that education level did not have a direct influence on dietary intake patterns for this research population. This alludes to the fact that regardless of education level, individuals do not always make healthier choices.

Table 4.32: DQQ indicators based on income

Income	n (%)	Mean (SD)			
		GDR	NCD Protect	NCD Risk	FGDS
Up to R10 000	15 (13.8)	9.27 (2.54)	2 (1.63)	1.87 (1.41)	4.2 (1.33)
R11 000 – R20 000	38 (34.9)	8.92 (2.30)	2.05 (1.21)	2.21 (1.75)	4.1 (1.26)
R21 000 - R30 000	17 (15.6)	9.76 (1.77)	2.24 (0.93)	1.65 (1.71)	4.76 (1.01)
R31 000 – R40 000	15 (13.8)	9 (1.87)	2.27 (1.22)	2.73 (1.69)	4.6 (1.14)
R41 000 – R50 000	11 (10.1)	10.18 (2.72)	2.73 (1.71)	1.46 (1.56)	4.55 (1.44)
R51 000 – R60 000	1 (0.9)	10 (0)	2 (0)	3 (0)	5 (0)
R61 000 – R70 000	3 (2.8)	10 (0)	3 (0.82)	2 (0.82)	5.33 (0.47)
Above R71 000	2 (1.8)	11.5 (2.5)	4 (1)	1.5 (1.5)	6 (1)
Prefer not to say	7 (6.4)	9.29 (1.58)	1.86 (0.83)	1.57 (1.18)	4.71 (0.7)

GDR - Global dietary requirement; NCD protect - Non-communicable disease protect; NCD risk- Non-communicable disease risk and FGDS -Food group diversity score

Results in Table 4.32 indicate that those who earned in the range between R41 000 to above R71 000, had a healthier dietary intake than those who earned up to R10 000 and R40 000.

Table 4.33 Correlation between DQQ dietary indicators and income

	GDR	NCD protect	NCD risk	FGDS
Mean (SD)	9.30 (2.263)	2.28 (1.299)	2.01 (1.658)	4.47 (1.191)
Median	9.00	2.00	2.00	4.00
CI	(4.868; 13.738)	(-0.261; 4.830)	(-1.241; 5.259)	(2.134; 6.802)
Spearman's test – income	0.93	.233*	-.008	.216*
Significance	.355	.018	.939	.029

GDR - Global dietary requirement; NCD protect - Non-communicable disease protect; NCD risk- Non-communicable disease risk and FGDS -Food group diversity score

There was a weak positive correlation between income and NCD protect and FGDS. Implying that employees who have more disposable income may be more likely to afford healthy foods.

4.9 Framingham Risk Score

The Framingham Risk Score was utilised to predict participant risk for the development of CHD in a 10-year period, as detailed in section 3.5.3.3 of this thesis, are presented in Table 4.34.

Table 4.34: Framingham cardiovascular risk score

Criteria		Framingham risk category		
		Low [a]	**Moderate** [b]	**High** [c]
Gender	Male (n= 69)	41 (34.7)	27 (39.1)	1.4 (1)
	Female (n= 78)	77 (65.3)	1.3 (1)	.0 (0)
	Total (n= 147)	118 (80.3)	19.0 (28)	.7 (1)
Intervention group	CB group (n= 72)	57 (79.2)	15 (20.8)	0
	CO group (n= 75)	61 (81.3)	13 (17.3)	1.3 (1)
Race	Black (n= 76)	62 (81.6)	13 (17.1)	1 (1.3)
	Coloured (n= 9)	9 (100)	0 (0)	0 (0)
	Indian (n= 49)	35 (71.4)	14 (28.6)	0 (0)
	White (n= 13)	12 (92.3)	1 (7.7)	0 (0)
	Total (n= 147)	118 (80.3)	28 (19.0)	1 (0.7)

a. Low: risk of cardiovascular events < 3% in 10 years
b. Moderate: Risk of cardiovascular events ≥3% and < 15% in 10 years
c. High: Risk of cardiovascular events ≥ 15 and < 30% in 10 years (Klug *et al.* 2018: 979; Reiger *et al.* 2017: 6)

The application of the Framingham Cardiovascular Risk calculation, as recommended by Klug *et al.* (2018: 978), revealed that a notable 80.3% (n= 118) of the participants at EL, were at low risk for CVD events in ten years while 19.0% (n= 28) and 0.7% (n= 1) were at moderate and high risk, respectively. Of the 118 low-risk individuals, 34.7% (n= 41) were males, while 65.3% (n = 77) were females. The Fisher's exact test = 37.844, p<.001, indicated that there was a significant relationship between the Framingham Risk% and gender. The spread of the risk profile for the CB group was: low risk 79.2% (n= 57), moderate risk 20.8% (n= 15) and nil for high risk; while the spread of the risk profile for the CO group was low risk 81.3% (n= 61), moderate risk 17.3% (n= 13) and high risk 1.3% (n= 1). The interracial breakdown indicated a higher prevalence of low risk for a CVD event in a 10-year period, along with a lower prevalence of moderate and high-risk for cardiovascular events in ten years, across race groups. However, the Indian sub-group presented with a high risk in relation to their participation number in this study.

4.10 Measurement research objectives

The measurement of the intervention effect is presented in the tables that follow Table 4.35 to 4.37.

Table 4.35: Effectiveness of CO and CB intervention on improvement of cardiometabolic risk factors

Variable	Measurement	CO	CB	Total
HbA1c	Decrease ≥0.5%	6	6	12
SBP	Decrease ≥ 5mmHg	36	31	67
Triglycerides	Decrease ≥.1mmol/L	36	32	68

Variable	Measurement	CO	CB	Total
Composite scores	0 1 2 3	22 29 23 1	21 38 13 0	43 67 36 1

Table 4.35 indicates that both the CO and CB groups achieved targeted decreases in cardiometabolic risk factors, in particular for SBP and TG. Majority of the participants, 67 met 1 cardiometabolic risk reduction, while 36 met 2 and 1 met 3. It is noted that 43 particpants, 21 from the CB and 22 from the CO groups respectively, met zero cardiometabolic risk reductions.

Table 4.36: Paired difference for cardiometabolic risk from BL to EL for CB group stratified by gender

Variable	Males paired difference BL to EL Mean (SD)	df	P-value	Females paired difference BL to EL Mean (SD)	df	P- value
HbA1c (%)	-0.65 (0.60)	37	*.001	-0.74 (0.49)	33	*.001
TG (mmol/L)	0.05 (1.29)	37	.831	-0.07 (0.87)	33	.647
LDL-C (mmol/L)	0.11 (0.58)	37	.240	-0.01 (0.60)	33	.901
HDL-C (mmol/L)	-0.07 (0.18)	37	*.029	0.04 (0.29)	33	.473
TC-(mmol/L)	0.33 (0.49)	37	*.001	0.39 (0.69)	33	*.003
BMI-(kgm^2)	-0.16 (0.96)	37	.317	0.12 (1.62)	33	.660
Weight-(kg)	-0.30 (2.81)	37	.515	-0.10 (4.03)	33	.888
WC- (cm)	-0.11 (3.89)	37	.868	-0.59 (5.18)	33	.514
SBP (mmHg)	3.50 (12.33)	37	.088	4.44 (15.33)	33	.100
DBP (mmHg)	4.16 (8.65)	37	*.005	4.82 (13.49)	33	*.045

*****Indicates significant at the 95% level, TG-triglycerides, LDL-C- low-density lipoproteins, HDL-C- high-density lipoproteins, TC- total cholesterol, BMI- body mass index, WC- waist circumference, SBP- systolic blood pressure, DBP- diastolic blood pressure

Table 4.36 indicates that the pre-post-test CB group results for males and females were mixed, with some variables increasing and others decreasing for males and females, respectively. The following mean values increased in the CB male group from BL to EL: HbA1c (significant change, p<0.001), HDL-C (negative effect), weight (-0.30) and WC (-0.11), while the mean values for the following variables decreased TG, LDL-C, TC, SBP (3.50) and DBP (4.16). Some of the decreases were modest like in the case of TG with a 0.05 mean difference, other mean changes, including LDL-C (0.11), SBP (3.50) and DBP (4.16), were larger. Significant decreases were noted for TC (0.33) and DBP (4.16) for males, p<0.001. Results from the CB female cohort indicate that increases and decreases were different from those observed with the male cohort findings. The female group mean increases were for HbA1c, TG, LDL-C, weight (-0.10), WC (-0.59), and HDL-C (positive effect). There was no significant change in BMI, weight, WC and SBP. Significant differences were noted for TC (0.39) and DBS (4.82), p<0.001.

Table 4.37 Paired difference for cardiometabolic risk variables from BL to EL for the CO group by gender

Variable	Males paired difference BL to EL Mean (SD)	df	P-value	Females paired difference BL to EL Mean (SD)	df	P- value
HbA1c (%)	-0.87 (0.45)	30	*.001	-0.7 (0.60)	43	*.001
TG (mmol/L)	0.06 (1.92)	30	.870	0.09 (1.16)	43	.600
LDL-C (mmol/L)	0.12 (0.57)	30	.241	0.13 (0.56)	43	.141
HDL-C (mmol/L)	-0.03 (0.21)	30	.457	-0.03 (0.30)	43	.564
TC (mmol/L)	0.46 (0.55)	30	*.001	0.37 (0.73)	43	*.002
BMI (kg/m^2)	-0.04 (0.80)	30	.790	0.39 (1.59)	43	.113
Weight (kg)	-0.11 (2.21)	30	.781	0.71 (3.80)	43	.218
WC (cm)	0.66 (3.66)	30	.325	0.04 (4.65)	43	.954
SBP (mmHg)	2.39 (10.04)	30	.196	8.59 (12.45)	43	*.001
DBP (mmHg)	1.32 (8.55)	30	.396	6.50 (11.51)	43	*.001

*indicates significant at the 95% level, TG- triglycerides, LDL-C- low-density lipoproteins, HDL-C- high-density lipoproteins, TC- total cholesterol, BMI- body mass index, WC- waist circumference, SBP- systolic blood pressure, DBP- diastolic blood pressure

Table 4.37 indicates that the pre-post-test CO group results for males and females were also mixed, with some variables in the pretest having a lower mean than the post-test, increasing and others decreasing for males and females, respectively. For males, the following variables reflected a reduction in the mean value for the CO group from BL to EL: TG, LDL-C (0.12), WC (0.66), SBP (2.39) and DBP, however, a significant difference was noted for TC (0.46) p<0.001. For females, the following mean values decreased: TG, LDL-C (0.13), BMI (0.39), weight (0.71), and WC (0.04), however, a significant difference was noted for TC (0.37), SBP (8.59) and DBP (6.50). The following variables' mean values increased for females: HbA1c and HDL-C (negative change), and the following mean values increased for males: HbA1c (significant change, p<0.001), HDL-C (negative change), BMI and weight (0.11).

Table 4.38: Mean anthropometric and clinical values for the CO and CB groups from BL and EL

Variable	CO		Paired differences	CB		Paired differences
	BL Mean (SD)	EL Mean (SD)	Mean (SD)	BL Mean (SD)	EL Mean (SD)	Mean (SD)
HbA1c (%)	5.453 (0.479)	5.532 (0.367)	-0.078 (0.433)	5.453 (0.440)	5.507 (0.330)	-0.054 (0.348)
TG (mmol/L)	2.271 (1.819)	2.193 (1.548)	0.078 (1.509)	1.752 (1.204)	1.760 (1.212)	-0.008 (1.102)

Variable	CO		Paired differences Mean (SD)	CB		Paired differences Mean (SD)
	BL Mean (SD)	EL Mean (SD)		BL Mean (SD)	EL Mean (SD)	
LDL-C (mmol/L)	3.281 (1.005)	3.156 (0.867)	0.124 (0.557)	3.036 (0.996)	2.982 (0.815)	0.053 (0.592)
HDL-C (mmol/L)	1.293 (0.367)	1.321 (0.284)	-0.027 (0.266)	1.321 (0.388)	1.338 (0.316)	-0.017 (0.242)
TC (mmol/L)	5.282 (1.086)	4.876 (1.009)	0.406 (0.659)	5.004 (0.968)	4.647 (0.9531)	0.357 (0.588)
BMI (kg/m²)	30.145 (7.692)	29.933 (7.575)	0.212 (1.333)	29.531 (6.126)	29.556 (6.060)	-0.025 (1.313)
Weight (kg)	82.679 (21.338)	82.305 (21.409)	0.373 (3.242)	83.777 (17.508)	83.982 (16.860)	-0.205 (3.40)
WC (cm)	94.807 (16.502)	94.511 (16.596)	0.296 (4.256)	95.061 (14.179)	95.393 (14.464)	-0.332 (4.517)
SBP (mmHg)	129.28 (14.255)	123.25 (14.337)	6.027 (11.850)	129.89 (13.180)	125.940 (12.737)	3.9440 (13.733)
DBP (mmHg)	83.71 (10.664)	79.35 (11.938)	4.360 (10.640)	85.40 (10.019)	80.93 (10.447)	4.472 (11.122)

TG- triglycerides, LDL-C – low density lipoproteins, HDL-C – high density lipoproteins, TC- total cholesterol, BMI-body mass index, WC – waist circumference, SBP – systolic blood pressure, DBP – diastolic blood pressure

Table 4.38 indicates that HbA1c, TG, LDL-C and HDL-C, BMI, weight, and WC, remained similar from BL to EL for the CO and CB groups respectively. Decreases were noted for TC, SBP and DBP from BL to EL for both CO and CB groups.

Table 4.39: Measurement of secondary outcomes BL to EL by count

Variable	BL		EL	
	CO	CB	CO	CB
Diabetes				
Type-2 diabetes	0	0	2	1
Prediabetes	22	23	23	26
Normoglycemia	53	49	50	45
BMI (kg/m^{2})				
<18.5	1	0	1	0
18.5-24.9	19	18	17	18
25-29.9	25	27	28	26
30-34.9	13	12	11	14
>35	17	15	17	14
Dyslipidaemia				
Yes	53	52	57	43
No	22	20	18	29

Variable	BL		EL	
	CO	CB	CO	CB
HPT (mmHg)				
Normal SBP<120 DBP<80	5	4	28	15
Optimal	13	7	4	18
High normal	32	32	28	21
Grade 1	20	21	12	15
Grade 2	5	8	1	3
Grade 3	0	0	2	0
WC (cm)				
<94/80	24	28	26	29
94-<102/80-<88	13	14	10	10
102+/88+	38	30	39	33
LDL-C (mmol/L)				
≤3	34	38	36	45
>3	41	34	39	27
HDL-C (mmol/L)				
Male > 1 mmol/L	58	57	61	61
Female > 1.2 mmol/L	17	15	14	11
TC (mmol/L)				
TC≤5	33	37	47	47
TC>5	42	35	28	25
TG (mmol/L)				
TG≤1.7	42	45	37	48
TG >1.7	33	27	38	24

TG-triglycerides, LDL-C- low-density lipoproteins, HDL-C- high-density lipoproteins, TC- total cholesterol, BMI- body mass index, WC- waist circumference, SBP- systolic blood pressure, DBP- diastolic blood pressure

Table 4.39 indicates that the number of participants with prediabetes and normoglycemia remained constant from BL to EL however, three participants, two from the CO and one from the CB, became diabetic. There is scope for 49 more participants, i.e. 23 from the CO and 26 from the CB, to move from prediabetes to normoglycemia. The number of participants with the reference ranges for BMI remained constant from BL to EL for both CO and CB groups. At EL, 56 participants from the CO and 54 from the CB groups has a less than optimal BMI. At EL, 32 particpants from the CO and 33 from the CB had a BP that was within the normal to optimal range. A large number of the participants, i.e. 49 from the CO and 43 from the CB group had an increased risk of metabolic complications based on their WC measurements. There is scope for 38 participants from the CO and 24 from the CB groups respectivey, to improve their TG.

4.5 Conclusion

In this chapter, all the results from the two-step screening, BL and EL processes were presented. Based on the study findings, vast body of literature in the research area, and experiences during the data collection process; discussions, challenges and outcomes will be provided in the next chapter.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This study aimed to evaluate the effectiveness of two worksite interventions—a canteen-only (CO) intervention and a combined canteen and behavioural (CB) intervention—in reducing cardiometabolic risk in South Africa (SA). By examining these interventions in real-world worksite settings, this study provides valuable insights into their practical effectiveness. The importance of awareness, screening, timely diagnosis, and intervention in controlling and reducing NCDs, such as diabetes, dyslipidaemia, and hypertension, is well documented and advocated in the literature (Zand, Ibrahim and Patham 2018: 295, Ekoru *et al.* 2019: 40, ElSayed *et al.* 2023: S24). However, implementing these interventions effectively and sustainably in real-world settings poses numerous challenges. These challenges can affect participation, delivery, and logistics, highlighting the need for more implementation data, especially from low- and middle-income countries (LMICs) (Checkley *et al.*, 2014). Understanding the optimal interventions and their ease of implementation is crucial for achieving impactful outcomes. Additionally, gaining insights into the challenges and barriers encountered during implementation, and how they were navigated, can provide valuable information for future studies.

In this pioneering worksite lifestyle intervention study in SA (Figure 1.1), phase one involved the recruitment of worksite/s, while phase two focused on formative work to engage worksite stakeholders and tailor interventions to the specific context. The third phase, represented by this study, involved the implementation of contextualised interventions through an RCT. Two multinational companies, one with multiple sites in SA, agreed to participate in this study. Key role-players and employees were sensitised to the study during several site meetings. A two-step screening process was used to recruit legible participants for the study. Employees from the eight worksites were eligible to participate in this study if they presented with prehypertension and/or prediabetes and met the inclusion requirements for the two-step screening process. Phase four, which was not part of the research objectives of this study, included the follow-up of the study to establish participant perception and feedback on the intervention implementation.

5.2 Step one screening and contextual overview

In the step one screening process, an eight-item questionnaire was used to determine participant inclusion in the study. The questionnaire collected data on the type of employment, gender, pregnancy, race group, diabetes and hypertension status, medication used to treat diabetes and/or hypertension, and food purchasing patterns at the worksite canteen. Of approximately 3000 employees, 797, i.e. 439 females and 358 males, agreed to participate in step-one screening. Full results are presented in Table 4.1, which highlights that more females than males agreed to participate in step-one screening. This finding aligns with other wellness intervention types of research that reflect similar participation patterns. A detailed breakdown of participation by worksite and gender, Table 4.2, indicated that production worksites like Unilever: MW, I, BB, LV, K, and P, had higher male participation than office-based worksites like Unilever LL and Retailability. This pattern could reflect the higher employment ratio of males to females at production versus office-based worksites however, similar to other study findings (Sloan and Gruman 1988: 275; Robroek 2009: 4; Dale *et al.* 2016: 279), it could also indicate that males in an office-based setting, may benefit from and require encouragement to engage in personal health and wellness programmes when these are introduced at worksites. On the other hand, female employees in an office-based setting actively participated in the screening opportunity, implying that worksites with a similar characteristic could expect high participation from their female employees and should consider this behaviour when introducing such interventions at worksites. While pregnancy was an exclusion criterion, it is noteworthy that pregnancy did not deter female employees' interest in health screenings. A small number of female employees who were pregnant or unsure of their pregnancy status, also requested to participate in the screening initiative.

5.2.1 Corporate culture in screening and challenges in recruitment

Research has indicated that, at times, screening for NCDs is absent due to several different reasons, including apathy, (fear of diagnosis), the lack of access to healthcare and funding to enable screening (WHO 2022b: 26). In this worksite study, the latter may partly explain the lack of screening at the Retailability site as it did not offer an in-house screening option. On the other hand, all seven of the participating Unilever sites offered the option of screening services through their onsite clinics, yet a large number of their employees had yet to take advantage of this option. This could be due to several reasons. When the research study was launched at the worksites, it was still reasonably early in the first quarter of 2022. Staff could have planned to complete their testing by the mid- or three-quarter-year cycle. It must be noted, though, that March 2022 marked almost two years of work-from-home following the COVID-19 pandemic that swept across the globe, and for most employees, it also marked a distinct change to return to the worksite. During the lockdown, individuals were urged to get vaccinated against progressive variants of the COVID-19 virus; this could have influenced their willingness to progress straight into screening once they returned to the work environment in early March 2022.

Many organisations also adapted their work model; for example, Unilever LL introduced different working models: work from home or a hybrid system with three days' of work from home and two days on-site. This model was also applied to other employees across Unilever sites whose work lent itself to working remotely. This flexible work dynamic negatively influenced participation in both the screening steps and in RCT at BL and EL, as sometimes the individual's remote and onsite roster did not enable the follow-ups needed for the research. Access to the Retailability employees, was better as all employees were required to return to the physical worksite following the relaxing of the lockdown in March 2022. However, this mass return to the worksite was led by a demanding retail pace, meaning that individuals were often too busy with their tasks to sacrifice time for personal health and wellness.

While reviewing the contextual influences, the literature advises one to be mindful that some individuals are apathetic towards personal health National Department of Health (NDoH *et al.* 2019: 21; Gottfredson 2021: 4) and may thus intentionally opt out of screening participation to know their health numbers and avoid interventions to engage in activities to change their health status. One certainty is that individuals must make some degree of effort and commitment to invest in their health, and this can be especially challenging as these changes, which require daily inputs, are a long-term and continuous commitment; thus, any measures that can help individuals avoid non-adherence, should be adopted. In this study, some of these measures included: messaging employees a week in advance to schedule classes, sending reminders the day prior to the class and on the morning of the class, offering three session times/multiple classes to accommodate shift workers/and peak periods, having a buddy system (which while weak, was present at some sites like Unilever LL and MW), to enable participants to support each other for the sessions. Lifestyle intervention programmes at workplaces that have included peer support have shown increased and sustained uptake (Linnan, Fisher and Hood 2013: 1). While the peer support element was present to some degree in the CB intervention, there is scope to increase its reach and effectiveness in a non-COVID worksite intervention context and with more robust support from supervisors and management.

All race groups participated in the step one screening process (Table 4.3), implying that if screening was available to employees at worksites with a similar representation of the population, a diverse group of employees may be interested in participating in the screening process for NCDs. Non-communicable disease screening, when available, may thus not be considered as something that only a selected segment of the population participates in. Thus, worksites would need to factor this into their planning and logistics when offering such opportunities to employees. It is important to note that prior to any clinical testing, 96.9 % of the sampled population stated they did not have diabetes, and 93.2 % claimed not to have hypertension. The largest number of participants who consented to the step one screening were permanent employees (n= 641), followed by long-term (n= 100) and then short-term contract employees (n= 56) (Table 4.1). This indicates an interest in screening for NCDs from more than only full-time employees. If screening were available at worksites, it would be taken up by all employees, regardless of their type of employment contract. Worksites would need to factor this into their planning if screening was included in worksite wellness interventions so that peak period production demand or day-to-day operations may be accounted for, including the scheduling for shift employees, while also ensuring that key sections and departments are facilitated to make optimal use of the screening provided.

Feedback from the step one screening questionnaire indicated that five hundred and seventy-six participants purchased food at the worksite canteen a minimum of 1-2 times per week, with one hundred and thirty-nine participants indicating that they purchased meals at the canteen five times per week (Table 4.1). As discussed in Chapter 2, with obesity on the rise and reflected in the prevalence of high BMIs and WC for both males and females in this study (Table 4.20), this high volume of meal purchases at the canteen presents a key and strategic opportunity for the worksite canteen to be used as an entry point for the introduction of guidelines to regulate the provisioning of food and beverages at a worksite. It may also be paired with workplace wellness initiatives to promote and support healthy lifestyles and food choices for employees, as advocated by NDoH (2016: 5).

During the step one screening, step two screening and the baseline process were also explained to participants so they would be aware of the follow-up processes should they be eligible to participate further in the study. During the rollout of the screening, it would be useful to enlist the services of a dietician and psychologist based on experience from the worksites in this study, especially as blood pressure (BP) measurements are available immediately and stimulate individuals to think about how to make the needed changes. Thus, this would be an optimal time for newly diagnosed participants to interact with a dietician and psychologist, to help individuals optimise their screening. Having the psychologist present may seem extreme; however, NCDs are complex and compounded by individuals' ability to manage day-to-day living, stress and mental health and wellness such that, inadvertently, it forms an important part of such screening interactions. Importantly, given the latent outward development of NCD symptoms, it is important to address preventative measures in newly diagnosed participants sooner rather than allowing apathy to set in (Gottfredson 2021: 4).

5.3 Step two-screening and chronic disease profile of participants at baseline

Eligible participants from step-one screening proceeded to step-two screening, which included BP measurements, a lipid profile test, an HbA1c test, and waist circumference and body mass index (BMI) calculation. Overall, the response to the call for participation in the screening process was well received, considering that this study took place during the post-COVID return to work after two years of absence from the worksite following various levels of lockdown as imposed in SA. This was a tumultuous time with employees fearful of the return to work, the personal health exposure this presented, pressure from the mounting workload enabled through the new hybrid work model, and anxiety and mental health wellness due to the COVID-induced isolation, personal grief and loss. Given the then prevailing climate of vaccinating against COVID-19 and the pressure and fear to vaccinate against successive variants of the COVID virus, it was also understandable that there was some fear, concern and hesitation to participate in needle stick-related activities. Some employees were also nervous about the venous method used in this study to draw blood, while others were time-constrained and could not spare the time to complete the testing required. This context may explain why 161 employees participated in blood pressure measurements but refrained from full participation in the veinous draw. To counter some of the drawbacks of participation, it may be beneficial for future studies to have alternate methods available to conduct blood glucose and lipid profile tests if these are offered. However, the post-COVID context of this study, with its reduced opportunity for exercising and higher food intake, could also have encouraged other employees to take a more active interest in their health and thus could have motivated some employees to participate. Within this context, many consenting employees were still keen to know their numbers. Thus, even under challenging circumstances, when screening was made available, employee participation levels demonstrated promising scope for worksites to be used as a semi-captive segment in support of the 2022-2027 National Strategic Plan for the Prevention and Control of Non-Communicable Diseases, to maximise participation in screening and preventative health management (NDoH 2022). To further support the South African governments strategy, there is scope for occupational healthcare workers (if present at worksites), to assist and reinforce, by following up with employees who have been diagnosed, to implement corrective action for their condition/s as they may feel overwhelmed, be apathetic, or lack motivation/ drive/ awareness on how to manage their condition (NDoH *et al.* 2019: 21). Given the challenging COVID context that this research took place in, it is also projected that participation in screening processes that entail blood draws may be better received by employees when hosted under non-COVID conditions. It is recommended that worksites acknowledge these factors in their planning and roll out of such screening as it is anticipated that employee participation can be much more robust.

5.3.1 Participant blood glucose profile

Results for the HbA1c test (Table 4.4) show the glucose metabolism categories for 601 participants and indicate that 74.2% of the participants were categorised as normoglycaemic (i.e. blood glucose ≤5.6%), 20.6% as prediabetic (i.e. blood glucose ≥5.7% to ≤6.3%) and 5.2% as diabetic (i.e. blood glucose ≥6.5%). During the step-one screening process, 96.5% of the sampled population stated that they did not have diabetes. However, participants were unaware of prediabetes. These findings are similar to the 2016 SADHS (NDoH *et al.* 2019: 306), which found that 67% of males and females screened for the first time were prediabetic. Screening remains a challenge in LMICs, with a large percentage of the population undiagnosed and hence unaware of their condition (Tuomilehto et al., 2023: 1; NDoH *et al.* 2019: 306). As indicated in chapter two of this thesis, if prediabetes is not attended to with lifestyle changes, it places these individuals at risk as prediabetes will lead to diabetes within three to five years if there is no intervention (Hostalek 2019: 1; Climie *et al.* 2019: 1). This highlights a critical gap in the screening, diagnosis and awareness of diabetes, reflecting broader issues as noted in the literature (Pheiffer *et al.* 2021: 2; Kamerman 2022: 13519). These findings underscore the importance and need for proactive screening at worksites to timely identify at-risk individuals and to implement evidence-based interventions and monitoring to prevent, among other aspects, the natural progression from prediabetes to diabetes.

In this study population, the mean HbA1c test results by gender and race at step two, were 5.5% for males and 5.4% for females (Table 4.3). However, mean results can mask other important contributing data. For example, at baseline, the interracial breakdown of the HbA1c results in this study showed a only a small difference with the highest mean result for Indians (5.7%) followed by Whites (5.5%), Blacks (5.4%), and Coloureds (5.2%). However, at baseline, the Indian participants were the only group with a mean score that categorised their results within the prediabetic range as defined by the NDoH *et al.* (2019: 305). This finding also aligns with existing research on the higher prevalence of diabetes among Asians (Gujral 2013: 51; Narayan and Kanaya 2020: 1103), suggesting that genetics, lifestyle, and possibly socioeconomic factors play a role in these disparities.

5.3.2 Participant dyslipidaemia profile

The prevalence of dyslipidaemia was observed among 610 participants (Table 4.3). Key findings showed that males exhibited higher levels of LDL-C (3.2 vs. 3.0 mmol/L), TG (2.1 vs. 1.4 mmol/L), and TC (5.0 vs. 4.9 mmol/L) compared to females. This aligns with research indicating males are more susceptible to high serum cholesterol (Woldu, Minzi and Engidawork 2022: 10). In the literature, LDL-

C is the key lipoprotein type that is targeted for cardiovascular (CV) risk reduction and prevention (Catapano *et al.* 2016: 25; NCEP: 2002: 19). When broken down by race, this research results further indicate that with the highest mean LDL-C of 3.5 mmol/L, Indians in this research cohort, were the most vulnerable to CVD risk. They would thus benefit most from making a three-point change to their lifestyle, e.g., adjusting their diet to one that is low in saturated fats and cholesterol, reducing and maintaining optimal weight for height, and increasing PA (NCEP 2002: 19) and intensity level. However, with the remaining study population LDL-C results for Whites at 3.3mmol/L, Coloureds at 3.1 mmol/L and Blacks with 2.7mmol/ L, it indicates potential for the White and Coloured study participants to benefit from adopting the three-point recommended preventative measure. This is especially important when one considers that efforts to lower TGs or to raise HDL-C have a simultaneously beneficial effect across the lipid profile (NCEP 2002: 33. Thus, the data revealed critical insights into gender and racial disparities in health risks with the Indian participants in this study showing a two-fold risk for NCDs. It is also worth noting that both males and females had an HDL-C of 1.2 mmol/L and 1.5 mmol/L, respectively, which are within the range for both genders.

5.3.3 Participant hypertension profile

The findings from the screening process highlight several critical trends and patterns in hypertension prevalence and awareness within the study population. Despite 92.3% of participants indicating they did not have hypertension during the step one screening, the step two screening did not corroborate this. This discrepancy underscores a significant issue of undiagnosed versus diagnosed hypertension prevalence. For example, using data from the SANHANES research, a study conducted by Berry *et al.* (2017: 3) bears significance as they quantified that 48.7% of the study population who presented with hypertension indicated that they had never been screened. This offers insight that a substantial portion of the population remains unaware of their hypertensive status and is consistent with broader epidemiological trends. Other studies also show that many individuals with hypertension are undiagnosed due to a lack of regular screening (Govender *et al.* 2021: 74; Parati *et al.* 2022: 1949). This lack of awareness can lead to untreated hypertension, which increases the risk of cardiovascular complications, adds to the disability induced burden and related higher long-term healthcare costs (Govender *et al.* 2021: 78; Parati *et al.* 2022: 1949).

In this study cohort, of the 790 participants who participated in the screening, only 32.7% of the participant's results were within the normal range. In contrast, 67.3% had varying categories of BP, as indicated in Table 4.6. Notably, 23.3% of participants (n= 184), had measurements within the hypertension range while 44% (n= 348), had measurements within the pre-hypertensive range. Both SBP and DBP are used as markers for CVD risk, though the literature indicates that SBP is often used as the reference for CVD risk (Selassie *et al.* 2011: 583; Fuchs and Whelton 2020: 285; The Heart and Stroke Foundation South Africa (SA) 2021: 4; Muntner *et al.* 2019: e55). With a mean SBP value of 126.0mmHg and 121.8mmHg, for males and females respectively, both genders in this study had a less-than-normal mean SBP, with males also showing a less than normal mean DBP of 81.2mmHg (Table 4.3). The mean SBP results in this study population, placed both genders in the prehypertensive range, reflecting a widespread problem with BP that transcends gender lines. This finding aligns with existing literature and statistics that point to an increasing number of individuals presenting with a less-than-normal BP (Berry *et al.* 2017: 3; NDoH *et al.* 2019: 319; The Heart and Stroke Foundation SA 2020: para. 1). Critically, as indicated Selassie *et al.* (2011: 579) if this is not addressed through interventions, these participants' condition can develop from prehypertension to hypertension within four years and have devastating consequences.

It must be noted that literature has documented evidence of a two-fold increase in CVD risk with a BP measurement from 115/75 mmHg (Fuchs and Whelton 2020: 286). It is concerning that the South African classification of BP ranges lists a measurement of 140/90 as a starting classification for grade 1 hypertension. These findings must be noted along with those from Hostalek (2019: 1) and the CDC (2023: para. 4), who have evidenced a three-to-five-year timeline progression from prehypertension to hypertension. For the general population, unawareness of their condition when they are prehypertensive, masks the true number of individuals who should be actively using diet and lifestyle modifications to improve their health numbers. Especially as a growing body of literature underscores the prevalence of those afflicted with prehypertension to become hypertensive with an increase in age, and lack of timely screening and intervention to mitigate disease progression (Pimenta and Oparil 2010: 22). When coupled with poor adherence to pharmacology and high-risk behaviours (low levels of physical inactivity, unhealthy diet, stress-inducing behaviours, tobacco and alcohol consumption), individual risk, especially in SA, is amplified.

The findings also showed ethnic disparities in hypertension, with the study highlighting significant variations in hypertension prevalence among different racial groups. In this study, the sampled Indian participants fell in the high-risk ethnic group for hypertension (Unger *et al.* 2020: 1350) with the highest recorded mean SBP and DBP values (126.5 mmHg and 81.2 mmHg, respectively). This finding is consistent with existing research, which indicates a higher predisposition to hypertension among individuals of Indian descent (Unger *et al.* 2020: 1350). In contrast, the Coloured population exhibited the lowest mean values for SBP and DBP. Similar to research conducted by other researchers (Berry *et al.* 2017: 9; Govender *et al.* 2021: 74; Parati *et al.* 2022: 19490), the results of this study underscore the urgent need for improved screening and awareness campaigns. Apart from screening, public health initiatives must focus on education and awareness about hypertension and the risks associated with untreated hypertension. This approach could help mitigate long-term health complications and reduce the overall burden on healthcare systems.

5.4 Endline participant profile and results

Following the step two screening, 395 eligible participants were invited to continue with the study. Of these, 207 participants consented to participate further after receiving detailed information about the study. However, 188 participants declined to proceed, citing reasons including lack of time, workload, loss of interest, unwillingness to undergo additional venous draws for the follow-up lipid profile and HbA1c tests, and preference for pursuing health management with their medical practitioners. Consequently, 207 participants completed the necessary research documents, including sociodemographic and dietary questionnaires, the Global Physical Activity Questionnaire (GPAQ), and two 24-hour diet recalls. Despite this, attrition occurred when 20 participants who had completed the documentation and baseline clinical testing had to be excluded from the study due to an unplanned plant shutdown, which prevented their release from work for the planned interventions. This resulted in 187 consenting participants for the RCT, with 93 allocated to the CB and 94 to the CO arm, respectively. A further 7 participants from the CB arm and 21 from the CO arm were lost to follow-up due to lack of time, lack of interest, feedback and commitment to the study. Thus, 147 participants completed the full participation required in the study, with 72 participants in the CB arm and 75 in the CO arm. Unwillingness to participate in a study is common. In a population-based cross-sectional study in SA, Berry *et al.* (2017: 9) also noted attrition, with only 42.9% of those interviewed consenting to participate fully in the study. A high attrition (almost one third of patients) was also reported in the lifestyle study conducted by Ferrara *et al.* (2012: 771). However, there may be scope to improve participation numbers for future worksite-based wellness offerings if, for example, screening was offered directly by the worksite.

Of the 147 participants, there were 78 females and 69 males. All race groups participated in the intervention and EL phase of the study, with 76 Black, 49 Indian, 13 White and 9 Coloured participants. While participants used a mix of all 11 languages, it was clear that the majority of languages used was English, followed closely by isiZulu (Table 4.9). Participant age was dominant in the 30-39 and 40-49 categories, with the lowest participation in the 60-69 age category. Almost 60% of the participants were from an office environment instead of production (Table 4.10). This may allude to a higher flexibility of office-based than production-based employees to participate in wellness-type interventions, especially as the former participants had resources and access to online classes which could be taken at their leisure. The flexibility this delivery offers may help improve participation and be considered in future wellness-type interventions.

5.4.1 Participant HbA1c BL to EL

The global prevalence and steady rise in the number of individuals presenting with diabetes has been well documented. At the second measurement point in this study, the mean HbA1c for the canteen-only (CO) group was 5.453% at baseline (BL) and 5.532% at endline (EL), while for the canteen and behavioural (CB) group, it was 5.453% at BL and 5.507% at EL (Table 4.40). These results indicate that the overall findings for the CO and CB intervention groups were similar, and that diabetes was not as prevalent in this research cohort. However, prediabetes was detected among participants (Table 4.41), which is consistent with broader trends.

The South African Demographic and Health Survey 2016 (NDoH *et al.* 2019: 297) reported an alarming prevalence of diabetes in the population aged 15 and older, with 13% of women and 8% of men diagnosed as diabetic, and 64% of women and 66% of men being prediabetic based on adjusted HbA1c levels. In a systematic review that assessed the prevalence and correlates of pre-diabetes in adults of diverse ethnicities in the South African population, an overall prevalence of pre-diabetes was reported to be 15.56%. The study identified hypertension, obesity, and a sedentary lifestyle as correlates for prediabetes (Sosibo *et al.* 2022: 1). In the absence of lifestyle modification, the likelihood for prediabetes to advance to diabetes, as a fully developed chronic condition, has been projected to occur within five years (Hostalek 2019: 1; The Heart and Stroke Foundation SA 2023a: para.1).

5.4.2 Participant lipid profile BL to EL

Participant TG, LDL-C and HDL-C results remained constant from BL to EL for both the CO and CB arms of the intervention (Table 4.41). In the CO group, participant mean TC decreased from 5.282 mmol/L at BL to 4.876 mmol/L at EL. Similarly, in the CB group the mean TC decreased from 5.004 mmol/L at BL to 4.647 mmol/L at EL. The mean paired difference for TC was 0.406mmol/L for the CO group and 0.357mmol/L for the CB group, indicating an overall improvement in the TC levels for both groups. The recorded decrease was also above the targeted 0.3 mmol/L. However, as noted in Chapter 2, dyslipidemia is diagnosed based on individuals meeting one or more of the following criteria: TC >5mmol/L, LDL-C >3.0 mmol/L, HDL-C <1.2mmol/L, triglycerides >1.7mmol/L (Reiger *et al.* 2017: 4). Thus, the overall post-intervention results at EL, both CO and CB groups met the definition for dyslipidemia. The EL data used to calculate the Framingham cardiovascular risk score indicated that in the CO group, 81.3% of participants were at low risk, 17.3% at moderate risk, and 1.3% at high risk. In comparison, the CB group had 79.2% at low risk, 20.8% at moderate risk, and 0% at high risk (Table 4.36). When the Framingham cardiovascular risk score was calculated by gender, males presented with a higher risk than females. Additionally, when calculated by race, Indians presented with the highest risk.

5.4.3 Participant BP BL to EL

A growing body of literature underscores the prevalence for those afflicted with prehypertension to become hypertensive with an increase in age, lack of timely screening and intervention to mitigate disease progression (Pimenta and Oparil 2010: 22). In this study, the mean SBP for the CO group was 129.28 mmHg at BL and 123.25 mmHg at EL, while the DBP was 83.71mmHg at BL and 79.35mmHg at EL. For the CB group, the SBP was 129.89mmHg at BL and 125.94mmHg at EL, while the DBP was 85.40mmHg at BL and 80.93mmHg at EL. Thus, the overall results for the BP measurements were categorised within the prehypertensive range. Despite the short duration of the intervention, both the CO and CB interventions showed promising decreases in participant BP readings for SBP and DBP, alluding to the potential for higher decreases in BP over a more extended study duration. The detailed changes in results are noted in Table 4.41. However, as evidenced by Rayner et al. (2019: 184), it must be noted that the South African Hypertensive Society (SAHS) does not clearly identify its classification of range readings; those who are prehypertensive, i.e. the words 'prehypertensive' do not appear on range breakdown. This is a missed "shared' opportunity to alert individuals who are prehypertensive, to take stock, engage with their BP measurements, and access and action interventions to avert their natural progression to hypertension. It is important that tools like the range breakdown for BP categories are developed, clearly set out and made accessible to the general population, with the intention that individuals interact with and become more aware of the BP categories in relation to their BP measurements when these are taken. Essentially, this step can help towards addressing what Checkley *et al.* (2014: 432) termed passive dependence. Thus, this more inclusive "whole of society" approach can empower individuals to understand a little more about their condition without *only* relying on those in the medical field to indicate if their BP measurement was *'ok' or not*. Importantly, it is anticipated that the development of such a tool along with simple guidelines on how to manage risk factors, will help shift individuals from apathy towards becoming more conscious about and actively involved in mitigating the impact of NCDs (Checkley *et al.* 2014: 432) like prehypertension and hypertension. This shared undertaking to reduce risk can do more good than harm and is worth investing in given the ever-increasing prevalence of prehypertension and hypertension.

As one of the factors contributing to the prevalence of hypertension is influenced by salt consumption, the finding on participants salt consumption must be noted. The WHO recommends <5g/day salt consumption (WHO 2023f: para.1). In this study, when asked about their salt consumption patterns, 96 participants were unaware of their daily salt intake (Table 4.19). This raises a cause for concern as when individuals are unaware, there is a higher probability of them unknowingly exceeding the recommended intake, thus increasing the prevalence of hypertension (WHO 2023f: para.1). There is a need to educate individuals on their salt intake, and how to decrease their daily intake. Creating awareness of foods with 'hidden salt' and high salt containing foods that should be consumed sparingly can also be used to target and decrease salt consumption.

5.4.4 BL to EL prevalence of overweight, obesity and WC

In this study, the data presented a high prevalence of overweight and obesity in both males and females, reflecting prevailing global patterns (Global Nutrition Report 2022b: para. 9). The majority of the participants in this study were classified as overweight, obese, or extremely obese both at BL and EL in the CB and CO groups respectively (Table 4.11). This indicates that neither intervention yielded a significant change in participant BMIs. Notably, the mean BMI for males was 27.881kg/m^2 at BL and 27.986kg/m^2 at EL; while for females it was 31.581kg/m^2 at BL and 31.308kg/m^2 at EL. Thus, while the study has scope to improve the overall BMI of both genders, it was not realised in this short duration intervention study. Similar findings were reported in other intervention studies (Daley *et al.* 2019: 52). This may allude to a need for a longer duration of the intervention than the 6-week cycle used in this study and a need to invest in more targeted strategies than were accepted by the canteen service provider, to modify food and beverages within the worksite food environment (WFE).

This research findings also indicated a prevalence of less-than-optimal WC. To minimise the risk of metabolic complications, the NDoH *et al.* (2019: 300) recommends an ideal WC for females: ≥80 cm and <88 cm and males: ≥94 cm and <102 cm. However, participant waist measurements showed that collectively, only 35.4% of participants had an optimal WC for both the CB and CO groups at BL, which increased slightly to 37.4% at EL (Table 4.22). The CB group paired difference WC finding for males from BL to EL was -0.11, while for females, it was -0.59 (Table 4.38). The CO group paired difference WC finding for males from BL to EL was 0.66, while for females, it was 0.04 (Table 4.39). Thus, while the CO group showed very modest improvements for both male and female WC when compared to the CB group, these changes were not significant. At the same time, similar to Goetjes *et al.* (2021: 7), the BMI and WC findings in this research indicate that the obesity burden on female participants was higher than for males and that a majority of females were at a substantially increased risk of metabolic complications. While even a moderate 5% weight loss (Fruh 2017: S3) would have helped to reduce the burden of disease caused by obesity and to increase life expectancy by five to ten years (Fruh 2017: S4), this target was not met in both the CB and CO groups. The lack of significant weight loss across the study cohort suggests that additional interventions may be needed to achieve effective weight reduction. Alternatively, the study duration may need to be extended to determine if a longer duration intervention may produce significant results. One would also need to be mindful of the COVID context within which this study took place, as for almost 2 years, individuals were restricted from freely socialising, shopping and having access to a range of food and drinks as was the norm pre-COVID. With the restrictions lifted and the return to work initiated, this post-COVID phase was more social, celebratory and indulgent and could have influenced the results.

5.4 5 Nutrition and dietary status

The findings of this study showed that participants mainly followed a meat and starch-based diet, which resonates with two key messages from the South African Food-based dietary guidelines, " Fish, chicken, lean meat or eggs can be eaten daily" and "Make starchy foods part of most meals" (Vorster, Badham, Venter 2013: S7). The 24-hour food recall results conducted at baseline and endline for the CB and CO groups provided a snapshot of participants' consumption patterns, indicating suboptimal nutrient intake for both males and females. Dietary inadequacies observed included fibre, calcium, folate, vitamin D and energy intake, while the excesses reported and of concern were protein, total fat and carbohydrates. These findings presented at both BL and EL mean that participants' diet did not change significantly pre and post the CO intervention (Table 4.25 and Table 4.26). While similar inadequacies and excesses were observed for the CB intervention group from BL to EL (Table 4.27), it was also noted that the energy intake for males in the CB group lowered from BL to EL (Table 4.28). In contrast, for the female group, it remained similar from BL to EL.

Several dietary excesses were reported, and of concern were protein and total fat. Using the 24-hour food recall data at EL, dietary indicators were calculated using the DQQ, which provided insight into the participant's dietary patterns. This study's GDR score of 9.30 reflected sub-optimal diet quality (Table 4.31). This was supported by a low NCD-protect score, indicating a lack of health-promoting foods in participants' diets. However, the NCD-risk score was reported as low, potentially influenced by several reasons. The first possible reason could be that participants were sensitised during the intervention and were aware of the monitoring at the endline, which may have influenced the self-reporting of the diet. The second possible reason could be the lack of variability in diet, as observed in the dietary questionnaire and the 24-hour food recall, which could have impacted the score. Given that in the NCD risk score, foods consumed are only counted once as a food group, variability will be difficult to measure if the diet is limited to specific food items, as observed in this study, in which most participants followed largely a meat and starch-based diet. The FGDS corroborates the lack of variability in the diet, as reflected by a low FGDS score.

Results from the dietary questionnaire provided insight into participant consumption of fats and oils, starch types, dietary supplements, salt intake and consumption patterns. While participants mainly used sunflower, olive and canola oil, it is also important to sensitise participants to quantities used to ensure that they avoid using excessive amounts. Results on the types of starch consumed indicated that rice was the most frequently consumed starch, followed by bread and maize meal. When paired with the findings from the 24-hour food recall, it is evident that participants (males and females) in both CO and CB groups from BL to EL, have a high carbohydrate intake. Diets, where more than 60% of total energy is derived from carbohydrates, have been correlated with high TG (NCEP 2002: 28); thus, when this risk factor is known, the afflicted individual should take steps to reduce their carbohydrate intake to within the optimal percentage of total energy consumption (NCEP 2002: 28). Since dietary inadequacies were reported for fibre at BL and EL for both genders in the 24-hour food recall, scope exists to introduce wholegrains or unrefined grains to worksite canteen patrons. Other steps that can be adopted include decreasing weight if BMI is less than optimal as per WHO guidelines, increasing PA, and ideally eliminating alcohol and tobacco consumption (NCEP 2002: 28).

Consumers have access to a lot of information on healthy eating, including that a higher meat intake carries an inherent health impact (Leahy, Lyons and Tol 2011: 3). However, in this study, uptake of a vegetarian diet was similarly weak between male and female participants (Table 4.17). This indicates that there is scope for practical guidelines and education on how consumers can incorporate information on healthy eating in real-world settings. At the eight worksite canteens, 339 lunch-type meal purchases were recorded daily. This therefore suggests a potential of 2205 meals (147 x 3 meals x 5 days) that could be sold at the worksite canteen per week. This type of information is beneficial as it offers an opportunity to provide a target population with relevant information regarding their purchase behaviour. For example, these participants may benefit from information on healthy breakfast and lunch type meals, including ideal components and portion sizes for meat, starch and vegetables. Kilojoule content, photos of healthy meals, and ideas on how to swap out unhealthy items, e.g., condiments and cooking methods, for healthier options could also be beneficial - for example, swapping some white rice in participants' diets with unrefined brown rice. Research by Gulzar *et al.* (2018: 603) indicates that different rice varieties have a varying glycaemic index (GI) impact, with low, medium and high GI labelling used to describe how rapidly food can raise blood sugar when consumed. However, similar to Reddy, Naicker and Singh (2023), Gulzar *et al.* (2018: 605) indicated that to optimise health and nutritional benefits, "paired meals" should be assessed as the overall GI would be dependent on the foods a low GI starch may be paired with. A growing body of evidence has proven that low GI diets can positively impact several causal factors for cardiometabolic disease, including weight loss, body fat mass reduction, and lipids improvement (Thomas 2007: 1; Zafar *et al.,* 2019: 891). Research by Gautier *et al.* (2019: 1) have indicated how displayed pictures of high-energy and low-energy meals shifted individuals towards healthier lower energy options. These types of interventions could be explored further in other research to determine intervention impact and ability to lower cardiometabolic risk.

5.4.6 Physical activity

The Global Physical Activity Questionnaire (GPAQ) was used to determine participants self-reported weekly physical activity using three domains: work, travel to and from places and recreational activities (WHO 2021e: 2). Use of the WHO analysis guide for the GPAQ data (2021e: 14) indicated that overall, 102 participants achieved ≥600 METS and were therefore within the recommended weekly physical activity for health. However, 45 participants achieved <600 METS (Table 4.13). Results indicate that participants engaged in moderate rather than vigorous intensity activities when they were at their worksite. However, a breakdown of the results showed that only 45.6% of the study participants engaged in moderate and 7.5% in vigorous activity while at work. This indicates that more than half of the participants are sedentary at work. This finding is not isolated. In a national population-based survey in SA involving 26 339 participants, Mlangeni *et al*. (2018: 1) also reported that 57.1% were inactive, and 14.8% were moderately physically active. The WHO (WHO 2022: para. 5) indicates that even small changes that can help to increase and make a meaningful difference in employees' PA levels are beneficial. Thus, collective efforts must be made to help increase PA. For example, findings from this study can provide an opportunity for worksites to introduce changes aimed at creating opportunities for employees to increase the amount of time they engage in moderate PA. Worksites can promote ergonomic workspaces and encourage active breaks by introducing formal walking routes, offering walking meetings, and encouraging group activities like jogging, soccer and cricket.

Travel to and from work and PA during leisure time are other domains that may be explored as avenues to increase participant PA levels and duration, as the findings indicate opportunity for growth. Most participants, 105 (71.4%), indicated that they did not expend energy through cycling or walking to work. Instead, more sedentary modes like driving a car, or being a passenger on a taxi/bus/car were used, which did not entail expending as much energy as the former methods. Additionally, only 42 (28.6%) participants reported participating in vigorous leisure PA, while 73 (49.7%) reported participating in moderate leisure PA. These findings are similar to that observed by WHO (2022c para.: 5), which found that low levels of PA during leisure time, the use of 'passive' modes of transport to and from work and sedentary behaviour at work and home, resulted in low PA levels. It must also be noted that South Africa has a high crime rate, and this may influence the uptake of PA for travel to and from places and recreational activities (WHO 2021e: 2). In their meta-analysis, Rees-Punia *et al.* (2018: 307) state that many variables may influence the lack of higher uptake in vigorous and/ moderate leisure PA including for example inaccessible sidewalks, perceived traffic risks, access to recreational facilities, and socioeconomic status. However, they posit a significant relationship exists between perceptions of safety from crime, objectively measured crime rates, and PA levels. They found a 27% increase in the probability of meeting higher levels of PA when individuals felt safe from crime. At the same time, areas with a high record of police-reported crime had up to a 28% probability of not achieving high levels of PA (Rees-Punia *et al.* 2018: 311). While this may allude to a need for better planning and development of the built environment and law enforcement, it also underscores the opportunity and potential to develop the under-utilised GPAQ domain of PA while at work, especially if individuals feel safer at work.

It is also notable that female participants in this study spent more time sedentary than males, with 7.33 hours for females compared to 5.09 hours for males (Table 4.14). The latter finding was similar to the WHO physical activity profile for SA (2022e: 331), which reported that more females than males were physically inactive. However, it could reflect the office versus production environments in this study where the former work culture is more sedentary than a production line; and is often staffed by more females than males. A corporate culture of aiming for a minimum targeted step count could perhaps also help encourage employees to higher PA levels.

While the protective effect of PA as a modifiable risk factor for cardiovascular disease is well established, it is also valued for its complementary role with diet in reducing weight. In a systematic review that compared the effectiveness of diet or exercise interventions versus combined behavioural management programmes, the pooled results showed that combined behavioural weight management programmes had significant weight loss at 3 to 6 months (–5.33 kg; 95% CI –7.61 to –3.04) and at 12 to 18 months (–6.29 kg; 95% CI –7.33 to –5.25). The study suggests that while short-term weight loss is similar between diet-only and combined programmes, incorporating both diet and physical activity in behavioural management programmes results in increased weight loss in the longer term (Johns *et al.* 2014: 1557). Therefore, physical activity was integrated into all six lifestyle lessons in the CB group, whilst the CO group were exposed to the benefits of PA through the promotion of PA using multi-language table tents at canteen tables. This study did not achieve the targeted weight loss in either of the CB and CO groups; however, as indicated by Johns *et al.* (2014: 1557), this finding could be different if implemented in a longer-term rather than short-term study.

5.5 Interventions

There is compelling evidence that lifestyle intervention programmes, including multi-component interventions at worksites, have positive effects on the health outcomes of employees (Song and Baicker 2019: 1492; Mattke *et al.* 20chapter 609: 31; Naicker *et al.* 2021: 27; Alkhatib *et al.* 2021: 10). However, the type of interventions implemented, the challenges experienced, and results obtained may differ. This discussion provides feedback on CO and CB type interventions implemented at production and office type worksites.

5.5.1 Canteen-only intervention: components and challenges

The food environment at worksites has a direct influence on the dietary choices of employees. Hyperpalatable foods often dominate the food environment in and around the worksite. The demand for these foods and beverages within the food environment is maintained when coupled with fast-paced, time-trapped lifestyles. Thus, an enabling food environment with healthier food choices can complement lifestyle interventions adopted at worksites. When changing consumption, creating a food environment more responsive to healthy dietary practices and behaviour is important. This study introduced multicomponent canteen interventions to promote healthy dietary practices, exposing all participants to this intervention regardless of the intervention treatment. As described in Table 3.7, feedback on potential interventions were obtained from the formative study by Singh (2022). Healthy food options that targeted decreasing fats and oils, including higher vegetable ratios, plant-based proteins, and umami ingredients like tomatoes and mushrooms, were developed to gauge staff and employee openness to change and make meal recommendations to the onsite catering service providers. Lessons and training on the preparation of these dishes were offered during phase 2 of this study to the catering service providers and their food preparation staff at DUT, and certificates were issued on completion. During the training session, the use of herbs, spices, lemon, chilli and garlic were promoted to bring out the flavour of ingredients rather than the use of salt and stock cubes. This intervention also included a site based sensory evaluation which was conducted during phase 3 of the study, where employees frequenting each of the canteens could taste test the food samples and provide feedback.

Canteen interventions can also include a range of aspects that can be impactful, cost-effective, and simple, e.g., designing educational prompts, table tents, infographics, and videographics to initiate behaviour change. These tools were developed and utilised across all the worksites participating in the study. These tools had a widespread reach, targeted all employees, and were easy to use. It also enabled participant exposure to a wide variety of educational prompts as these tools were changed each week over six weeks to deliver different messages, for example: stay healthy with water, know your carbs for good health, life is sweeter with less sugar, less salt = better health, the facts on fat – how much do you need, move your muscles. Another canteen intervention that was easy to implement was the healthier beverage option, where free bottled water was provided at each of the canteens to encourage and promote water consumption as opposed to sugar-sweetened beverages. The use of portioning spoons at the servery counters were quick to implement and well received by food service staff as it helped to regulate and standardise portions served. Another intervention that was easy to implement and well received was the healthy snacks (trail mix snack packs) in the boardrooms; and the seed bar (chia, flaxseed, sesame, oat bran and sunflower seeds). These snacks also included messaging on the health benefits of consuming the trail mix snack and the seed sprinkle. Another intervention that was well received by all role-players was the introduction of unrefined carbohydrates, including hot cooked oats for breakfast, and brown rice and whole wheat pasta options for lunch or supper type meals. These interventions were also very appropriate for this study cohort, as participants 24-hour food recall results indicated low intake of fibre.

At the same time, some canteen interventions were not well received. For example, the suggestion box for meal recommendations and commendations had to be removed as the catering service provider indicated that it was not part of their mandate. They also felt that not meeting employees' demands and expectations at each site could damage their reputation and impact their contract retention. However, employees were very keen to provide input to advise meals and snacks offered at the canteens. While there is much potential to introduce meaningful interventions at the canteen that will impact and have a wide reach over many employees, these interventions may be easier to implement when the canteen is operated in-house by the employer as opposed to externally by a contractor. In the case of the latter, the profit model is emphasised, and aspects like decreasing salt, fat and sugar content may not be well received or accepted.

Additionally, catering contractors and employers are guided and bound by their contractual obligations, so it may not be as easy to introduce changes to canteens, especially if the profit margin is impacted and sales volumes drop. In these cases, it is advisable and recommended for worksites that want to make positive changes, for example, decreasing salt, sugar and fat, to include this in their contracts or negotiate this in conjunction with the catering service provider. As indicated in this study, with a large percentage of semi-captured employees purchasing meal/s daily from the onsite canteen (and food vendors close to a worksite), these service providers have a marked impact on employee health and wellness. The food environments within worksites can be used effectively to promote healthy eating. Canteen contracts can be negotiated to target health and wellness as a corporate culture and should be implemented as a standard operating procedure with all catering service providers. Organisations can also work with their in-house catering providers to offer subsidised healthy meals to generate interest and drive meal purchases, e.g. subsidised healthy breakfast. Additionally, in the production type worksites in this study, there was a strong culture of production targets and rewards. Employers should consider revising the reward coupons to ones that can be redeemed at the canteen for a healthy meal or beverage option rather than the current 'open' voucher at the canteen, which is frequently exchanged for snacks like chips, chocolates and sugar-sweetened beverages.

5.5.2 Canteen and behavioural (CB) intervention: components and challenges

Participants in the CB arm were exposed to all aspects of the canteen interventions as reported for the CO arm and the interventions from the lifestyle component (40-minute lifestyle lessons and a 20-minute PA and weigh-in component).

The lifestyle classes offered in this research study were based on the Diabetes Prevention Program (DPP), which offers a 16-week programme scientifically proven on free-living individuals in a normal environment. However, for this study, the programme was modified to fit a 6-week condensed model as doing a 16-week programme in a busy, target-driven production and or fast-paced retail environment would have been very challenging, especially as the research timeline was changed post-COVID, to fit a 1-year timeline. Overall, even a 6-week programme in real-world settings was challenging, with both retail and production environments having deadlines that often superseded the attendance requirements for lifestyle classes.

5.5.2.1 Lifestyle classes participation (CB group)

Once the 6-week lifestyle programme was ready to be offered, it was implemented across all sites 2-3 days per week, depending on venue availability at each site. Repeat lessons and offering one-on-one lessons were used at each production site to allow flexibility for shiftwork and peak period demands. To accommodate all participants at the production sites, the lifestyle coaches also worked on a flexible system where different lessons could be offered on a given day as planned e.g. offering a week two lesson in one of the lesson slots to someone who missed a lesson two and using the remaining two lesson periods to continue with other lessons for the remaining participants. A hybrid lesson delivery was offered at the office-based sites, with face-to-face lessons offered once a week and supplemented with a recorded lesson uploaded each week on each of the participating sites' Teams group set up for the purpose. As indicated previously, participants were given multiple support reminders about their lessons/ times a week before, day prior and on the day of their lessons; to help encourage and maximise attendance. However, not all participants attended all the lessons. As indicated on the CONSORT diagram (Figure 3.3), from a total of 93 participants who were randomised to the CB group, 14 did not receive the lifestyle intervention, as five of them indicated that they could not attend any of the lessons due to workload, nine of them did not provide a reason for not participating. This reduced the number of participants in the CB arm to 79. Of the 79 participants who received the intervention, 59 completed all six lessons, 1 completed three lessons, 15 completed two lessons, and four completed one lesson. During the intervention, a further 7 participants opted to discontinue the program, citing high workload. The six lifestyle classes took participants longer than six weeks to complete due to shift work, production deadlines, workload and the post-COVID hybrid 2-days on-site 3-day work-from-home policy implemented at Unilever LL. At the office-based sites, most participants completed the lifestyle classes online, with the hybrid mode enabling them to move easily between face-to-face and the recorded lesson delivery modes depending on their availability and workload commitments. As used in this study setting, a condensed programme format and the support provided to participants may have helped encourage and maintain attendance levels. However, the cost of this system must be explored for viability in other studies to ensure that the cost input does not exceed the return from investment for the worksite.

In other worksite settings, a 16-week lifestyle programme may enjoy more success. However, it would not have worked well in this production and office-type environment due to the fatigue it would have brought to maintain participant attendance and interest. This was especially true in this study as although management, supervisors, occupational health nurses (OHNs), employees and union members were part of the worksite team who were sensitised to the research study and the requirement for participating employees to be released to participate when completing the screening, documentation, BL and EL clinical testing and lifestyle classes (if selected), production and workload demands took precedence. Participating employees were not given the required time off to attend. This resulted in some participants opting out of the study while others tried completing parts of the requirements in their own time: before shift, during breaks or after work. However, if specific times/days were set aside for participation in these health and wellness screenings, follow-up, and lifestyle classes, uptake from individuals may be improved and maintained.

In this study, the availability of optimal venues for the lifestyle classes were needed to enable the lessons and PA aspect offered. Thus, worksite venues with desks, chairs, projectors, good ventilation and sufficient space were required at each site, to host the classes. The availability of training and meeting rooms at sites assisted in meeting venue needs. However, this also posed a problem as internal training, and events took precedence over the lifestyle classes offered by the DUT research team. This was especially problematic when these training sessions took place over several days. Scheduling participants for lessons took much planning and involved input from multiple role-players: participants, lifestyle coaches, site-based research assistants, site-based venue and facilities planners, site-based OHNs, and site-based section supervisors. However, once these role-players were in place, and a change was made, e.g. internal site training received precedence to use all the training rooms. It resulted in the research team having to cancel the session and reschedule with all parties concerned. This had a negative impact on participant retention – optimally when lifestyle lessons are offered at a worksite, its venue resource needs must be accounted for, and it should receive the same support as any other training or meeting provided on-site. Attending to self-health can be challenging without this being able to be superseded by any other item. Still, once employees see that other tasks and requirements can supersede this, their motivation, which can be weak to start with, can wane detrimentally. Support from management and facilities management for health and wellness initiatives will help ensure better adherence and support with such programs when offered at worksites.

The fact that the lifestyle classes aimed at reducing cardiometabolic risk were a DUT initiative, with background support from the host site, also contributed to the attrition rate experienced, as attending classes did not help participants meet their immediate work objectives. The research team were also external to the worksite and had to rely on support from key worksite internal and insider role-payers to access, promote and enforce. However, it is anticipated that when initiatives like screening, lifestyle classes and interventions with the WFE are offered directly by the worksite, it will have a higher participation and success rate and will be able to strategically and with quick turnaround, use its vast networks to better support such initiative. Participating in worksite health and wellness could also be explored as part of an employees' key performance indicator or as part of an organisation's vision, as it may be more internalised, credibly received and better supported by all the role players. This opportunity warrants further exploration as there is much scope for worksites to facilitate, engage with and enable worksite wellness type interventions to reduce cardiometabolic risk. Importantly, buy-in from stakeholders requires more detailed input, accountability and buy-in for success. Opportunities for a cascaded performance management system that includes health and wellness may be better placed to achieve success and should be explored.

5.5.2.2 Physical activity (CB group)

To help motivate participants and provide varied exercise options to complete their targeted 30 minutes of PA per day up to a minimum of 150 minutes per week. The research team produced six PA workout videos, as described in Chapter 3, section 3.7. At each of the six lifestyle classes, participants completed 10 minutes of PA and were expected to complete the remaining 2x 10 minutes of PA at their convenience. The PA workouts were shared with participants so they could easily complete their 30-minute PA target per day using varied routines. A challenge observed during the PA session was that while participants enjoyed participating in the PA session and having access to the recorded workout routines, not all participants were keen to get too energetic and break into a sweat, as they had to return to work after the session and did not want to be sweaty and hot. If PA sessions are offered with the lifestyle and behavioural classes in future worksite interventions, it would be ideal to schedule these classes towards the end of the shift or to be near participants break time so that individuals could either leave after the session rather than return to work, or in the case of the latter, they could have extra time to change and cool down after their activity and before going back on shift. In this way, participants may feel free to engage in the activity, which will help elevate their heart rate. Participants could also attend classes dressed in their PA gear to optimise engagement; however, the time needed to change at the start and end of the session would need to be factored in, especially as time was already a sought-after commodity.

For the online lessons, while this mode offered maximum flexibility for participants to take the lesson, it was also unlike the face-to-face sessions where the physical activity routine was done with participants. This variable may have impacted the outcomes achieved for the CB arm intervention. It is advisable that online lifestyle classes, when offered, have a check-in that requires participants to upload their workout video or, if funding permits, for participants to have a pedometer/ activity tracker to help nudge participants on the PA input.

5.5.2.3 Participant food diaries (CB group)

At the first lifestyle intervention lesson, 72 participants were given food diaries and training to record their daily PA and food and drink intake. It was expected that each participant would return six food diaries by the end of the six-week lifestyle classes, resulting in a collection of 432 diaries. The food diary tool was intended to help with constructive and individual-specific feedback and support based on reported physical activity levels and food and drink intake, thus assisting participants in meeting their targeted weight reduction goals and improving or maintaining their PA levels. The food diary activity also served as an opening discussion and method of peer encouragement at each of the remaining five weekly lessons. Participants were invited to share their challenges and/or successes realised during the week or obtain clarity on any of these aspects. This was valuable as different meal preparation methods, food combinations and choices, as well as portion sizes and social eating, were topical during these sessions. Participants who completed the face-to-face sessions were reminded to return their completed diaries at each weekly session. New dairies were issued two copies at a time, to ensure that sufficient copies were available for participants to use at any given time. For those completing the online programme (Unilever LL and Retailability), the food diaries were swopped based on completed copies for new copies. The reception for Retailability and the OHN and administrative assistant at Unilever LL were used as the exchange point for completed dairies with feedback/recommendations provided for these participants. However, the food diary part of the CB intervention was not well adhered to by participants, with only 20 participants returning completed diaries; this equated to a 27.8% return rate despite repeat reminders from the lifestyle coaches, researcher and the research assistants (RAs) for the copies to be returned. The return rate of the food diaries was also poor, with only 51 of 432 being returned.

Self-reporting of PA and food and drink intake was challenging for participants as even from the limited sample of participants who kept the food diary, at times, the data reported was sometimes incomplete. Participants also found it challenging to set aside time each day to complete the diaries, and frequently forgot to carry the diaries to their weekly lessons. The attrition rate in the return of food diaries in a lifestyle intervention study is not new and was also reported in a study conducted by Ainscough *et al.* (2020: 10). In their aim to improve eating habits, Eigen *et al.* (2018: 339) also noted challenges with regards to food journalling where manual records of food and drink intake is required daily. They described the system as demotivating and “cumbersome” for participants. It may be more viable to investigate alternate methods or to set up a voice recorded log for ones PA, food and drink intake as participants may find this less tedious than writing in the data, which this study cohort described as their ‘homework’ at their lifestyle class.

5.6 Conclusion

Effective interventions can significantly reduce cardiometabolic risk factors, but challenges often arise in real-world settings. In this study, 147 participants were randomised into CO and CB groups using a two-step screening process. After implementing the interventions and conducting EL assessments, both groups showed similar short-term results. Worksites can choose between these intervention types based on available resources and timelines to effectively target and reduce cardiometabolic risks. However, in this worksite study, canteen interventions, were able to reach a larger number of employees and was relatively easy to implement once guidelines are established. This suggests that simiilar worksites, could achieve significant improvements in employee BP measurements and lipid profile, as demonstrated in this study, by adopting canteen-based interventions.

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

This chapter draws conclusions from the main findings of the study and makes recommendations. The strengths, limitations and recommendations are also discussed to assist and provide guidance for future studies within this field. This study aimed to measure the effectiveness of a canteen and behavioural (CB) intervention versus a canteen-only (CO) intervention among participants at a worksite by evaluating the change in number of individuals reaching two or more cardiometabolic risk goals, namely reductions in blood pressure, triglycerides, and HbA1c (the primary outcome), and through changes in secondary outcomes including rates of type-2 diabetes prevalence and regression to normoglycemia and changes in anthropometry, lipids, and blood glucose.

6.2 Summary of findings

Specific objective 1: *To measure the effectiveness of a CO intervention on a composite score based upon improvement in cardiometabolic risk factors (0-3) with success defined by a systolic blood pressure decrease ≥ 5mmHg, a decrease in plasma triglycerides ≥0.1 mmol/L and decrease ≥0.5% HbA1c.*

To determine effect, a pre-post-test design was used to measure CO participants blood pressure (BP), glycated haemoglobin (HbA1c) and blood lipids [low-density lipoproteins (LDL-C), high-density lipoprotein (HDL-C), triglycerides (TG) and total cholesterol (TC)] at baseline (BL) and endline (EL) of the study, following six-weeks of targeted CO interventions. The effectiveness of the CO interventions were tested by comparing the participant clinical test results at BL and EL using the clinical cutoffs for each of the NCD risk factors. Results indicated that twenty-two participants met 0 improvement of cardiometabolic risk factors while 29 participants improved one objective, 23 participants improved two objectives, and one participant improved all three objectives.

Specific objective 2: *To assess the effectiveness of a CB intervention on a composite score based upon improvement in cardiometabolic risk factors (0-3) with success defined by a systolic blood pressure decrease ≥ 5mmHg, a decrease in plasma triglycerides ≥.1 mmol/L and a decrease ≥0.5% HbA1c to determine effect.*

To determine effect, a pre-post-test design was used to measure CB participants blood pressure (BP), glycated haemoglobin (HbA1c) and blood lipids [low-density lipoproteins (LDL-C), high-density lipoprotein (HDL-C), triglycerides (TG) and total cholesterol (TC)] at baseline (BL) and endline (EL) of the study, following six-weeks of targeted CO interventions. Effectiveness of the CB interventions were tested by comparing the participant clinical test results at BL and EL using the clinical cutoffs for each of the NCD risk factors. Results indicated that 21 participants met 0 improvement of cardiometabolic risk factors, followed by 38 participants improving one risk factor, 13 participants improving two, and 0 participants improving three cardiometabolic risk factors.

Specific objective 3: *To evaluate the effectiveness of a CO intervention on diabetes risk*

To determine effect, a pre-post-test design was used to measure CO participants glycated hemoglobin (HbA1c) at BL and EL of the study, following six-weeks of targeted CO interventions. The effectiveness of the CO interventions was tested by comparing the participants clinical test results at BL and EL using the clinical cutoffs for HbA1c. Results indicated that 6 participants met the planned intervention effect; however, 69 did not. From BL to EL, 2 participants moved from prediabetic to diabetic, 20 participants at BL increased to 23 presenting with prediabetes EL, and finally, 53 participants without diabetes at BL decreased to 50 at EL. This was not optimal, as some participants had moved from normoglycemia to prediabetes.

Specific objective 4*: To measure the effectiveness of a CB intervention on diabetes risk*

To determine the effect, a pre-post-test design was used to measure CB participants glycated hemoglobin (HbA1c) at BL and EL of the study, following six-weeks of targeted CB interventions. The effectiveness of the CB interventions was tested by comparing the participants clinical test results at BL and EL using the clinical cutoffs for HbA1c. Results indicated that 6 participants met the planned intervention effect; however, 66 did not. From BL to EL, 1 participant became diabetic, 22 participants at BL increased to 26 presenting with prediabetes and finally, 49 participants without diabetes decreased to 45 at EL.

Specific objective 5: *To evaluate the combined effect of CB intervention versus a CO intervention on diabetes risk*

To determine effect, a pre-post-test design was used to measure CO and CB participants glycated haemoglobin (HbA1c) at BL and EL of the study, following six-weeks of targeted CO and CB interventions. The effectiveness of the CO and CB interventions was tested by comparing the participants clinical test results at BL and EL using the clinical cutoffs for HbA1c. Results indicated that 12 participants met the planned intervention effect; however, 135 did not. Six participants from the CO and six participants from the CB group respectively, met the targeted HbA1c decrease of ≥0.5%.

6.3 Strengths of the study

- All interventions relating to CO and CB groups were contextualised for fit and advised by the formative work conducted at the site.
- A comprehensive six-week lesson guide with participant handouts and infographics was developed for this research study and can be used for other similar research or modified to fit other environments targeting cardiometabolic risk for example, school food environment, and community development programmes.
- The CO intervention demonstrated wider reach and greater ease of implementation than the CB intervention.

- Diverse and multinational worksites were represented in this study, including a research population with a mix of genders.
- Worksite stakeholders at each of the participating worksites were consulted and approved participation in this worksite research study, including unions.
- Majority of the participants in CB group attended all the lessons, and for those who missed scheduled lessons, small group catch-up lessons were offered as well as online lessons to enable higher attendance.
- All tools and lifestyle curriculum materials used in the study were shared with the participating site manager on completion of the study for sustained dissemination to all staff.
- Even under challenging and unusual circumstances, this study achieved reductions in cardiometabolic risk factors.

6.4 Challenges experienced

- COVID-19 and the hard lockdown, with its restriction of movement and rapid spread of the virus, meant that the start date for the study was deferred by one year to March 2022.
- A post-COVID-19, face-face return to the worksite after two years of hybrid or work from home options created a challenging and uncertain time for both employees and the researchers conducting field work accross multiple sites.
- Implementing interventions across multiple sites had some challenge in terms of logistics and resources (time and staffing); good communication skills, project management skills and perseverance were essential.
- Access to resources like a private room for the blood draws, or access to projectors, screens and a quiet venue to host the lifestyle classes was challenging to secure.
- Participants could opt out of the study at any point, which increased the loss to follow-up.

6.5 Limitations of the study

- A costing of the intervention was not conducted to advise cost implementations for a CO and CB implementation.
- This intervention timeline was directly influenced by the worksite production schedule, peak production periods and plant shutdowns.
- With regard to participant adherence, encouraging employees to adhere to lifestyle changes and meet lifestyle goals that were set at the start of the program, was challenging.
- The 24-hour food recall and physical activity was self-reported and may be subject to bias.
- The food service contractors at the sites had a pre- signed service level agreement in place, thus commitment from them to change some aspects within the food environment was challenging.

6.6 Recommendations

- This study can serve as a blueprint which could be tested at several other types of worksites in SA to determine how these worksites would respond to a study of this nature (outside the context of COVID).
- Spill-over benefits and effect from the intervention to filter to families and their communities, must be explored through follow-up studies.
- A longitudinal study must be undertaken to compare the impact of CO and CB type interventions at worksites in SA.
- The intervention cost must be cross-checked with the economic value realised from absenteeism, presenteeism, employee turnaround and wellbeing post intervention to compare the actual gains against the planned.
- This study will benefit from the inclusion of a step to include worksite health champions to help support and motivate employees who are trying to reduce cardiometabolic risk..
- To promote employee wellness, worksites must adopt health days aimed at: promoting one or more of the following: screening for NCDs, increasing PA to 30 minutes per day, promoting healthy eating and by offering demand driven lifestyle education information sessions.
- Government and educational institutions must romote awareness and a culture of self-responsibility towards managing NCD risk factors, in particular, for BP, through the development of targeted educational tools. For example, a BP chart suitable for both healthcare workers as well as the general population, can generate interest and understanding of one's BP measurements.This may help mitigate apathy and help to foster a sense of awareness and self-responsibility.
- Worksites that offer wellness interventions and have onsite occupational health nurses (OHNs), should assist employees with goal setting to reduce cardiometabolic risk factors, as well as follow-up to support employees with their targeted risk reduction goals.
- Future studies of this nature will benefit from including a stronger focus on mental health. The pre-post consults noted above, were taken up by many staff and overlapped with a need for general mental health wellness and support. It is not discounted that part of this need may be attributed to the fact that this study was conducted during the traumatic post COVID-19 lockdown and return to work.
- Strong commitment is required and should thus be leveraged with all stakeholders at the outset and reinforced during each pre-post intervention.
- Government, through legislation, must further regulate the food and beverage manufacturing industries e.g. through timely inflation-linked increases to the Health Promotion Levy on sugar sweetened beverages (Boachie, Thsehla and Hofman 2022: 454), i.e., the 4g/100ml threshold for sugar sweetened beverages, and through additional regulation of other beverages e.g. 100% fruit juices (Swart 2020: para. 6) Even modest changes can have a positive effect on cardiometabolic risk factors. Other modifiable risk factors like alcohol and smoking cessation should be expanded upon in lifestyle intervention programmes.

- Worksites with canteen facilties must develop a worksite food and beverage guideline for implementation and to support the provisioning of healthy food and beverages. This document can have the dual purpose of securing profit while also promoting health and wellbeing.

6.7 Conclusion

This randomised control trial findings indicated that there is potential to modify cardiometabolic risk factors using both CO as well as CB interventions at worksites in SA. Timely screening for NCD risk factors can also be successfully incorporated into the intervention design. Communities embedded within such environments can play an important role in supporting such interventions thus ensuring greater adherence and success. Thus, there is implied success potential for such interventions in other community settings like schools, universities, religious groups and so forth. Such a model would help to spread the access to screening and intervention measures aimed at combating the prevalence of NCDs. While this study design was tested at both production and office type worksites, to get a more complete insight on its effectiveness, it is advisable for the design to be tested on other types of worksites in SA, that were not covered in this study design. This alludes to the opportunity for improvement of employee cardiometabolic health at other worksites. Given the demonstrated potential for both CO and CB interventions to elicit a positive reduction of NCD risk, even under a challenging COVID-19 step-lockdown period, there are many gains for organisations that invest resources towards CO or CB type interventions aimed at improving employee health. Collectively, improved employee health has potential gains for the organisation, their employees and the country as a whole. Scope exists to improve the effectiveness of the outcome through more integrated communication and support from the different role players including human resources, shift supervisors, management, occupational health nurses and through the election of employee health champions.

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APPENDICES

APPENDIX A

Gate Keeper Permission – Unilever

Unilever South Africa
(Pty) Ltd.
15 Nollsworth Crescent
Nollsworth Park
La Lucia Ridge Office Estate
La Lucia 4051

P O Box 4923 Durban 4000

Telephone (031) 570 3000
Facsimile (031) 570 3600

5/05/2021

To whom it may concern

This letter serves to confirm that Unilever South Africa approves the study research titled, "Acceptability, feasibility and effectiveness of a worksite intervention to lower cardiometabolic risk in South Africa: SA Pioneer Worksite Study" taking place at our worksites.

Thank you or the opportunity to participate.

Yours Sincerely,

Dr DA Viljoen

Head Medical and Occupational Health Services Unilever South Africa

Gate Keeper Permission – Retailability

RETAILABILITY (PTY) LTD

15 Nollsworth Crescent
Nollsworth Park
La Lucia Ridge Office Estate
La Lucia 4051

T. 031 0100 800
E. enquiries@retailability.co.za
W. www.retailability.co.za

1 March 2022

To whom it may concern

This letter serves to confirm that Retailability approves the study research titled, "Acceptability, feasibility, and effectiveness of a worksite intervention to lower cardiometabolic risk in South Africa: SA Pioneer Worksite Study" taking place at our worksite.

Thank you for the opportunity to participate.
Yours Sincerely,

Keli Bell
People, Communications, and Branding Specialist

APPENDIX B

Durban University of Technology (DUT) Institutional Research and Ethical Clearance (IREC)

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

15 October 2021

Mrs E S Singh
28B Furness Avenue
Berea

Dear Mrs Singh

Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa
Ethics Clearance Number: 080/20

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the data collection tool has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letter.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC Standard Operating Procedures (SOP's).

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely,

Prof J K Adam
Chairperson: IREC

APPENDIX C1

Copy of Power Point ® slides Informing Staff About the Screening

Invite: "Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa."

1

- Good day, my name is Evonne Singh.
- I am a Doctor of Philosophy in Food and Nutrition (PhD) student at the Durban University of Technology (DUT) undertaking a research titled "Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa."
- I would like to invite you to participate in the above research partnered with Harvard University, Yale, DUT and the South African Medical Research Council (SAMRC).
- Research is a step-by-step search for new knowledge in a variety of areas. The results can be used to advise informed decisions, in this case, to support and sustain employee health through health wellness programs at a worksite.

Background:

- Type 2 diabetes and cardiometabolic diseases including cardiovascular diseases have moved to the second and third cause of death and disability in South Africa.
- South Africa is facing an increase in the prevalence of overweight and obesity, an increase in the consumption of high energy-dense foods and beverages, and a decrease in physical activity.
- There is strong evidence that lifestyle change, particularly weight loss, increasing physical activity, and improving diet quality can prevent or delay diabetes and reduce cardiometabolic risk factors such as elevated glucose, plasma lipids (fat), and blood pressure.
- Employees spend 6-7 hours at their worksite.
- Worksite interventions can be used to facilitate healthy food choices, health education, and social support.
- This type of support is especially important given COVID-19 and comorbidities: Higher risk with obesity, diabetes and hypertension

Outline of the procedures:

• Worksite interventions can help facilitate healthy food choices, health education, and social support and can provide an important way to implement certain cardiovascular disease prevention efforts. This study will measure the effectiveness of a canteen and a lifestyle education intervention to lower the prevalence of prediabetes and prehypertension.

• This participation opportunity is available to all employees and has 2 steps.

- **Step 1** of the research is to use a 10-point inclusion/exclusion screening tool to establish employee suitability to participate in the study. Step one will include 8 questions.
- **Step 2** of the screening will include one finger prick and one 5mmol/L fasting blood draw which will be used to measure cardio-metabolic outcomes (HbA1c, blood pressure and fasting blood glucose).

  Finger prick and blood draw will be administered by a SANAS accredited laboratory and minimal post needle soreness is expected. Any residual blood samples will be disposed of using a SANAS accredited service provider. Minimal post-needle soreness is expected.

- **Confidentiality**: personal information shared with the researcher will be deidentified and remain confidential, your identify will be protected.
- Step 2 of the screening will take place at a suitable venue allocated by the worksite, COVID guidelines will apply.
- Your employer has granted permission for the study to be conducted for the duration of the study with no adverse consequences to you. Taking part in this screening process will not affect your work commitments negatively as the anticipated time is 30 minutes and could be scheduled and completed prior to start of the workday.

• COVID guidelines that will be adhered to:

- Hand Sanitising (provided by SAMRC funding)
- Maintaining social distance
- Wearing of face masks to cover nose and mouth (participants own)
- Provision of sanitised pencils to complete documents
- Adhering to the stipulated number of people in the venue at a given time
- Adhering to the worksite COVID health checker
- Where possible, lifestyle education classes will be conducted online.

- Taking part in this study is voluntary based and you are entitled to withdraw at any time. You have the right to take your time in making decisions about participating in this research. You may discuss your decision with your family, your friends and/or your doctor. If you decide to participate in this 2-step prescreening for the research, you will be asked to sign the consent form. A copy of the signed form will be provided to you for your record. It is your choice whether or not to participate. If you choose to participate, you may change your mind and leave the study at any time.
- You are free to ask questions and get clarity or more information you may need.

Benefits:

- Many employees may not be aware of their health status – it is important that staff go for regular health check so that they are more aware of their risk factors and may take an active role in preventative measures where possible.
- Current evidence indicates that health and wellness programs at worksites provide numerous benefits with respect to altering cardiovascular risk factor profiles. Implementing health programs at worksites allows for the opportunity to continually engage adults for positive and sustainable lifestyle choices.
- Employee team spirit and motivation can also help to drive and sustain such interventions. Given the current COVID crisis and its crippling impact on employees emotional and physical wellbeing, nudges and guidance provided via such health and wellness programs have beneficial spin off to both employees and employers.
- There is also potential for employees to carry good practices beyond the worksite, to their family and friends.

Why me?: benefit potential

- Please feel free to ask as many questions as you would like, to understand this research. You are also welcome to discuss this study with your family, friends and your doctor. You are under no obligation to commit at this stage. You will also be given a copy of the Letter of information, which provides detailed information on this study, to take home so you may decide if you would like to be part of this study.

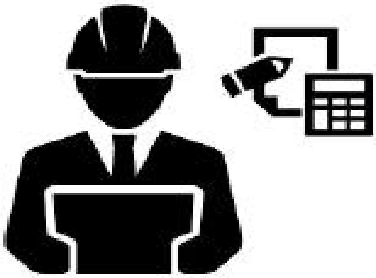
Thank you,

Evonne

Appendix C2

Copy of Information to Share at Departmental Meetings

Invite letter to participate in research.



Good day, my name is Evonne Singh.

- I am a Doctor of Philosophy in Food and Nutrition (PhD) student at the Durban University of Technology (DUT) undertaking a research titled "Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa."
- I would like to invite you to participate in the above research partnered with Harvard University, Yale, DUT and the South African Medical Research Council (SAMRC).
- Research is a step-by-step search for new knowledge in a variety of areas. The results can be used to advise informed decisions, in this case, to support and sustain employee health through health wellness programs at a worksite.

Background:

- Type 2 diabetes and cardiometabolic diseases including cardiovascular diseases have moved to the second and third cause of death and disability in South Africa.
- South Africa is facing an increase in the prevalence of overweight and obesity, an increase in the consumption of high energy-dense foods and beverages, and a decrease in physical activity.
- There is strong evidence that lifestyle change, particularly weight loss, increasing physical activity, and improving diet quality can prevent or delay diabetes and reduce cardiometabolic risk factors such as elevated glucose, plasma lipids (fat), and blood pressure.
- Employees spend 6-7 hours at their worksite.
- Worksite interventions can be used to facilitate healthy food choices, health education, and social support.
- This type of support is especially important given COVID-19 and comorbidities: Higher risk with obesity, diabetes, and hypertension.

Outline of the procedures:

- Worksite interventions can help facilitate healthy food choices, health education, and social support and can provide an important way to implement certain cardiovascular disease prevention efforts. This study will measure the effectiveness of a canteen and a lifestyle education intervention to lower the prevalence of prediabetes and prehypertension.
- This participation opportunity is available to all employees and has 2 steps.

- **Step 1** of the research is to use a 10-point inclusion/exclusion screening tool to establish employee suitability to participate in the study. Step one will include 8 questions.
- **Step 2** of the screening will include one finger prick and one 5mmol/L fasting blood draw which will be used to measure cardio-metabolic outcomes (HbA1c, blood pressure and fasting blood glucose).

  Finger prick and blood draw will be administered by a SANAS accredited laboratory and minimal post needle soreness is expected. Any residual blood samples will be disposed of using a SANAS accredited service provider. Minimal post-needle soreness is expected.

- **Confidentiality:** personal information shared with the researcher will be deidentified and remain confidential, your identify will be protected.
- Step 2 of the screening will take place at a suitable venue allocated by the worksite, COVID guidelines will apply.
- Your employer has granted permission for the study to be conducted for the duration of the study with no adverse consequences to you. Taking part in this screening process will not affect your work commitments negatively as the anticipated time is 30 minutes and could be scheduled and completed prior to start of the workday.

- COVID guidelines that will be adhered to:
- Hand Sanitising (provided by SAMRC funding)
- Maintaining social distance
- Wearing of face masks to cover nose and mouth (participants own)
- Provision of sanitised pencils to complete documents
- Adhering to the stipulated number of people in the venue at a given time
- Adhering to the worksite COVID health checker
- Where possible, lifestyle education classes will be conducted online.

- Taking part in this study is voluntary based and you are entitled to withdraw at any time. You have the right to take your time in making decisions about participating in this research. You may discuss your decision with your family, your friends and/or your doctor. If you decide to participate in this 2-step prescreening for the research, you will be asked to sign the consent form. A copy of the signed form will be provided to you for your record. It is your choice whether or not to participate. If you choose to participate, you may change your mind and leave the study at any time.
- You are free to ask questions and get clarity or more information you may need.

Benefits:

- Many employees may not be aware of their health status – it is important that staff go for regular health check so that they are more aware of their risk factors and may take an active role in preventative measures where possible.
- Current evidence indicates that health and wellness programs at worksites provide numerous benefits with respect to altering cardiovascular risk factor profiles. Implementing health programs at worksites allows for the opportunity to continually engage adults for positive and sustainable lifestyle choices.
- Employee team spirit and motivation can also help to drive and sustain such interventions. Given the current COVID crisis and its crippling impact on employees emotional and physical wellbeing, nudges and guidance provided via such health and wellness programs have beneficial spin off to both employees and employers.
- There is also potential for employees to carry good practices beyond the worksite, to their family and friends.

Why me?: benefit potential

- Please feel free to ask as many questions as you would like, to understand this research. You are also welcome to discuss this study with your family, friends and your doctor. You are under no obligation to commit at this stage. You will also be given a copy of the Letter of information, which provides detailed information on this study, to take home so you may decide if you would like to be part of this study.

Thank you,

Evonne

APPENDIX D

Infographics Advising About and Inviting Employees to Participate in the Research Study

KNOW YOUR NUMBERS – WELLNESS DRIVE

EFFECTIVENESS OF A CANTEEN AND A BEHAVIOURAL INTERVENTION TO LOWER CARDIOMETABOLIC RISK IN SOUTH AFRICA

WHY PARTICIPATE:

Type 2 diabetes and hypertension are a growing health concern and is a leading cause of death globally
Importantly, more than 45.4% of people are undiagnosed.
How to secure your share of health and wellness?
Know your health numbers.

Participate in the Unilever- Durban University of Technology, worksite study by coming to our screening process to find out your numbers.
Then take part in our planned efforts to help find the most effective way, to help you be the healthiest you!

Your participation has potential for significant health benefit for you and millions of South Africans.
We would love to help you to make a difference; and to provide solutions for a healthier you!

KNOW YOUR NUMBERS:

- blood pressure,
- (fasting) blood sugar,
- Body Mass Index (BMI)
- cholesterol
- triglycerides

and take ACTION
Having 3 raised markers can put you at risk for metabolic syndrome.

IF YOUR NUMBERS ARE NOT OPTIMAL:

Please participate…
- Make the choice to rework your numbers
- Make the choice to re-energise
- Make the choice to be healthy for yourself and your family

…..We can help

RESEARCH INDICATORS:

Type 2 diabetes and hypertension can be managed through
- lifestyle changes,
- weight loss,
- increasing physical activity, and
- by improving one's food choices

ROAD TO WELLNESS:

By making small adjustments to your lifestyle, you have potential for a healthier you. We look forward to being part of your road to wellness!! Thank you!

COVID-19 guidelines that will be adhered to:

Hand sanitising;
wearing face masks to cover mouth and nose (participants own);
Provision of sanitised pencils to complete documents; Adhering to the stipulated number of people in the venue at a given time;

Adhering to the worksite COVID health checker;
Where possible, lifestyle education classes will be conducted Online.

For more information on this research please feel free to contact Dr Ashika Naicker on 031 373 2333 or ashikan@dut.ac.za Alternately, please contact Evonne Singh on 031 373 2335 or evonnes@dut.ac.za

APPENDIX E

Letter of Information – Two-step Screening Process

LETTER OF INFORMATION – TWO STEP SCREENING PROCESS

Title of the Research Study:

"Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa."

Principal Investigator/s/researcher: (Name, qualifications)
Evonne Singh, Med

Brief Introduction and Purpose of the Study:

Good Day and thank you for the opportunity to share the details of this upcoming research with you.

I am a post graduate student doing research at DUT for my degree in Doctor of Philosophy in Food and Nutrition.

I would like to invite you to participate in the research. Research is a step-by-step search for new knowledge in a variety of areas. I would love to answer any questions you may have on my study. Please feel free to ask as many questions as you would like, to understand this research. You are also welcome to discuss this study with your family, friends, and your doctor. You are under no obligation to commit at this stage. You will also be given a copy of the Letter of information, which provides detailed information on this study, to take home so you may decide if you would like to be part of this study.

Outline of the procedures:
Worksite interventions can help facilitate healthy food choices, health education, and social support and can provide an important way to implement certain cardiovascular disease prevention efforts. This pioneer study will measure the effectiveness of a canteen and a lifestyle education intervention on cardio-metabolic risk at your worksite. Prediabetes and prehypertension can be reversed.
The aim of this initial phase of the research is to use a 10-point inclusion/exclusion screening tool to establish employee suitability to participate in the study. COVID-19 worksite guidelines will be adhered during data collection such as:

- Hand sanitising
- Maintaining social distance
- Wearing of face masks to cover nose and mouth (participants own)
- Provision of sanitised pencils to complete documents
- Adhering to the stipulated number of people in the venue at a given time
- Adhering to the worksite COVID health checker
- Where possible, lifestyle education classes will be conducted online.

<u>Outline of the Screening process:</u>

- We will conduct a two-step screening process to check employee eligibility to participate in the research study.
- All employees are legible for the screening.
- Step one will include 8 questions.
- Step two will include blood pressure measurement; one finger prick and one veinous draw for two 5mmol/L blood draws, to total 10ml, which will be used to measure cardio-metabolic outcomes (HbA1c and fasting blood glucose).
- Finger prick and blood draw will be administered by a SANAS accredited laboratory. Any residual blood samples will be disposed of using a SANAS accredited service provider.
- Screening will take place at a suitable venue allocated by the worksite, COVID guidelines noted below, applies to any face-to-face session/s.
- Your employer has granted permission for the study to be conducted for the duration of the study with no adverse consequences to you.
- Taking part in this screening process will not affect your work commitments negatively as the anticipated time is 30 minutes and could be scheduled and completed prior to start of the workday.

Risks or Discomforts to the Participant:

- Minimal post-needle soreness is expected.

Explain to the participant the reasons he/she may be withdraw from the Study:

- Taking part in this study is voluntary based and you are entitled to withdraw at any time. You have the right to take your time in making decisions about participating in this research. You may discuss your decision with your family, your friends and/or your doctor. If you decide to participate in this screening for the research, you will be asked to sign the consent form. A copy of the signed form will be provided to you for your record. It is your choice whether to participate. If you choose to participate, you may change your mind and leave the study at any time.

Benefits:

- Many employees may not be aware of their health status – it is important that staff go for regular health check so that they are more aware of their risk factors and may take an active role in preventative measures where possible. Current evidence indicates that health and wellness programs at worksites provide numerous benefits with respect to altering cardiovascular risk factor profiles. Implementing health programs at worksites allows for the opportunity to continually engage adults for positive and sustainable lifestyle choices. Employee team spirit and motivation can also help to drive and sustain such interventions. Given the current COVID crisis and its crippling impact on employees emotional and physical wellbeing, nudges and guidance provided via such health and wellness programs have beneficial spin off to both employees and employers. There is also potential for employees to carry good practices beyond the worksite, to their family and friends.

Renumeration:

- No payment will be offered for your participation in the study.

Costs of the study:

- You will not be expected to pay for anything during participation.

Confidentiality:

- Personal information shared with the researcher will be deidentified and remain confidential and will be included in the study by using a mix of alphabets and numbers to code information and to protect your identify and guaranteed non traceability to you.

Results:

- The results of this study will be shared with your worksite to enable the worksite to support employee wellness and wellbeing.
- If the program is shown to be feasible, acceptable, effective, and cost effective at your worksite, the results of this study will be used to make recommendations and dissemination plans on how to implement and sustain lifestyle interventions at other worksites in South Africa.
- It is also envisaged the findings of this research will be published in peer reviewed journals and presented and national and international conferences.

Research-related Injury:

- No research related injury is anticipated.

Storage of all electronic and hard copies including tape recordings:

- Data will be stored at DUT for the stipulated 5-year period, under lock and key, in the departmental archives on level 3, S9, Steve Biko Campus, Department of Food and Nutrition. The departmental secretary holds the key to the storage area which has restricted access. After 5 years, the data will be shredded, and any audio deleted.
- Any residual blood samples will be disposed of using a SANAS accredited service provider.

Persons to contact in the Event of Any Problems or Queries:

Please contact the researcher: Evonne Singh, M Ed, cell number 0848101701 or email evonnes@dut.ac.za,
Supervisor: Dr A. Naicker, PhD: Nutrition, cell number: 0313732333 or email ashikan@dut.ac.za or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support Dr L Linganiso on 031 373 2577 or researchdirector@dut.ac.za.

DUT DURBAN UNIVERSITY OF TECHNOLOGY INSTITUTIONAL RESEARCH ETHICS COMMITTEE

INCWADI YEMININININGWANE

Isihloko socwaningo:
"Ukusebenza kwe-nkantini kanye nokungenelela kokuziphatha ukunciphisa ingozi ye-cardiometabolic eNingizimu Afrika."

Umcwaningi oyinhloko: Evonne Singh, Med

Isingeniso esifushane nenhloso yocwaningo:
Usuku oluhle, ngiyabonga ngethuba lokwabelana nawe ngemininingwane yalolu cwaningo oluzayo.

Ngingumfundi oyi- post graduate ngenza ucwaningo e-DUT ngeziqu zami zeDoctor of Philosophy in Food and Nutrition.

Ngithanda ukuthatha lelithuba ngikumeme ukuthi ubambe iqhaza kulolu cwaningo. Ucwaningo luwukusesha kwesinyathelo ngesinyathelo solwazi olusha emikhakheni eyahlukene. Ngingathanda ukuphendula noma yimiphi imibuzo ongase ube nayo ngocwaningo lwami. Sicela ukhululeke ukubuza imibuzo eminingi ngendlela ongathanda ngayo, ukuze uqonde lolu cwaningo. Wamukelekile futhi ukuthi uxoxe ngalolu cwaningo nomndeni wakho, abangani kanye nodokotela wakho. Awuphoqelekile ukuthi uzinikele kulesi sigaba. Uzophinde unikezwe ikhophi yeNcwadi yolwazi, ehlinzeka ngolwazi oluningi ngalolu cwaningo, ozoya nayo ekhaya ukuze unqume ukuthi ungathanda yini ukuba yingxenye yalolu.

Chaza izinqubo:

Ukungenelela kwendawo yokusebenza kungasiza ekukhetheni ukudla okunempilo, imfundo yezempilo, kanye nokwesekwa komphakathi futhi kunganikeza indlela ebalulekile yokusebenzisa imizamo ethile yokuvimbela izifo zenhliziyo. Lesi sifundo sokuphayona sizokala ukuphumelela, we-canteen kanye nokungenelela kwezemfundo yokuphila engozini ye-cardio-metabolic endaweni yakho yokusebenza. I-Prediabetes kanye ne-prehypertension ingahlehliswa. Inhloso yalesi sigaba sokuqala socwaningo ukusebenzisa ukuhlungwa kwamaphuzu ayi-10 okufakwa/okungafakwa ithuluzi lokuhlola ukuze sungulwe ukufaneleka kwabasebenzi ukubamba iqhaza ocwaningweni. Imihlahlandlela yendawo yokusebenza ye-COVID-19 izolandelwa ngesikhathi sokuqoqwa kwedatha efana nale:

- Ukuhlanza izandla
- Ukugcina ibanga elide phakathi kwabantu
- Ukugqoka imaski yobuso ukuvala ikhala nomlomo
- Ukuhlinzekwa kwamapensela ahlanzekile ukuze kugcwaliswe amadokhumenti
- Ukuhambisana nenani elibekiwe labantu endaweni ngesikhathi esithile
- Ukulandela umhloli wezempilo we-COVID endaweni yokusebenza
- Lapho kungenzeka khona, amakilasi emfundo yendlela yokuphila azoqhutshwa ku-inthanethi
- Sizokwenza inqubo yokuhlola enezinyathelo ezimbili ukuze sihlole ukufaneleka kwabasebenzi ukubamba iqhaza ocwaningweni locwaningo
- Bonke abasebenzi bavumelekile ukuthi bahlolwe
- Isinyathelo sokuqala sizofaka imibuzo engu-8
- Isinyathelo sesibili sizobandakanya ukukala umfutho wegazi; ukuhlaba komunwe owodwa kanye nokudonsa kwemithambo okukodwa kokudonsa igazi okubili okungu-5mmol/L, kube yisamba esingu-10ml, ezosetshenziselwa ukukala imiphumela ye-cardio-metabolic (HbA1c kanye nokuzila ukudla kweglucose yegazi)

- Ukuhlaba iminwe nokudonsa igazi kuzophathwa ilabhorethri egunyaziwe ye-SANAS. Noma yimaphi amasampuli egazi ayinsalela azolahlwa kusetshenziswa umhlinzeki wesevisi ogunyaziwe we-SANAS.
- Ukuhlolwa kuzokwenziwa endaweni efanelekile eyabelwe indawo yokusebenza, Imihlahlandlela ye-COVID ephawulwe ngezansi, isebenza kunoma yisiphi isikhathi sobuso nobuso.

- Umqashi wakho unikeze imvume yokuthi ucwaningo luqhutshwe phakathi nesikhathi socwaningo ngaphandle kwemiphumela emibi kuwe.

- Ukubamba iqhaza kule nqubo yokuhlola ngeke kuthinte izibopho zakho zomsebenzi ngendlela engafanele njengoba isikhathi osilindele siyimizuzu engama-30 futhi singahle sihlelwe futhi siqedwe ngaphambi kokuqala kosuku lomsebenzi.

Izingozi noma Ukungaphatheki kahle Kobambe iqhaza:
- Ubuhlungu obuncane bangemuva kwenaliti kulindelekile.

Chazela umhlanganyeli izizathu zokuthi angahoxa Ocwaningweni:

- Ukubamba iqhaza kulolu cwaningo kusekelwe ngokuzithandela futhi unelungelo lokuhoxa noma nini. Unelungelo lokuthatha isikhathi sakho ekwenzeni izinqumo ngokubamba iqhaza kulolu cwaningo. Ungaxoxa ngesinqumo sakho nomndeni wakho, abangani bakho kanye/noma nodokotela wakho. Uma unquma ukubamba iqhaza kulokhu kuhlolelwa ucwaningo, uzocelwa ukuthi usayine ifomu lemvume. Ikhophi yefomu esayiniwe izonikezwa wena ukuze uthole irekhodi lakho. Kungukuzikhethela ukuthi ubambe iqhaza noma cha. Uma ukhetha ukubamba iqhaza, ungashintsha umqondo wakho futhi ushiye ucwaningo noma nini.

Izinzuzo:
Abasebenzi abaningi bangase bangasazi isimo sabo sempilo - kubalulekile ukuthi abasebenzi bayohlolwa njalo impilo ukuze bazazi izinto eziyingozi futhi babambe iqhaza elibonakalayo ezinyathelweni zokuvimbela lapho kungenzeka khona. Ubufakazi bamanje bukhombisa ukuthi izinhlelo zezempilo nempilo enhle ezindaweni zokusebenza zinikeza izinzuzo eziningi maqondana nokuguqula amaphrofayili wesici esiyingozi senhliziyo. Ukusebenzisa izinhlelo zezempilo ezindaweni zokusebenza kuvumela ithuba lokuxoxisana nabantu abadala ngokuqhubekayo ukuze bakhethe indlela yokuphila enempilo futhi eqhubekayo. Umoya weqembu labasebenzi kanye nogqozi nakho kungasiza ekuqhubeni nasekusimamiseni ukungenelela okunjalo. Uma kubhekwa inkinga yamanje ye-COVID nomthelela wayo okhubazayo kubasebenzi ngokomzwelo kanye nokuphila kahle ngokomzimba, ukugudluzwa kanye neziqondiso ezinikezwa ngalezo zinhlelo zezempilo nempilo enhle zinenzuzo kubo bobabili abasebenzi nabaqashi. Kukhona futhi amathuba okuthi abasebenzi baziphathe ngale kwendawo yokusebenza, nase emndenini nakubangani babo.

Iholo:
- Awukho umholo wemali wokubamba iqhaza ocwaningweni.

Izindleko Zocwaningo:
- Ngeke ulindeleke ukuthi ukhokhele noma yini ngesikhathi ubambe iqhaza kulogcwaningo.

Ukugcinwa kuyimfihlo:
- Ulwazi lomuntu siqu olwabiwe nomcwaningi aluzodalulwa futhi luhlale luyimfihlo futhi luzofakwa ocwaningweni ngokusebenzisa inhlanganisela yezinhlamvu nezinombolo ukuze kufakwe ikhodi yolwazi kanye nokuvikela ukuhlonza kwakho nokuqinisekisa ukuthi awulandeleki kuwe.

Imiphumela:

- Imiphumela yalolu cwaningo izokwabelwana nenkampani yakho ukuze inkampani ikwazi ukusekela impilo nempilo yabasebenzi.
- Uma uhlelo luboniswa ukuthi luyenzeka, lwamukeleka, lusebenza ngempumelelo futhi lungabizi kakhulu endaweni yakho yokusebenza, imiphumela yalolu cwaningo izosetshenziselwa ukwenza izincomo nezinhlelo zokusabalalisa mayelana nendlela yokusebenzisa kanye nokusimamisa ukungenelela kwendlela yokuphila kwezinye izindawo zokusebenza eNingizimu Afrika.
- Kuphinde kubhekwe ukuthi okutholwe yilolu cwaningo kuzoshicilelwa emaphephandabeni abuyekezwe futhi kwethulwe kanye nezinkomfa zikazwelonke nezamazwe ngamazwe.

Ubungozi noma Ukungaphatheki kahle kobambe iqhaza:

- Abukho ubungozi obungaba khona kuwe, uma ubamba iqhaza kulolu cwaningo.

Ukugcinwa kwawo wonke amakhophi e-elekthronikhi kanye namakhophi aqinile okuhlanganisa aqoshiwe:

- Idatha izogcinwa e-DUT isikhathi esinqunyiwe seminyaka emihlanu, ngaphansi kokhiye nokhiye, endaweni yokugcina umlando yomnyango esezingeni 3, S9, Steve Biko Campus, Department of Food and Nutrition. Unobhala womnyango nguyena ophethe ukhiye wendawo yokugcina okunemingcele yokungena. Ngemva kweminyaka engu-5, idatha izosikwa, futhi noma yimuphi umsindo uzosuswa.
- Noma yimaphi amasampuli egazi ayinsalela azolahlwa kusetshenziswa umhlinzeki wesevisi ogunyaziwe we-SANAS.

Abantu ongabathintana nabo Esimeni sanoma Iziphi Izinkinga noma Imibuzo:
Sicela uxhumane nomphenyi: Evonne Singh, M Ed, cell number 0848101701 or email evonnes@dut.ac.za
Umphathi: Dr A. Naicker, PhD: Nutrition, inombolo yeselula: 0313732333 or email ashikan@dut.ac.za noma I-DUT-Institutional Research Ethics Administrator ku 031 373 2375. Izikhalazo zingabikwa kuMqondisi: Ucwaningo kanye Nokwesekwa Kwabaneziqu Zokufunda Dr Linganiso ku-0313732577 noma researchdirector@dut.ac.za

APPENDIX F

Consent Pre-Screening

CONSENT PRE-SCREENING

Full Title of the Study: "Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa."

Names of Researcher/s: Evonne Singh

Statement of Agreement to Participate in the Research two step screening process:

- I hereby confirm that I have been informed by the researcher, (Evonne Singh), about the nature, conduct, benefits, and risks of this study - Research Ethics Clearance Number: ___________,
- I have also received, read, and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- I am aware that there will be a finger prick and one blood draw at the second step of the research.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I am aware that COVID guidelines must be adhered to.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during this research which may relate to my participation will be made available to me.

______________________ ___________ _______ ________________

Full Name of Participant **Date** **Time** **Signature/Right Thumbprint**

I, _______________ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

___________________ ___________ _____________________

Full Name of Researcher **Date** **Signature**

___________________ ___________ _____________________

Full Name of Witness (If applicable) **Date** **Signature**

IMVUME

Isihloko socwaningo: "Ukusebenza kwe-nkantini kanye nokungenelela kokuziphatha ukunciphisa ingozi ye-cardiometabolic eNingizimu Afrika."

Amagama omcwaningi: Evonne Singh

Isitataimende Sesivumelwano Sokuba Iqhaza Ocwaningweni Locwaningo:

- Ngiyaqinisekisa ukithi ngazisiwe umcwaningi,_____________ mayelana nobunjalo, ukuziphatha, izinzuzo kanye nobungozi balolu cwaningo- Inombolo yemvume yezimiso zokuziphatha:_____________
- Ngiphinde ngathole, ngifunde futhi ngaqonda ulwazi olubhalwe ngenhla (Incwadi Yolwazi Lobambiqhaza) mayelana nocwaningo.
- Ngiyazi ukuthi imiphumela yocwaningo, ukuhlanganisa imininingwane yomuntu isiqu mayelana nobulili, ubudala, usuku lokuzalwa, amagama okuqala kanye nokuxilongwa kuzocutshungulwa ngokungaziwa kwenziwe umbiko wocwaningo.
- Ngiyazi ukuthi kuzoba nokuhlaba umunwe bese kudonswa igazi elilodwa esinyathelweni sesibili socwaningo.
- Ngokubheka izidingo zocwaningo, ngiyavuma ukuthi idatha eqoqwe phakathi nalolu cwaningo ingacutshungulwa ohlelweni lwekhompuyutha ngumcwaningi.
- Ngiyazi ukuthi imihlahlandlela ye-COVID kufanele ilandelwe.
- Ngingakwazi, kunoma yisiphi isigaba, ngaphandle kokubandlulula, ngihoxise imvume yokubamba iqhaza ocwaningweni.
- Ngibe nethuba elanele lokubuza imibuzo futhi (ngokuzithandela kwami) ngazitshela ukuthi ngikulungele ukuhlanganyela esifundweni.
- Ngiyaqonda ukuthi okutholakele okusha okubalulekile okuthuthukiswe phakathi nalolu cwaningo okungenzeka kuhlobane nokubamba kwami iqhaza kuzokwenziwa kutholakale kimi.

___________________	__________	__________	__________________
Igama lakho eliphelele (Noma isithupha)	**Usuku**	**Isikhathi**	**Sayina**

Mina, _______________________ngiyavuma ukuthi obhalwe ngaphezulu uchazeliwe ngokuphelele ngalolucwaningo.

___________________	__________	__________	__________________
Igama lomcwaningi	**Usuku**	**Isikhathi**	**Sayina**
________________	__________	__________	__________________
Igama likafakazi	**Usuku**	**Isikhathi**	**Sayina**

APPENDIX G

Screening Criteria Questionnaire

SCREENING CRITERIA

Employee name: ____________________________ Date: ___________ March/April 2022

Cell number: _______________________________ Section: _________________________

Issue letter of information. Apply pre-screening consent form (Appendix D), employees response indicates:

ELIGIBILITY CRITERIA

1. Are you a permanent employee of this worksite a) Yes ___ (b) No ___
2. Gender: Male___________ Female_____________ Non Binary __________
3. (If female), are you currently pregnant? (a) Yes ___ (b) No ___ (c) Unsure ___
4. What is your race group: ______________________
5. Has a doctor ever told you that you have diabetes? (a) Yes ___ (b) No ___
6. Are you currently taking any medicines for diabetes? (a) Yes ___ (b) No ___
7. Has a doctor ever told you that you hypertensive (a) Yes ___ (b) No ___
8. Are you currently taking any medicines for hypertension? (a) Yes ___ (b) No ___
9. How many times do you purchase food from the worksite canteen? ____

Apply Pre-screening consent form (Appendix D), employee responses indicate:

(a) Agree ___ (b) Disagree _____Interview ends

Part 1:

Fasting blood Glucose	Blood pressure	Blood pressure
/mmol/L	/ mmHg	/ mmHg

Part 2:

HbA1C
/mmol/L

Based on eligibility criteria, the employee is:

a suitable candidate for participation in the study ☐ not a suitable candidate for participation in the study ☐

APPENDIX H

Follow-up Letter of Information to Participate Further in the Research Study

FOLLOW UP LETTER OF INFORMATION

Title of the Research Study:

"Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa."

Principal Investigator/s/researcher: (Name, qualifications)

Evonne Singh, Med

Brief Introduction and Purpose of the Study:

Good Day and thank you for the opportunity to share the details of this upcoming research with you.

I am a post graduate student doing research at DUT for my degree in Doctor of Philosophy in Food and Nutrition.

I would like to invite you to participate further in this research. Research is a step- by-step search for new knowledge in a variety of areas. I would love to answer any questions you may have on my study. Please feel free to ask as many questions as you would like, to understand this research. You are also welcome to discuss this study with your family, friends, and your doctor. You are under no obligation to commit at this stage. You will also be given a copy of the Follow Up Letter of information, which provides detailed information on this study, to take home so you may decide if you would like to be part of this study.

Outline of the Procedures:

- Worksite interventions can help facilitate healthy food choices, health education, and social support and can provide an important way to implement certain cardiovascular disease prevention efforts. This pioneer study will measure the effectiveness of a canteen and a lifestyle education intervention on cardio-metabolic risk at your worksite. Prediabetes and prehypertension can be reversed.
- The aim of this secondary phase of the research is to establish the following:
  - the effect a canteen and behavioural intervention will have on the improvement of cardio metabolic risk factors.
  - the effect a canteen and behavioural intervention will have on diabetes risk independently and combined?
  - the effect a canteen and behavioural intervention have on dietary behaviour.
  - COVID-19 worksite guidelines will be adhered during data collection such as:
  - Hand sanitising
- Maintaining social distance
- Wearing of face masks to cover nose and mouth (participants own)
- Provision of sanitised pencils to complete documents
- Adhering to the stipulated number of people in the venue at a given time

- Adhering to the worksite COVID health checker
- Where possible, lifestyle education classes will be conducted online.

- 180 consenting full-time employees with elevated blood pressure, fasting blood sugar, or glycosylated haemoglobin (HbA1c) will be recruited. At baseline (start), we will measure demographic variables, lifestyle factors, diet, anthropometry (proportions of ones' body), fasting blood sugar, HbA1c, triglyceride, total cholesterol, high density lipoprotein and low-density lipoprotein.
- After the baseline and the formative results, we will implement the physical environment and canteen intervention for 3 months to offer a healthier diet and to promote physical activity.
- Interviews/meetings will take place at a suitable venue allocated by the worksite, alternatively, these may be conducted online. COVID guidelines noted below, applies to any face-to-face session/s.
- Then, participants will be randomized into two groups to receive a behavioural intervention (canteen and behaviour) comprised of canteen intervention plus 6 weeks of lifestyle education sessions, while the other group will receive a canteen-only intervention.
- One veinous blood draw will be implemented to collect two vials of 5ml each, to total 10 ml during this phase of the study.
- The blood draw will be used to measure cardio-metabolic outcomes (HbA1c and lipids (high density lipoproteins, low density lipoproteins, triglycerides, and total cholesterol). Blood pressure will be measured, and body mass index (BMI) will be calculated: at baseline and 6 months.
- The total duration of the study inclusive of the 3-month follow-up is approximately 1 year.
- Your employer has granted permission for the study to be conducted for the duration of the with no adverse consequences to you.
- Taking part in this study will not affect your work commitments negatively as the canteen intervention will be offered within the workplace operating hours and meal periods. The lifestyle education classes will be offered online on teams, for participants to take at a convenient time within the 16-week schedule. Data will be provided to enable this alternatively, these can also be offered face to face at a time suitable for participants prior to, after work or during lunch.

Risks or Discomforts to the Participant:
- Minimal post-needle soreness is expected.

Explain to the participant the reasons he/she may be withdraw from the Study:

- Taking part in this study is voluntary based and you are entitled to withdraw at any time. You have the right to take your time in making decisions about participating in this research. You may discuss your decision with your family, your friends and/or your doctor. If you decide to participate in this screening for the research, you will be asked to sign the consent form. A copy of the signed form will be provided to you for your record. It is your choice whether to participate. If you choose to participate, you may change your mind and leave the study at any time.

Benefits:
- Many employees may not be aware of their health status – it is important that staff go for regular health check so that they are more aware of their risk factors and may take an active role in preventative measures where possible. Current evidence indicates that health and wellness programs at worksites provide numerous benefits with respect to altering

- cardiovascular risk factor profiles. Implementing health programs at worksites allows for the opportunity to continually engage adults for positive and sustainable lifestyle choices. Employee team spirit and motivation can also help to drive and sustain such interventions. Given the current COVID crisis and its crippling impact on employees emotional and physical wellbeing, nudges and guidance provided via such health and wellness programs have beneficial spin off to both employees and employers. There is also potential for employees to carry good practices beyond the worksite, to their family and friends.

Renumeration:

- No payment will be offered for your participation in the study.

Costs of the study:

- You will not be expected to pay for anything during participation.

Confidentiality:

- Personal information shared with the researcher will be deidentified and remain confidential and will be included in the study by using a mix of alphabets and numbers to code information and to protect your identify and guaranteed non traceability to you.

Results:

- The results of this study will be shared with your worksite to enable the worksite to support employee wellness and wellbeing.
- If the program is shown to be feasible, acceptable, effective, and cost effective at your worksite, the results of this study will be used to make recommendations and dissemination plans on how to implement and sustain lifestyle interventions at other worksites in South Africa.
- It is also envisaged the findings of this research will be published in peer reviewed journals and presented and national and international conferences.

Research-related Injury:

- No research related injury is anticipated.

Storage of all electronic and hard copies including tape recordings:

- Data will be stored at DUT for the stipulated 5-year period, under lock and key, in the departmental archives on level 3, S9, Steve Biko Campus, Department of Food and Nutrition. The departmental secretary holds the key to the storage area which has restricted access. After 5 years, the data will be shredded, and any audio deleted.
- Any residual blood samples will be disposed of using a SANAS accredited service provider.

Persons to contact in the Event of Any Problems or Queries:

Please contact the researcher: Evonne Singh, M Ed, cell number 0848101701 or email evonnes@dut.ac.za,
Supervisor: Dr A. Naicker, PhD: Nutrition, cell number: 0313732333 or email ashikan@dut.ac.za or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support Dr L Linganiso on 031 373 2577 or researchdirector@dut.ac.za.

INCWADI YEMININININGWANE

Isihloko socwaningo:
"Ukusebenza kwe-nkantini kanye nokungenelela kokuziphatha ukunciphisa ingozi ye-cardiometabolic eNingizimu Afrika."

Umcwaningi oyinhoko:
Evonne Singh, Med

Isingeniso esifushane nenhloso yocwaningo:
Ubuhlungu obuncane bangemuva kwenaliti kulindelekile.

Usuku oluhle, ngiyabonga ngethuba lokwabelana nawe ngemininingwane yalolu cwaningo oluzayo.

Ngingumfundi oyi- post graduate ngenza ucwaningo e-DUT ngeziqu zami zeDoctor of Philosophy in Food and Nutrition.

Ngithanda ukuthatha lelithuba ngikumeme ukuthi ubambe iqhaza kulolu cwaningo. Ucwaningo luwukusesha kwesinyathelo ngesinyathelo solwazi olusha emikhakheni eyahlukene. Ngingathanda ukuphendula noma yimiphi imibuzo ongase ube nayo ngocwaningo lwami. Sicela ukhululeke ukubuza imibuzo eminingi ngendlela ongathanda ngayo, ukuze uqonde lolu cwaningo. Wamukelekile futhi ukuthi uxoxe ngalolu cwaningo nomndeni wakho, abangani kanye nodokotela wakho. Awuphoqelekile ukuthi uzinikele kulesi sigaba. Uzophinde unikezwe ikhophi yeNcwadi yolwazi, ehlinzeka ngolwazi oluningi ngalolu cwaningo, ozoya nayo ekhaya ukuze unqume ukuthi ungathanda yini ukuba yingxenye yalolu.

Chaza izinqubo:
Ukungenelela kwendawo yokusebenza kungasiza ekukhetheni ukudla okunempilo, imfundo yezempilo, kanye nokwesekwa komphakathi futhi kunganikeza indlela ebalulekile yokusebenzisa imizamo ethile yokuvimbela izifo zenhliziyo. Lesi sifundo sokuphayona sizokala ukuphumelela, we-canteen kanye nokungenelela kwezemfundo yokuphila engozini ye-cardio-metabolic endaweni yakho yokusebenza. I-Prediabetes kanye ne-prehypertension ingahlehliswa.
Inhloso yalesi sigaba sesibili socwaningo ukusungula lokhu okulandelayo:

- Umthelela we-canteen kanye nokungenelela kokuziphatha okuzoba nawo ekuthuthukiseni izici eziyingozi ze-cardio metabolic.
- Umphumela ukungenelela kwecanteen kanye nokuziphatha kuzoba nayo engcupheni yesifo sikashukela ngokuzimela futhi kuhlangene?
- Imihlahlandlela yendawo yokusebenza ye-COVID-19 izolandelwa ngesikhathi sokuqoqwa kwedatha efana nale:
- Ukuhlanza izandla
- Ukugcina ibanga elide phakathi kwabantu
- Ukuhambisana nenani elibekiwe labantu endaweni ngesikhathi esithile
- Ukuhlinzekwa kwamapensela ahlanzekile ukuze kugcwaliswe amadokhumenti
- Ukulandela umhloli wezempilo we-COVID endaweni yokusebenza
- Lapho kungenzeka khona, amakilasi emfundo yendlela yokuphila azoqhutshwa ku-inthanethi.
- Izisebenzi ezivumayo eziyi-180 ezinomfutho wegazi ophakeme, ushukela wegazi ozila ukudla, noma i-glycosylated hemoglobin (HbA1c) zizocelwa ukuthi zibe inxenye yogcwaningo.

- Ekuqaleni (ukuqala), sizokala ukuguququguquka kwabantu, izici zokuphila, ukudla, i-anthropometry (izilinganiso zomzimba womuntu), ushukela wegazi ozila ukudla, i-HbA1c, i-triglyceride, i-cholesterol ephelele, i-high density lipoprotein kanye ne-low-density lipoprotein.
- Ngemuva kwesisekelo kanye nemiphumela yokudala, sizosebenzisa indawo engokoqobo kanye nenkantini yokungenelela izinyanga ezi-3 ukuze sinikeze ukudla okunempilo futhi sikhuthaze ukuzivocacavoca.
- Izingxoxiswano/imihlangano izoba endaweni efanelekile eyabelwe indawo yokusebenzela, uma kungenjalo, lezi zingaqhutshwa ku-inthanethi. Imihlahlandlela ye-COVID ephawulwe ngezansi, isebenza kunoma yisiphi isikhathi kwi seshini yoobuso nobuso.
- Ngemva kwalokho, ababambiqhaza bazohlukaniswa babe ngamaqembu amabili ukuze bathole ukungenelela kokuziphatha (inkantini nokuziphatha) okuhlanganisa ukungenelela kwenkantini kanye namaseshini angu-6 okufundisa ngempilo, kuyilapho elinye iqembu lizothola ukungenelela kwenkantini kuphela.
- Kuzothathwa igazi elilodwa lemithambo yegazi ukuze kuqoqwe izitsha ezimbili ezingu-5ml lilinye, ukuze libe nesamba esingu-10 ml phakathi nalesi sigaba socwaningo.
- Ukudonsa kwegazi kuzosetshenziselwa ukukala imiphumela ye-cardio-metabolic (HbA1c, umfutho wegazi kanye nomfutho wegazi osheshayo) futhi i-BMI izobalwa: ekuqaleni kanye nezinyanga ezingu-6.
- Ingqikithi yesikhathi socwaningo ehlanganisa nokulandelwa kwezinyanga ezi-3 cishe unyaka ongu-1
- Umqashi wakho unikeze imvume yokuthi ucwaningo luqhutshwe isikhathi eside ngaphandle kwemiphumela emibi kuwe.
- Ukuba nengxenye kulolu cwaningo ngeke kuphazamise izibopho zakho zomsebenzi ngendlela engafanele njengoba ukungenelela kwenkantini kuzokwenziwa phakathi namahora okusebenza emsebenzini nangezikhathi zokudla. Amakilasi emfundo yendlela yokuphila azokwenziwa kwi-inthanethi, ukuze ababambiqhaza bakwazi ukuba yigxenye yalamakilasi phakathi nohlelo lwamasonto ayi-16. Idatha izohlinzekwa ukuze lokhu kunikwe amandla ngenye indlela, lezi zingabuye zinikezwe ubuso nobuso ngesikhathi esifanele ababambiqhaza ngaphambi, ngemva komsebenzi noma phakathi nesidlo sasemini.

Izingozi noma Ukungaphatheki kahle Kobambe iqhaza:

- Ubuhlungu obuncane bangemuva kwenaliti kulindelekile.

Chazela umhlanganyeli izizathu zokuthi angahoxa Ocwaningweni:

- Ukubamba iqhaza kulolu cwaningo kusekelwe ngokuzithandela futhi unelungelo lokuhoxa noma nini. Unelungelo lokuthatha isikhathi sakho ekwenzeni izinqumo ngokubamba iqhaza kulolu cwaningo. Ungaxoxa ngesinqumo sakho nomndeni wakho, abangani bakho kanye/noma nodokotela wakho. Uma unquma ukubamba iqhaza kulokhu kuhlolelwa ucwaningo, uzocelwa ukuthi usayine ifomu lemvume. Ikhophi yefomu esayiniwe izonikezwa wena ukuze uthole irekhodi lakho. Kungukuzikhethela ukuthi ubambe iqhaza noma cha. Uma ukhetha ukubamba iqhaza, ungashintsha umqondo wakho futhi ushiye ucwaningo noma nini.

Izinzuzo:

- Abasebenzi abaningi bangase bangasazi isimo sabo sempilo kubalulekile ukuthi abasebenzi bayohlolwa njalo impilo ukuze bazazi izinto eziyingozi futhi babambe iqhaza elibonakalayo ezinyathelweni zokuvimbela lapho kungenzeka khona. Ubufakazi bamanje bukhombisa ukuthi izinhlelo zezempilo nempilo enhle ezindaweni zokusebenza zinikeza izinzuzo eziningi maqondana nokuguqula amaphrofayili wesici esiyingozi senhliziyo. Ukusebenzisa izinhlelo zezempilo ezindaweni zokusebenza kuvumela ithuba lokuxoxisana nabantu abadala ngokuqhubekayo ukuze bakhethe indlela yokuphila enempilo futhi eqhubekayo. Umoya weqembu labasebenzi kanye nogqozi nakho kungasiza ekuqhubeni nasekusimamiseni ukungenelela okunjalo. Uma kubhekwa inkinga yamanje ye-COVID nomthelela wayo okhubazayo kubasebenzi ngokomzwelo kanye nokuphila kahle ngokomzimba, ukugudluzwa kanye neziqondiso ezinikezwa ngalezo zinhlelo zezempilo nempilo enhle zinenzuzo kubo bobabili abasebenzi nabaqashi. Kukhona futhi amathuba okuthi abasebenzi baziphathe ngale kwendawo yokusebenza, nase emndenini nakubangani babo.

Iholo:

- Awukho umholo wemali wokubamba iqhaza ocwaningweni**.**

Izindleko Zocwaningo:

- Ngeke ulindeleke ukuthi ukhokhele noma yini ngesikhathi ubambe iqhaza kulogcwaningo.

Ukugcinwa kuyimfihlo:

- Ulwazi lomuntu siqu olwabiwe nomcwaningi aluzodalulwa futhi luhlale luyimfihlo futhi luzofakwa ocwaningweni ngokusebenzisa inhlanganisela yezinhlamvu nezinombolo ukuze kufakwe ikhodi yolwazi kanye nokuvikela ukuhlonza kwakho nokuqinisekisa ukuthi awulandeleki kuwe**.**

Imiphumela:

- Imiphumela yalolu cwaningo izokwabelwana nenkampani yakho ukuze inkampani ikwazi ukusekela impilo nempilo yabasebenzi.
- Uma uhlelo luboniswa ukuthi luyenzeka, lwamukeleka, lusebenza ngempumelelo futhi lungabizi kakhulu endaweni yakho yokusebenza, imiphumela yalolu cwaningo izosetshenziselwa ukwenza izincomo nezinhlelo zokusabalalisa mayelana nendlela yokusebenzisa kanye nokusimamisa ukungenelela kwendlela yokuphila kwezinye izindawo zokusebenza eNingizimu Afrika.
- Kuphinde kubhekwe ukuthi okutholwe yilolu cwaningo kuzoshicilelwa emaphephandabeni abuyekezwe futhi kwethulwe kanye nezinkomfa zikazwelonke nezamazwe ngamazwe.

Ubungozi noma Ukungaphatheki kahle kobambe iqhaza:

- Abukho ubungozi obungaba khona kuwe, uma ubamba iqhaza kulolu cwaningo.

Ukugcinwa kwawo wonke amakhophi e-elekthronikhi kanye namakhophi aqinile okuhlanganisa aqoshiwe:

- Idatha izogcinwa e-DUT isikhathi esinqunyiwe seminyaka emihlanu, ngaphansi kokhiye nokhiye, endaweni yokugcina umlando yomnyango esezingeni 3, S9, Steve Biko Campus, Department of Food and Nutrition. Unobhala womnyango nguyena ophethe ukhiye wendawo yokugcina okunemingcele yokungena. Ngemva kweminyaka engu-5, idatha izosikwa, futhi noma yimuphi umsindo uzosuswa.
- Noma yimaphi amasampuli egazi ayinsalela azolahlwa kusetshenziswa umhlinzeki wesevisi ogunyaziwe we-SANAS.

Abantu ongabathintana nabo Esimeni sanoma Iziphi Izinkinga noma Imibuzo:

Sicela uxhumane nomphenyi: Evonne Singh, M Ed, cell number 0848101701 or email evonnes@dut.ac.za

Umphathi: Dr A. Naicker, PhD: Nutrition, inombolo yeselula: 0313732333 or email ashikan@dut.ac.za noma I-DUT-Institutional Research Ethics Administrator ku 031 373 2375. Izikhalazo zingabikwa kuMqondisi: Ucwaningo kanye Nokwesekwa Kwabaneziqu Zokufunda Dr Linganiso ku-0313732577 noma researchdirector@dut.ac.za

APPENDIX I

Consent for Further Participation in the Study

CONSENT FOR FURTHER PARTICIPATION IN THE STUDY

Full Title of the Study: "Effectiveness of a canteen and a behavioural intervention to lower cardiometabolic risk in South Africa."

Names of Researcher/s: Evonne Singh

Statement of Agreement to Participate in the Research two step screening process:

- I hereby confirm that I have been informed by the researcher, (Evonne Singh), about the nature, conduct, benefits, and risks of this study - Research Ethics Clearance Number: ___________,
- I have also received, read, and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- I am aware that there will be one blood draw at this stage of the research.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I am aware that COVID guidelines must be adhered to.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during this research which may relate to my participation will be made available to me.

______________________ ___________ _______ _________________

Full Name of Participant **Date** **Time** **Signature/Right Thumbprint**

I, _______________ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

___________________ ___________ _____________________

Full Name of Researcher **Date** **Signature**

___________________ ___________ _____________________

Full Name of Witness (If applicable) **Date** **Signature**

IMVUME YOKUBAMBA IQHAZA OKWENGEZIWE OCWANINGWENI

Isihloko socwaningo: "Ukusebenza kwe-nkantini kanye nokungenelela kokuziphatha ukunciphisa ingozi ye-cardiometabolic eNingizimu Afrika."

Amagama omcwaningi: Evonne Singh

- Ngiyaqinisekisa ukithi ngazisiwe umcwaningi,_____________ mayelana nobunjalo, ukuziphatha, izinzuzo kanye nobungozi balolu cwaningo- Inombolo yemvume yezimiso zokuziphatha:_____________
- Ngiphinde ngathole, ngifunde futhi ngaqonda ulwazi olubhalwe ngenhla (Incwadi Yolwazi Lobambiqhaza) mayelana nocwaningo.
- Ngiyazi ukuthi imiphumela yocwaningo, ukuhlanganisa imininingwane yomuntu isiqu mayelana nobulili, ubudala, usuku lokuzalwa, amagama okuqala kanye nokuxilongwa kuzocutshungulwa ngokungaziwa kwenziwe umbiko wocwaningo.
- Ngiyazi ukuthi kuzothathwa igazi elilodwa kulesi sigaba socwaningo.
- Ngokubheka izidingo zocwaningo, ngiyavuma ukuthi idatha eqoqwe phakathi nalolu cwaningo ingacutshungulwa ohlelweni lwekhompuyutha ngumcwaningi.
- Ngiyazi ukuthi imihlahlandlela ye-COVID kufanele ilandelwe.
- Ngingakwazi, kunoma yisiphi isigaba, ngaphandle kokubandlulula, ngihoxise imvume yokubamba iqhaza ocwaningweni.
- Ngibe nethuba elanele lokubuza imibuzo futhi (ngokuzithandela kwami) ngazitshela ukuthi ngikulungele ukuhlanganyela esifundweni.
- Ngiyaqonda ukuthi okutholakele okusha okubalulekile okuthuthukiswe phakathi nalolu cwaningo okungenzeka kuhlobane nokubamba kwami iqhaza kuzokwenziwa kutholakale kimi.

________________	__________	__________	________________
Igama lakho eliphelele (Noma isithupha)	**Usuku**	**Isikhathi**	**Sayina**

Mina, ______________________ngiyavuma ukuthi obhalwe ngaphezulu uchazeliwe ngokuphelele ngalolucwaningo.

________________	__________	__________	________________
Igama lomcwaningi	**Usuku**	**Isikhathi**	**Sayina**
________________	__________	__________	________________
Igama likafakazi	**Usuku**	**Isikhathi**	**Sayina**

APPENDIX J

Non-disclosure Agreement

Good day,

This agreement is entered into on this __________day of ______________________ by and between

_____________________________ (the Researcher) and ____________________ (the participant), at

______________________location. This agreement will be in effect until the research ends 3 months

from the date of this signing on _________________________202__.

Why have a non -disclosure agreement?
A non-disclosure agreement is an important document intended to keep certain information confidential. Confidential information means that the information shared with you has limitations as to whom you are permitted to share such information with.

When conducting a research study like the one you are participating in currently, it may become necessary to protect the information process leading to the research outcomes and findings. This would relate to the content of the lifestyle classes you would attend in this research study.

This non-disclosure step is intended to ensure that the data gathered during the research, will not be compromised in any way. At all times, the research data gathered should reveal unique findings as these would naturally present rather than if all participants had to share information and due to this, all behave in a similar manner. If this were to happen, it would not be a true reflection of behaviour from a diverse group of participants and as a result, any unique and new findings will not emerge.

With whom may I share the information given to me in the course of this research?
You are free to share this information with family and friends as well as other employees who are in the same lifestyle classes as you. However, you may not share this information with any other colleagues.

What happens if I share the confidential information with my colleagues?
When an information breach occurs I.e., the confidential information is shared with a colleague at your workplace, then it would become unfortunately become necessary to exclude that participant from the research process and data collection.

How will I be protected?
All information shared with the researcher during the research period will be deidentified and kept confidential. You name will be coded so that it may not be traced back to you and you will remain anonymous in the research process, findings and in the workplace.

Should you have any concerns or further questions, please feel free to discuss this with me or to get clarity.

Thanking you,

Researcher: _____________________ Participant: ________________

Signature Signature

Appendix K

Socioeconomic and Lifestyle Questionnaire

FOOD AND NUTRITION CONSUMER SCIENCES

BASELINE SOCIOECONOMIC AND LIFESTYLE QUESTIONNAIRE

Interview start time...................... Date of interview (DD/MM/YYYY)................................

PARTICIPANT'S INTERVIEW

ID No __ ___ ___

This questionnaire covers certain aspects of your life, including work and personal details, health and illness and lifestyle that is relevant to health. The answers to these questions will be kept strictly confidential and the information will not be identifiable on any reports or publications.
Please answer all questions by marking the correct answer with X, except where otherwise indicated.

1. PERSONAL INFORMATION

1.1 When were you born? Year: Month: Day:

1.2 How old are you? years

1.3 Gender:

Male	Female

1.4 What is your mobile number? __ __ __ __ __ __ __ __ __ __

1.5 What is your race group?____________________

1.6 What is your marital status?__________________

1.7 What is the exact title of your current job?

1.8 Talking about the past year, what was your average earning? ___________ (per month)

2. EDUCATION AND LANGUAGE

2.1 What is your highest education level?

None	Primary School	Standard 8	Standard 10	College/FET	Other post school

2.2 What language is spoken mostly in the house?

____

Isizulu	Xhosa	English	Afrikaans	Sepedi	Sesotho
Setswana	siSwati	Tshivenda	Xitsonga	isiNdebele	

3. QUALITY OF LIFE AND MEDICAL HISTORY

NO	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP TO
3.1	Would you say your health is poor, average, good or very good/excellent?	Poor…………………………1 Average……………………2 Good………………………..3 Very good/ Excellent….4	
3.2	Do you personally think that you are underweight, normal weight or overweight?	Underweight………………1 Normal weight…………….2 Overweight………………..3 Don't know………………..5	
3.3	Has a **doctor or nurse or health worker** at a **clinic** or **hospital told you** that you have or have had any of the following conditions:		
3.3.1	High Blood Pressure?	Yes………………………….1 No……………………………2 Don't know……………..5	
3.3.2	Heart attack or angina (chest pains)?	Yes………………………….1 No…………………………..2 Don't know……………..5	
3.3.3	Stroke?	Yes…………………………..1 No……………………………2 Don't know………………5	
3.3.4	High blood cholesterol or fats in the blood?	Yes……………………………1 No…………………………….2 Don't know………………..5	
3.3.5	Diabetes or Blood Sugar?	Yes……………………………1 No………………………………2 Don't know………………..5	

3.4	Now I want to ask you about any medication you take		
3.4.1	Do you use any medication regularly or daily that a doctor or nurse has prescribed?	Yes…………………………..1 No…………………………...2 Don't know……………….5	4.
3.4.2	How many different medicines do you use regularly (more than once a month)?	Number of medicines _______	
3.4.3	List the names of medicines:		

4 SMOKING HABITS

NO.	QUESTIONS AND FILTERS	CODING CATEOGORIES	SKIP TO
4.1	Do you **currently smoke** any tobacco products such as cigarettes, cigars or pipes?	Yes 1 No 2	4.5
4.2	**How ol**d were you when you first **started** smoking daily?	Year old ____ Don't remember	
4.3	Approximately how many years have you been smoking?	Years_____	
4.4	On average, how many of the following items do you smoke each day? Manufactured cigarettes? Hand-rolled cigarettes? Pipes full of tobacco?	Manufactured cigarettes ☐ Hand-rolled cigarettes ☐ Pipes full of tobacco ☐	
4.5	**In the past**, did you ever smoke daily?	Yes 1 No 2	
4.6	**How old** were you when you **stopped** smoking?	Years old………. ☐☐ Don't remember…………….	
	ASSESSING USE OF SMOKELESS TOBACCO		
4.7	Do you **currently** use any smokeless tobacco, such as snuff or chewing?	Yes 1 No 2	5.

NO.	QUESTIONS AND FILTERS	CODING CATEOGORIES	SKIP TO
4.8	Do you currently use smokeless tobacco **daily**?	Yes 1 No 2	
4.9	On average, how many times do you use each of the following items per day? Snuff (by mouth) Snuff (by nose)? Chewing tobacco e-cigarettes Vaping	Snuff by mouth Snuff by nose Chewing tobacco e-cigarettes Vaping	

5 ALCOHOL USE

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
5.1	Have you ever consumed a drink that contains alcohol such as beer, wine, spirits or sorghum beer?	Yes 1 No 2	6
5.2	Was this within the past 12 months?	Yes 1 No 2	
5.3	In the past 12 months, how frequently have you had at least one drink? Read the answer categories to the participant		
5.4	When you drink alcohol on average how many drinks do you have during one day?		
5.5	During the past 7 days, how many standard drinks of any alcoholic drink did you have day?		

6 STRESS LEVELS

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES
6.1	How would you describe the stress level that you experience in life	1 Very low 2 Low 3 Medium 4 High 5 Very high
6.2	How would you relieve your stress (check all that would apply)	1 Nothing 2 Eat 3 Exercise 4 Watch television 5 Visit or call friends

		6 Pray 7 Read books 8 Smoke cigarettes 9 Have alcoholic beverages 10 Arts/crafts 11 Others: Specify

Thank you very much for your co-operation. We really appreciate your time.

APPENDIX L

Dietary Questionnaire

DIETARY QUESTIONNAIRE

Date of Interview: ______ /______/ ______

Day Month Year

Starting time of Interview (12 hr clock) ☐☐ Hrs ☐☐ Mins ☐☐ am/pm

Name of participant : ______________________________

Age (years) : ☐☐

OPEN ENDED QUESTIONS				
1	How often do you have the following meals outside home? ***(Mark the frequency as number of time(s) eaten, tick if "Never" eaten)***	***Breakfast*** Weekly ☐ Monthly. ☐ Never/Yearly ☐	***Lunch*** ☐ ☐ ☐	***Dinner*** ☐ ☐ ☐
2	Are you a? ***(Tick the appropriate box)***	Non- vegetarian Ovo vegetarian Latco vegetarian Vegetarian		☐ ☐ ☐ ☐
3	Indicate the oils & fat used for cooking ***(Mark in the order of usage as 1, 2, 3…..)***	Sunflower/Safflower Canola Olive oil Coconut Palm Others specify		☐ ☐ ☐ ☐ ☐ ☐

4.	What is the main staple item in your diet?	Maize meal Bread white Bread brown Rice Other	☐ ☐ ☐ ☐ ☐
5	What type of rice do you usually consume? ***(Tick the appropriate box)***	Long grain white rice Brown rice Basmathi white rice Basmathi brown rice Others specify __________	☐ ☐ ☐ ☐ ☐
6	Do you take any vitamin and / or mineral supplements? ***(Tick the appropriate box)*** If 'Yes', specify	Yes No 1. __________________ 2. __________________ 3. __________________	☐ ☐
7	Do you add salt on table/ while eating? Please specify the quantity if yes	Yes ☐ No ☐ ______Tsp/day, Pinch_____/day	

End time of interview: _____________________

APPENDIX M

24-Hour Food Recall

24–HOUR FOOD RECALL

Subject ID number: ____________________ Interviewer: ____________________

Name: ______________________________ Date: ________ / _______/ _______

Tick what the day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Would you describe the food that you ate yesterday as typical of your habitual food intake?

Yes	1	No	2

If not, why? ____

I want to find out about everything you ate or drank yesterday, including food that you picked from the field like herbs, mushrooms etc. Please tell me everything you ate from the time you woke up to the time you went to sleep. I will also ask you where you ate the food and how much you ate.

Time (approximately)	Place (Home, work, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
From waking up to going to work, or starting day's activities					

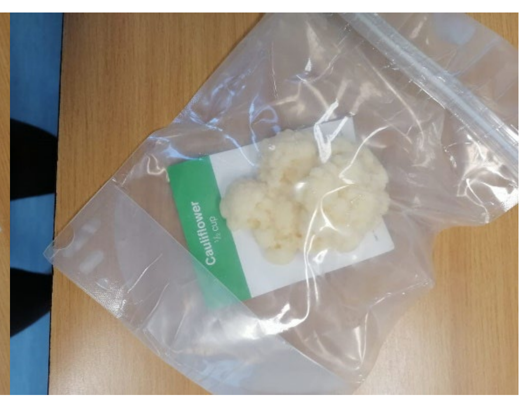
During the morning at work or at home					
Time (approximately	Place (Home, work, etc)	Description of food and Preparation method.	Amount	Amount in g (office use	Code (office use
				Only)	only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					
Time (approximately	Place (Home, work, etc)	Description of food and preparation method.	Amount	Amount in	Code (office

				g (office use Only)	use only)
After dinner, before going to sleep					

APPENDIX N

Snapshot of Food Models

Classification: Public



Classification: Public


Lifeform

Mashed Potatoes

Plain Yogurt

Butter Pats
5 pats
Calories
Sodium

HEALTH EDCO


Classification: Public


Fried Chicken Breast*
3 oz

APPENDIX O

Global Physical Activity Questionnaire

Name of the participant……………………………………………………..………Worksite:………………………………

Physical Activity			
Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. *[Insert other examples if needed].* In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.			
Questions		Response	Code
Activity at work			
1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like *[carrying or lifting heavy loads, digging or construction work]* for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 4*	P1
2	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days └─┘	P2
3	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P3 (a-b)
4	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads]* for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 7*	P4
5	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days └─┘	P5
6	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P6 (a-b)
Travel to and from places			
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. [insert other examples if needed]			
7	Do you walk or use a bicycle (*pedal cycle*) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to P 10*	P7
8	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days └─┘	P8
9	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P9 (a-b)
Recreational activities			
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure), [insert relevant terms].			
10	Do you do any vigorous-intensity sports, fitness or recreational (*leisure*) activities that cause large increases in breathing or heart rate like [*running or football,]* for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 13*	P10
11	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (*leisure*) activities?	Number of days └─┘	P11

12	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P12 (a-b)

Physical Activity (recreational activities) contd.			
Questions		Response	Code
13	Do you do any moderate-intensity sports, fitness or recreational *(leisure)* activities that causes a small increase in breathing or heart rate such as brisk walking,(*cycling, swimming, volleyball*)for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P16*	P13
14	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (*leisure*) activities?	Number of days └─┘	P14
15	How much time do you spend doing moderate-intensity sports, fitness or recreational (*leisure*) activities on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P15 (a-b)
Sedentary behaviour			
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping. *[INSERT EXAMPLES] (USE SHOWCARD)*			
16	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs min s	P16 (a-b)

Imibuzo yomzimba yomhlaba jikelele

Inombolo/Igama lendaba………………………………………..indawo yomsebenzi…………………………………..

Umsebenzi Womzimba			
Ngokulandelayo ngizokubuza mayelana nesikhathi osichitha ukwenza izinhlobo ezahlukene zokusebenza ngokomzimba ngesonto elijwayelekile. Ngicela uyiphendule imibuzo noma ungaziboni njengo muntu ojwayele ukuba matasa. Cabanga kuqala ngesikhathi osichitha wenza umsebenzi , cabanga into yokusebenza njengento okufanele uyenze njengomsebenzi okhokhelayo noma ongakhokhelwa, ukutadisha, ukuqeqesha, imisebenzi yasekhaya, ukuvuna ukudla noma izitshalo, ukudoba noma ukuzingela , funa umsebenzi. Ekuphenduleni imibuzo elandelayo "imisebenzi enamandla kakhulu yimisebenzi edinga umzamo onzima womzimba futhi kubangele ukwanda okukhulu ekuphefumuleni noma ngenhliziyo, imisebenzi enokulinganisela yimizamo edinga ukuzikhandla ngokomzimba futhi ibangele ukwanda okuncane ekuphefumuleni noma ngenhliziyo.			
Imibuzo		Impendulo	ikhodi
Izinto ozenzayo emsebenzini			
1	Ingabe umsebenzi wakho ufuna umsebenzi onamandla obangela ukwanda okukhulu ekuphefumuleni noma enhliziyweni [ukuthwala noma ukuphakamisa imithwalo enzima, ukumba noma umsebenzi wokwakha] okungenani imizuzu engu-10 ngokuqhubekayo?	Yebo 1 Cha 2 uma uthi cha iya ku P4	P 1
2	Ngeviki elijwayelekile zingaki izinsuku osebenzisa Amandla kakhulu njengengxenye yomsebenzi wakho?	Izinsuku ___________	P2
3	Singakanani isikhathi osichitha ukwenza imisebenzi enamandla okunamandla emsebenzini ngosuku olujwayelekile	Amahora: Imizuzu _____ :_____ Hora imizuzu	P3 (a-b)
4	Ingabe umsebenzi wakho uhilela ukusebenza okulinganiselayo okubangela ukunyuka okuncane ekuphefumuleni noma kwenhliziyo njengokuhamba okusheshayo [ngokuthwala umthwalo] okungenani imizuzu engu-10 ngokuqhubekayo?	Yebo 1 Cha 2 uma uthi cha iya ku P7	P4
5	Ngeviki elijwayelekile, zingaki izinsuku ozenzayo izinto ezilinganiselayo njengemisebenzi?	Izinsuku _________	P5
6	Uchitha isikhathi esingakanani ukwenza izinto ezilinganiselayo emsebenzini ngosuku olujwayelekile?	Amahora: imizuzu ____:_____ Hora: imizuzu	P6 (a-b)
Ukuya nokubuya endweni			
Imibuzo elandelayo ayifaki imisebenzi yemvelo osuvele uyishiyo. Manje ngithanda ukukubuza ngendlela evamile oya kuyo nakwezinye izindawo. Isibonelo ukusebenza, ukuthenga, ukuthengisa, indawo yokukhulekela. [faka ezinye izibonelo uma kudingeka]			
7	Uyahamba ngenyawo noma usebenzise ibhayisikili (unyikelezo wokuhamba) okungenani imizuzu engu-10 ngokuqhubekayo ukuze ufinyelele ezindaweni?	Yebo 1 Cha 2 uma uthi cha iya ku P10	P7
8	Eveikini elisezingenu eliphezulu, uhamba izinsuku ezingakaka noma usebenzisa ibhayisekili okungenani imizuzu engu-10 ngokuqhubekayo ukuze ufike ezindaweni?	Izinsuku ________	P8
9	Uchitha isikhathi esingakanani uhamba noma ungibele ibhayisekile osukwini?	Amahora: imizuzu ____:______ Ihora: imizuzu	P9
Imisebenzi yokuzijabulisa			
Imibuzo elandelayo ayifuki imsebenzi Kanye nokuthutha osukuvele ukushilo. Manje ngingathanda ukubuza mayelana nemidlalo, ukuqina nemisebenzi yokuzilibazisa [ukuzilibazisa], (faka imigomo ehambisanayo).			
10	Wenza noma yikuphi ukuzikhandla kwezemidlalo, ukuzivocavoca noma imisebenzi yokuzilibazisa eyenze ukwanda okukhulu kokuphefumula noma izinga lenhliziyo kufana nokugijima nomadlala ibhola okungenani imizuzu	Yebo 1 Cha 2 uma uthi cha iya ku P13	P10

	engu-10 ngokuqhubekayo? [faka isibonelo] (sebenzisa ama-showcards)		
11	Ngeviki elijwayelekile, zingaki izinsuku owenza imidlalo noma ezokugcebeleka ezindinga Amandla?	izinsuku	P11
12	Isikhathi esingakanani ojwayele ukwenza ezemidlalo edinga Amandla noma ezokungcebeleka?	Amahora: imizuzu _____:_____ Hora :imizuzu	P12
Umsebenzi womzimba (imisebenzi yokuzijabulisa) iyaqhubeka			
Imibuzo		impendulo	ikhodi
13	Wenza noma yikuphi ukulungiselela kwezemidlalo, ukufaneleka noma imisebenzi yoku zijabulisa eyenza ukwanda okwenziwe ukuphefumula noma ukushaya kwenhliziyo njengokuhamba okusheshayo, [ukuhamab ngebhayisekile, ukubhukuda, i-volleyball] okungenani imizuzu engu-10 ngokuqhubeka? [*faka isbonelo*] (*sebenzisa ama-showcard*)	Yebo 1 Cha 2 uma uthi cha iya ku P16	P13
14	Ngeviki elijwayelekile, zingaki izinsuku owenza imidlalo noma ukungcebeleka okudinga amandla	Izinsuku ______	P14
15	Isikhathi esingakanani ojwayele ukwenza ezemidlalo edinga Amandla noma ezokungcebeleka osukwini?	Amahora: imizuzu ______:_____ Hora: imizuzu	P15 (a-b)
Ukuziphatha okudlulile			
Umbuzo olandelayo ukhulum ngokuhlala noma ukuhlala emsebenzini, ekhaya ukuya nasezindaweni, noma nabangani kufaka phakathi isikhathi esichithekile (uhlezi etafuleni, uhlezi nabangani, uhamba ngezimoto, ibhasi, istimela, ukufunda, ukudlala – amakhadi noma ukubukela umabonakude), kodwa ungafaki iskhathi esichitha ukulala. *[faka isibonelo] (sebenzisa ama-showcard)*			
16	Ngosuku uchitha isikhathi esingakanani uhleli noma uhlezi	Amahora: imizuzu ___:_____ Hora:Imizuzu	P16 (a-b)

Other examples of SEDENTARY BEHAVIOUR during LEISURE TIME	• Reading • Watching television • During travelling with a car or public transport • Having dinner with friends • Lying on the beach • Playing board games

APPENDIX P

Contextualised Showcards Cards for Global Physical Activity Questionnaire

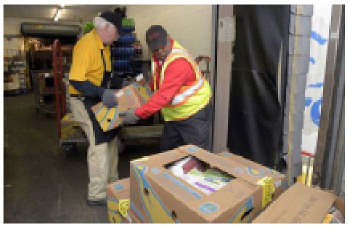
Physical Activity

Vigorous Physical Activity at Work

Examples for vigorous activities at WORK

VIGOROUS Intensity Activities
Make you breathe <u>much</u> harder than normal





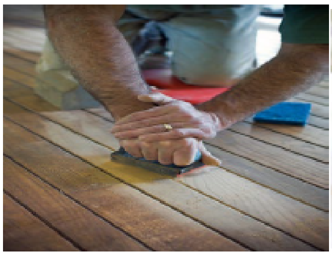

Other examples for VIGOROUS activities at WORK

- Forestry (cutting, chopping, carrying wood)
- Sawing hardwood
- Ploughing
- Cutting crops (sugar cane)
- Gardening (digging)
- Grinding (with pestle)
- Labouring (packing boxes pushing laden trolleys, shovelling sand)
- Loading furniture (stoves, fridge)
- Instructing spinning (fitness)
- Instructing sports aerobics
- Sorting postal parcels (fast pace)
- Cycle rickshaw driving

Moderate Physical Activity at Work

Examples for MODERATE activities at work

MODERATE Intensity Activities
Make you breathe somewhat harder than normal





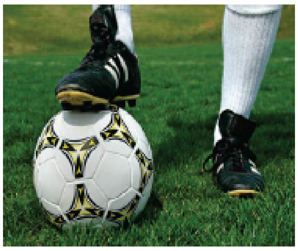

Other examples for MODERATE activities at WORK

- Cleaning (vacuuming, mopping, polishing, scrubbing, sweeping, ironing)
- Washing (beating and brushing carpets, wringing clothes (by hand)
- Gardening
- Milking cows (by hand)
- Planting and harvesting crops
- Digging dry soil (with spade)
- Weaving
- Woodwork (chiselling, sawing softwood)
- Mixing cement (with shovel)
- Labouring (pushing loaded wheelbarrow, operating jackhammer)
- Walking with load on head
- Drawing water
- Tending animals

Vigorous Physical Activity during Leisure Time

Examples for VIGOROUS activities during LEISURE TIME

VIGOROUS Intensity Activities
Make you breathe much harder than normal






Other examples for VIGOROUS activities during LEISURE TIME

- Soccer
- Rugby
- Tennis
- High-impact aerobics
- Aqua aerobics
- Ballet dancing
- Fast swimming

Moderate Physical Activity during Leisure Time

Examples for MODERATE activities during LEISURE TIME

MODERATE Intensity Activities
Make you breathe somewhat harder than normal






Other examples for MODERATE activities at WORK

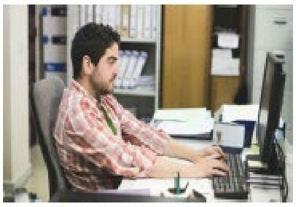
- Cycling
- Dancing
- Tai chi
- Pilates
- Cricket

*Jogging
*Horse-riding
*Yoga
* Low-impact aerobics

Sedentary BEHAVIOUR AT WORK

Examples of SEDENTARY BEHAVIOUR during WORK

SEDENTARY behaviour during work
Time spent sitting or reclining at the work place






Other examples of SEDENTARY BEHAVIOUR During WORK

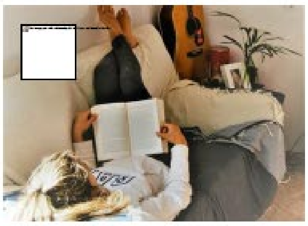
Sitting at meeting

- Staff workshops
- Forklift driving
- Answering calls
- Lunch time

SEDENTARY BEHAVIOUR during leisure time

Examples of SEDENTARY BEHAVIOUR during LEISURE TIME

SEDENTARY behaviour during leisure time
Time spent sitting or reclining during leisure time






APPENDIX Q

Food and Nutrition Consumer Sciences Anthropometric Measurements

FOOD AND NUTRITION CONSUMER SCIENCES
Anthropometric Measurements

Section A:

1. Number/Name of the subject…………………………………

2. Worksite:………………………………………………………………………..…

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Section B:

1. Body weight (kg)	1. Body weight (kg)	2. Height/Length (cm)	2. Height/Length (cm)
kg	kg	cm	cm

3. Waist circumference	3. Waist Circumference	4. Blood pressure	4. Blood pressure
cm	cm	/ mmHg	/ mmHg

5. Hip circumference	5. Hip Circumference
cm	cm

APPENDIX R

Food and Nutrition Consumer Sciences Laboratory Measurements

FOOD AND NUTRITION CONSUMER SCIENCES

Laboratory Measurements: Baseline and follow up

Section A:

1. Participant Id …………………………………

2. Worksite section :…………………………….

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Baseline:

5. HbA1C	6. Fasting blood glucose	7. HDL	8. LDL	9. Triglyceride	10. Total cholesterol
/mmol/L	/mmol/L	/mmol/L	/mmol/L	/mmol/L	/mmol/L

Follow up:

5. HbA1C	6. Fasting blood glucose	7. HDL	8. LDL	9. Triglyceride	10. Total cholesterol
/mmol/L	/mmol/L	/mmol/L	/mmol/L	/mmol/L	/mmol/L

APPENDIX S

Guidelines to Participants

<u>Dear participant, a few of these guidelines can help to assist you to manage your health markers.</u>

Please keep positive at working your health numbers, you can help yourself achieve optimal health and wellness 😊 please see guidelines below to help you manage your numbers.

<u>Diabetes Indicators on HbA1c test:</u>

5.6% and below 5.6% = *Normal*

Between 5.7- 6.4% = *Pre-diabetic*

6.5% and above = *Possibly diabetic, please also see your doctor*

<u>Manage prediabetes by:</u>

- Do frequent checks on your blood sugar and record your history. Take an active interest in knowing your numbers with action to help manage your health.
- Small amount of weight loss (if one is overweight, can also assist)
- Aim for a balanced diet (plate guide= non-starchy vegetables ½ plate, ¼ plate lean protein, ¼ plate grain or starch)
- Include 30 minutes of physical activity at least 3 x a week. Aim for 5x30 minutes per week.
- Eat small meals regularly *(Do not skip meals)*
- Get enough sleep.
- Increase whole grain foods and low glycemic index foods. *(Brown rice, brown or whole wheat bread, oats, barley, etc…)*
- *include lean meats, skinless chicken or turkey, fish, eggs, nuts, beans/chickpeas; non starchy vegetables e.g. greens, peppers, tomatoes, broccoli, carrots and starchy vegetables like corn, green peas potato etc.; include fruit and dairy in the diet*
- *limit the intake of foods high in salt, trans fats, saturated fats, or foods like candy, ice cream, baked goods, energy and sugary drinks*
- *drink plenty water, reduce alcohol consumption*
- *read food labels and select foods that are better for you*

<u>Hypertension Indicators</u>

Below 120/80mmHg is normal, 120 and above up to 139mmHg (systolic, top reading) or above 80 to 89mmHg (diastolic – down reading) = is pre-hypertension; grades 1 to 3 indicate hypertension (Refer to table). Higher readings, please see your doctor for ways to control your BP for optimal health.

BP category*	SBP		DBP
Normal	<120	and	<80
Optimal	120-129	and	<80
High normal	130-139	or	80-89
Hypertension			
Grade 1	140-159	or	90-99
Grade 2	160-179	or	100-109
Grade 3	≥ 180	or	≥110
Isolated systolic	≥140	and	<90
*Individuals with SBP and DBP in two categories should be designated to higher BP based on two or more careful readings obtained on two or more occasions.			

Reduce or manage hypertension by:

1. Manage your overall salt intake by:
- Avoiding extra salt or condiments, pickles, salad dressings, chutneys which often have hidden salts, fast and sugar.
- Avoid processed (biltong, cold meat, Vienna's, polony, bacon, smoked chicken) + canned foods.
- Decrease snacking on salty snack like chips, slated nuts, sweets and chocolates
- Season with herbs instead of salt and spices which often have hidden salts (e.g. chicken/fish spice).
- Buy lean and unprepared meats instead of that with added seasoning/sauces/marinades.
2. Maintain a healthy diet with plenty of fruit, vegetables, low fat dairy and reduced saturated fat intake.
3. Avoid smoking and limit alcohol intake.
4. Exercise at least 3 times a week for 30 minutes each time.
5. Decrease stress by using activities that help you relax (reading a book, gardening, yoga, meditation)
6. Take an active interest in knowing your numbers with action to help manage your health.

Cholesterol cutoffs used for prevention better than cure 'Know your numbers drive':

Numbers should be:

Total cholesterol: *below* 5*mmol/L*

HDL (good cholesterol): *above 1.2mmol/L (females) or above 1mmol/L for males*

Triglycerides: *below 1.7mmol/L*

LDL (bad cholesterol): *below 3mmol/L*

Reduce or manage cholesterol:

- Exercise at least 3 times a week for 30 minutes per session. Aim for 5x30 minutes per week.
- Target weight loss of even 2.5kg as this can also impact cholesterol levels
- Avoid smoking and limit alcohol intake.
- Reduce intake of saturated and trans fat *(Found in animal products, deep-fried foods, snacks etc...). Try to include lean meats, fish (pilchards, mackerel, salmon) and plant-based protein in one's diet*
- Make use of plant-based oils *(such as olive oil, canola oil).*
- Eat more soluble Fiber *(such as oats, brown rice/bread/pasta, legumes like beans, peas, lentils etc. and fresh fruit and vegetables).*
- *Take an active interest in knowing your numbers with action to help manage your health*

Please also chat to your doctor who can advise you further on any points of concern and if you have other conditions e.g. heart disease, previous strokes, or heart/kidney disease, or combination of conditions.

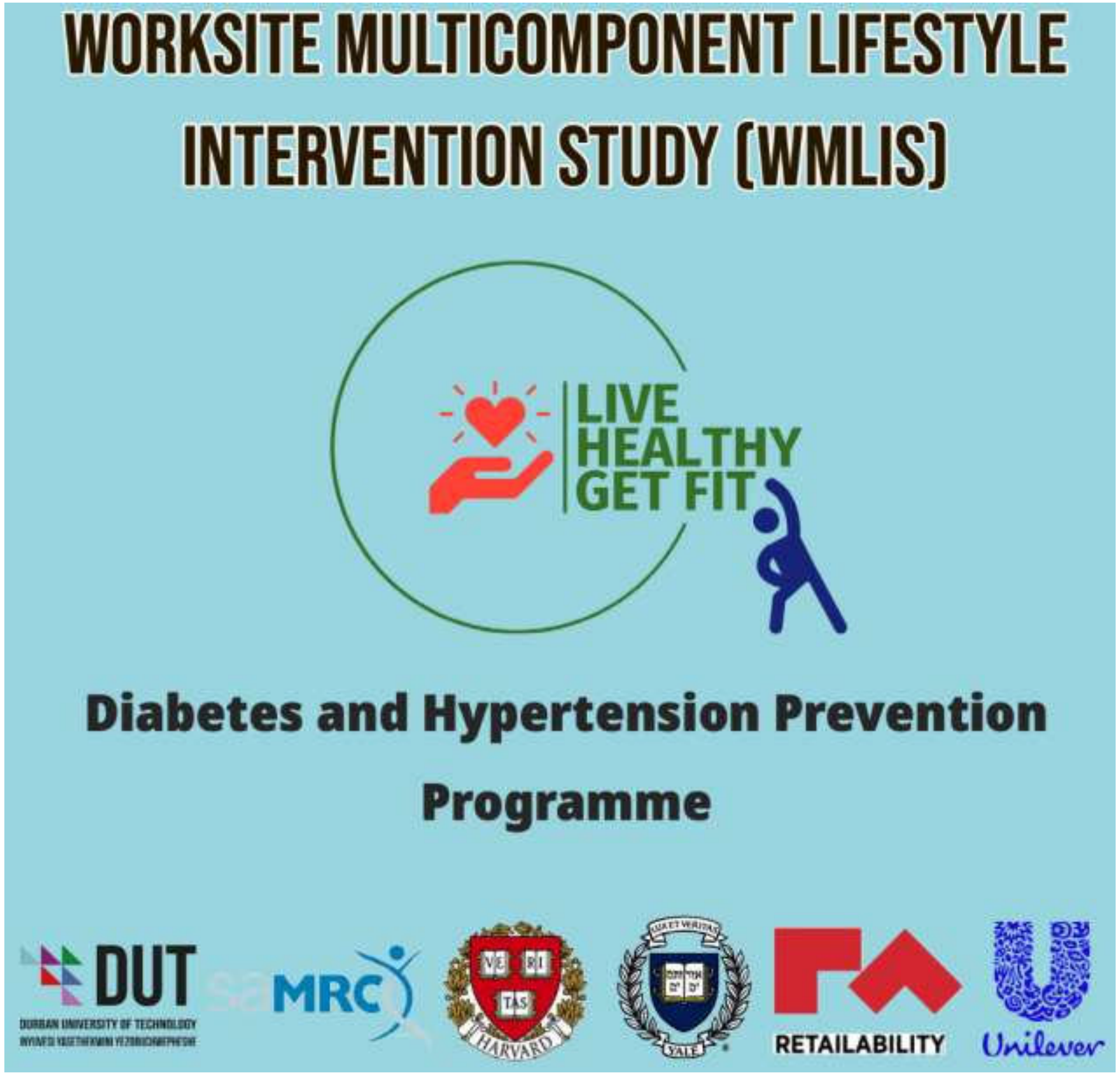
Many thanks and best wishes in your health management!

Team DUT

APPENDIX T

Lesson Teaching Aids and

Participant Handouts



LESSON 1: INTRODUCTION TO THE WORKSITE DIABETES AND HYPERTENSION PREVENTION PROGRAMME

Rules

- Be on time to the lifestyle classes.
- Switch phones onto silent.
- Let us know if you can’t make a meeting, we will assist you to find another slot.
- Complete the things you are supposed to do at home. Homework outside the group meetings is the **most important factor** in your success.

Objectives

In this session, you will:

- Meet the study team.
- Be provided with an overview of the diabetes and hypertension prevention programme.
- Learn about the study goals and your personal weight loss goal.
- Receive and learn how to use the study diet and physical activity diary.

Participant file and handouts

- Purpose of the participant file

Handout 1

<u>Lesson 1: Introduction to the diabetes and hypertension prevention programme</u>

Name: ____

My Lifestyle Coach is: ______________________________

Research coordinators contact information: Evonne Singh

Phone: 0848101701

Email: evonnes@dut.ac.za

Handout 2

Handout 2

Remember Your Purpose

Welcome to the Class

Take a moment to respond to these questions in the space provided below.

Why I joined the programme:

____

____

____

My goals in the program are:

____

____

____

Overview of the Diabetes and Hypertension prevention programme

DPP

More than 3000 adults took part in this study (US).

- Everyone in the study had prediabetes and each participant had an average weight of 93kg.
- Each person in the study were randomly assigned to a treatment.

1. Lifestyle change: 1000 participants focused on diet and being active
2. Medication: 1000 participants received Metformin
3. No treatment: 1000 participants- no intervention

Results:

1. Lifestyle change: Participants cut their risk by 58%
2. Medication: Participants cut their risk by 31%
3. No treatment: Participants had no change in the risk for type 2 diabetes

Welcome and introductions

Thobekile
Dlamuka
Lifestyle coach

Evonne Singh
Lead researcher

Shannon Pillay
Research assistant

Overview- Diabetes

Type	Blood Glucose (mg/dl)		HbA_{1c} (%)
	Fasting	post meal	
Normal	<100	<140	<5.6
Pre-Diabetes	≥100 to <126	≥140 - <200	>5.7 - ≤ 6.4
Diabetes	≥126	≥200	≥6.5

- What is diabetes?

-Type 2 diabetes is a disease caused by having too much sugar in our blood. The sugar in blood is called **glucose.**

-We get glucose from the food we eat. Our body breaks down all the sugar and starch we eat into glucose. Glucose is the basic fuel for the cells in our body.

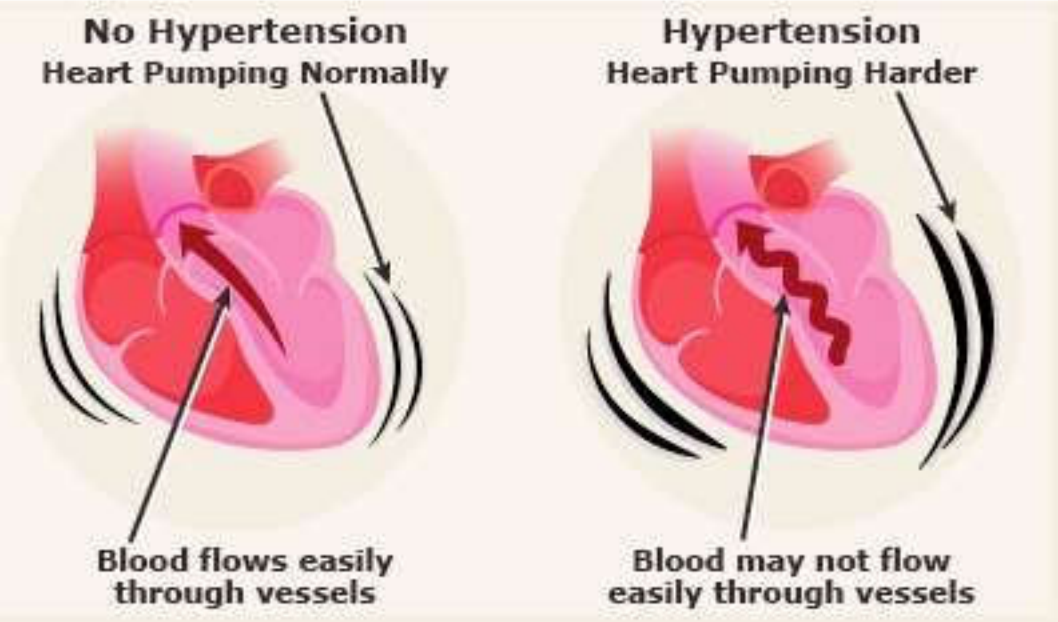
-Our bodies use a hormone called **insulin** to carry the glucose in our blood to the other cells in our body. The amount of glucose in our blood can get too high for two reasons: 1) our body does not have enough insulin or 2) our body does not use insulin properly.

-The glucose builds up in the blood instead of going into the cells, and we get diabetes. Diabetes can damage many parts of the body, including the heart, eyes, kidneys, and nerves.

-SA statistics

Overview- Hypertension

BP category*	SBP		DBP
Normal	<120	and	<80
Optimal	120-129	and	<80
High normal	130-139	or	80-89
Hypertension			
Grade 1	140-159	or	90-99
Grade 2	160-179	or	100-109
Grade 3	≥ 180	or	≥110
Isolated systolic	≥140	and	<90
*Individuals with SBP and DBP in two categories should be designated to higher BP based on two or more careful readings obtained on two or more occasions.			



Setting Goals

We want to to help improve your lifestyle by focusing on:

1. What you eat

   AND

2. How active you are

Your goals are to:

1. Lose 5% of your weight or maintain weight through healthy eating.

Your goal will be to weigh __________ kilograms (kg) or less.

2. Be more physically active.

Your goal is to do 150 minutes of moderate intensity physical activity each week. For example, walk 30 minutes on five days of the week.

Lifestyle coach and participant contract

Handout 5

Team Contract

We will count on you to:

- Attend sessions each week and bring your diet and physical activity diary
- Do your best to reach your eating and activity goals
- Keep track of your eating and activity every day and be honest
- Let your lifestyle coach know if you have any problems
- Stay willing and open to change

You can count on us to:

Increase Indent

- Follow our own advice
- Go over your records of what you eat and your activity and notice what you are doing well and what can be improved
- Answer your questions
- Be honest
- Stand by you during the hard times and believe you can reach your goals

We agree to work in the ways together described above:

Participant Signature: ______________________________ Date:______________________

Lifestyle Coach Signature: __________________________ Date: _____________________

Overview of lessons

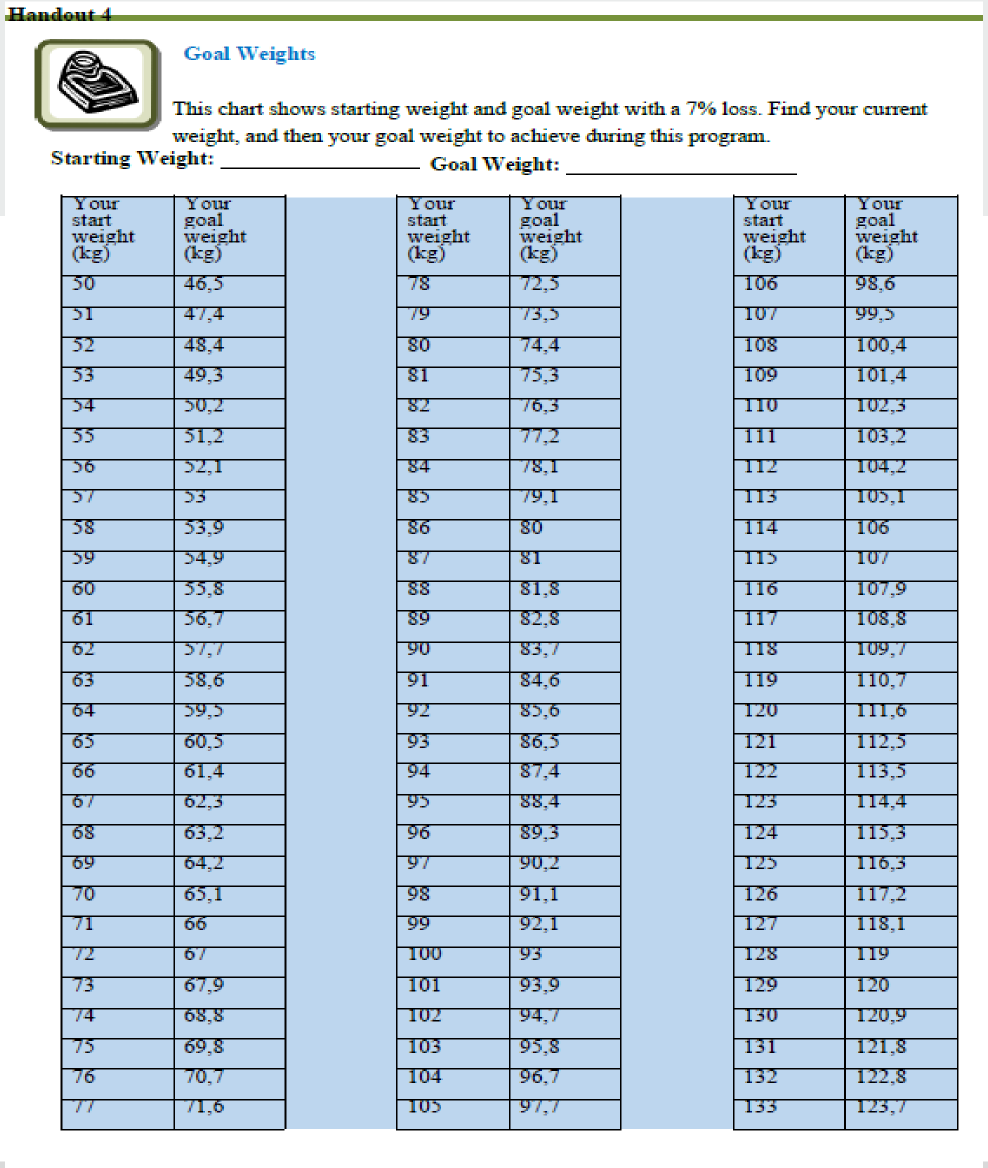
Handout 5

Weekly Lessons

Lesson	Topic
1	Welcome to the diabetes and hypertension prevention programme
2	Physical activity- Move your muscles
3	Healthy eating, portion sizes/ Physical activity
4	Identifying fats and carbs, salt intake/ Physical activity
5	Labelling and cooking/Physical activity
6	Stress management, alcohol and tobacco use/ Staying motivated/Physical activity

Each week teaches new aspects, so it is important to attend every class!

Goal Weights



Handout 4

Goal Weights

This chart shows starting weight and goal weight with a 7% loss. Find your current weight, and then your goal weight to achieve during this program.

Starting Weight: ______________ **Goal Weight:** ________________

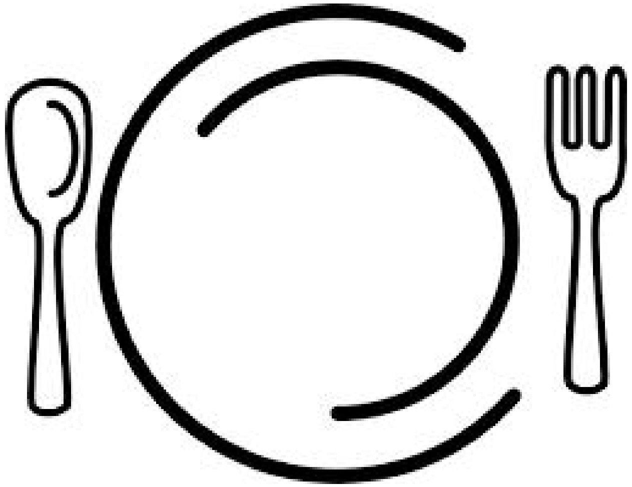
Your start weight (kg)	Your goal weight (kg)	Your start weight (kg)	Your goal weight (kg)	Your start weight (kg)	Your goal weight (kg)
50	46,5	78	72,5	106	98,6
51	47,4	79	73,5	107	99,5
52	48,4	80	74,4	108	100,4
53	49,3	81	75,3	109	101,4
54	50,2	82	76,3	110	102,3
55	51,2	83	77,2	111	103,2
56	52,1	84	78,1	112	104,2
57	53	85	79,1	113	105,1
58	53,9	86	80	114	106
59	54,9	87	81	115	107
60	55,8	88	81,8	116	107,9
61	56,7	89	82,8	117	108,8
62	57,7	90	83,7	118	109,7
63	58,6	91	84,6	119	110,7
64	59,5	92	85,6	120	111,6
65	60,5	93	86,5	121	112,5
66	61,4	94	87,4	122	113,5
67	62,3	95	88,4	123	114,4
68	63,2	96	89,3	124	115,3
69	64,2	97	90,2	125	116,3
70	65,1	98	91,1	126	117,2
71	66	99	92,1	127	118,1
72	67	100	93	128	119
73	67,9	101	93,9	129	120
74	68,8	102	94,7	130	120,9
75	69,8	103	95,8	131	121,8
76	70,7	104	96,7	132	122,8
77	71,6	105	97,7	133	123,7

Diet and Physical activity

Day of the Week: ____________ Date: ___________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		



Diet and Physical activity diary

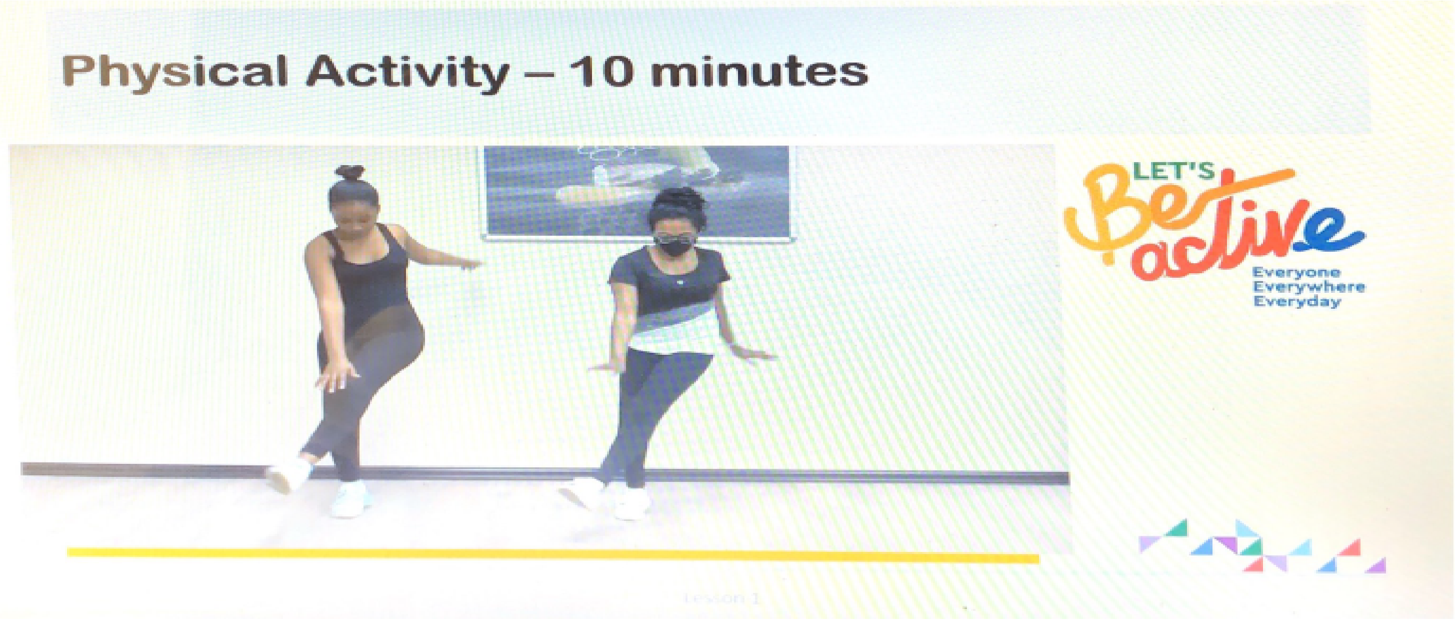
Day of the Week: ______________ Date: ____________

Physical Activity Diary

Time	Physical Activity Type	Duration

Daily Activity Goal: ____________________________________

Physical Activity – 10 minutes

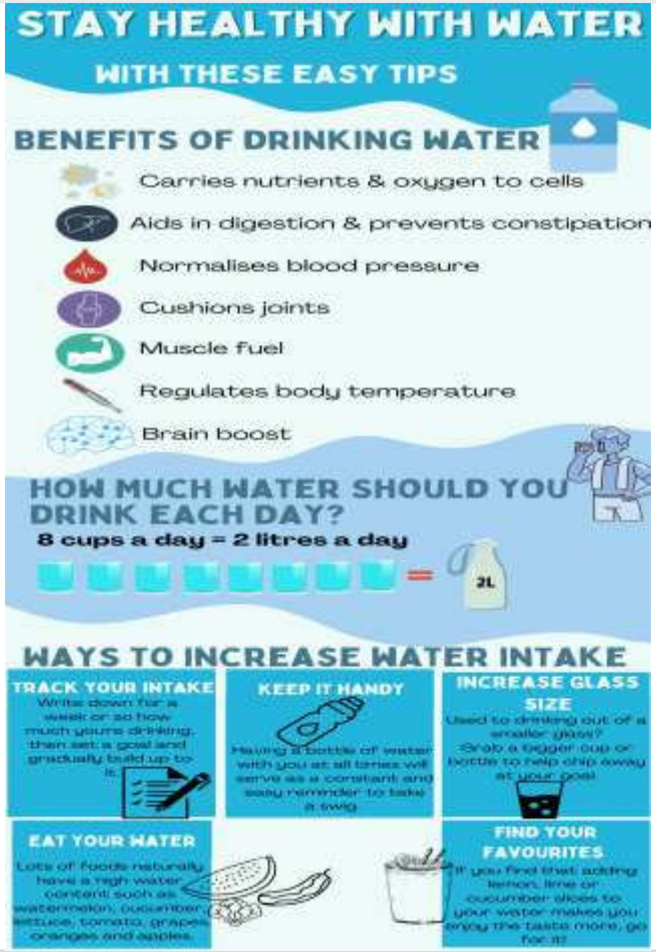


LET'S Be active

Everyone
Everywhere
Everyday

EVERY MOVE COUNTS

Water (handout and water sample)



Homework

- Each day, keep track of when and what you ate and drank by writing it in your diet and physical activity diary
- Keep track of any physical activity you completed in your diet and physical activity diary
- Bring your completed diet and physical activity dairy and your participant back to class with you next week

Does anyone have any questions?

Thank you and I look forward to seeing you next week.

WORKSITE MULTICOMPONENT LIFESTYLE INTERVENTION STUDY (WMLIS)

LIVE HEALTHY GET FIT

Diabetes and Hypertension Prevention Programme

DUT DURBAN UNIVERSITY OF TECHNOLOGY

SAMRC

HARVARD

YALE

RETAILABILITY

Unilever

LET'S Be active Everyone Everywhere Everyday

LESSON 2: MOVE THOSE MUSCLES

EVERY MOVE COUNTS

Welcome and introductions

Thobekile
Dlamuka
Lifestyle coach

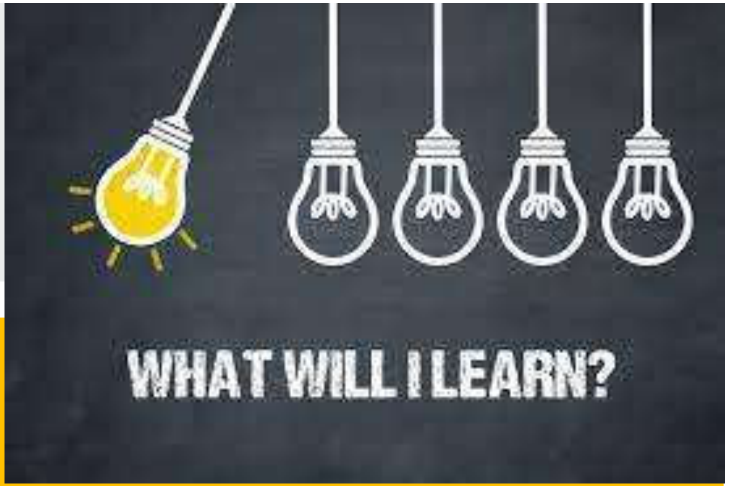
Evonne Singh
Lead researcher

Shannon Pillay
Research assistant

Rules

- Be on time to the lifestyle classes.
- Switch phones onto silent.
- Let us know if you can't make a meeting, we will assist you to find another slot.
- Complete the things you are supposed to do at home. Homework outside the group meetings is the **most important factor** in your success.

Objectives



In this session, you will:

- Recognise the importance of physical activity.
- Identify other activities equivalent to brisk walking that the you can enjoy.
- Discuss physical activity challenges, barriers to physical activity and find solutions.
- Identify ways to record physical activity.

Physical Activity Video

https://www.youtube.com/watch?v=jY7YvglA92s

EVERY MOVE COUNTS

LET'S Be active
Everyone
Everywhere
Everyday

Can I hear from one participant on what physical activity they did this last week?

What challenges did you encounter when engaging in physical activity?

How did you attempt to overcome these challenges? Were you successful?

What are some things you may do differently next time you engage in physical activity?

Physical Activity: Benefits (Handout 1)

Physical activity is any bodily movement produced by your muscles thi
energy expenditure. (Examples and Questions on what counts as PA)

Being more active will:

- Improve your mood
- Counter depression and anxiety
- Give you more energy
- Help reduce stress
- Help you to meet new friends
- Help you sleep better
- Improve your self-esteem
- Improve your muscle tone and body measurements

Physical Activity – Benefits

Regular physical activity will also make you **more physically fit.** It will:

- Strengthen your heart, lungs, bones, and muscles
- Make your joints more flexible
- Reduce back pain and injuries
- Make it easier for you to do your daily work, like climbing stairs and carrying heavy bags

Our goal is to lose weight and keep it off to prevent diabetes and hypertension. In addition to helping, you lose weight, be more fit, and feel better in general.

Being more active also:

- Raises HDL cholesterol (the good cholesterol)
- Lowers triglycerides
- Lowers blood pressure
- Lowers blood sugar by making the body more sensitive to insulin. This reduces the risk of diabetes and diabetes complications

Physical Activity – Handout 2

Physical Activity – Goal

Goal- 150 minutes of physical activity each week

- ✓ Work up to this goal *slowly*. It will take about 4 weeks.
- ✓ 150 minutes of activity will burn about 2000 kilojoules per week.
- ✓ Pick activities you *like*.
- ✓ Choose moderate kinds of activity, such as brisk walking.
- ✓ Spread the weekly total over 3, 4, or more days per week.

Physical Activity – Group activity

Each member of the group will take turns describing a physical activity that they enjoy doing or would like to do in a Taboo game like fashion. You will be provided with a card with written physical activities on top of the card along with a concise list of words related to the activities that you cannot use in your descriptions. Your partner will guess which activity their peer is describing in 60 seconds, making sure not to say the words on the list. Members also cannot act out the activity itself; they must simply describe it using words other than the ones provided.

Physical Activity – Barriers

We may have a lot of different reasons why we cannot do physical activity daily. One of the most common problems is lack of time. Therefore, we will now address strategies for overcoming this time barrier. There are two different ways to overcome time as a barrier.

- One way is to set aside one block of time for planned physical activity every day. Make being active a predictable part of your routine
- Some days, you will not be able to find one big block of time to be active. When this happens, be on the lookout during the day for 10 to 15 minutes of free time to be active.
- Exercise while doing other things – For example, you could walk in place, stretch, or do the exercises you learned in class here while you watch TV.

Physical Activity – Handout 3

Being Active as a Way of Life

1. Planned Activity: Find the time to be active

- Set aside one block of time every day to be active. When can you set aside 20 to 30 minutes to do an activity you like?

  ____

  ____

- Look for free time (10 to 15 minutes) during the day. Use this time to be active. During the day, when might you have some free time (10 to 15 minutes)?

  ____

  ____

Physical Activity – Handout 4

It can be challenging to get active. Here are some common challenges and ways to cope with them. your own ideas in the column that says, "Other Ways to Cope." Check off each idea you try.

Challenge	Ways to Cope	Other Ways to Cope
It's too hot, cold, or wet outside.	☐Workout indoors	☐ ____________
	☐Dress for the weather	☐ ____________
	☐Swim in hot weather	☐ ____________
I don't have time.	**To fit fitness in anytime:**	
	☐ Break your 150 minutes into smaller chunks.	☐ ____________
	☐ Park your car further away from the place you want to go.	☐ ____________
	☐ Get off the bus or taxi one stop early. Walk the rest of the way.	☐ ____________
	☐ Take stairs instead of elevator.	☐ ____________
	☐ Use a fitness app	☐ ____________
	To fit in fitness at home:	

Physical Activity – Handout 5

Let's Make a Plan

- Make being active a predictable part of your daily routine by planning
- Set aside one 20 to 30-minute block of time of time every day every for physical activity
- Plan activities you LIKE to do
- If one day you are not able to find one big block of time to be active, be on the lookout during the da for 10 to 15 minutes of free time to be active
- Use the time management skills you learned today

Use the chart below to plan your activity for the week

	What I will do	**When**	**Where**	**For how many minutes**
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				
Total minutes of activity:				

Physical Activity – Lifestyle activity

Lifestyle Activity: Spontaneous activity choices

Make active choices throughout the day. Every minute adds up for your health.

Inactive Choices (Limit)	Active Choices (Maximise)
Example: Take the elevator	*Example:* Use the stairs

Turn inactive into active time:

- Try cutting your TV time in half. Walk instead.
- Be active while you watch TV (e.g., stretching, lifting weights).

Physical Activity – Move those Muscles

Let's Be active
Everyone
Everywhere
Everyday

Physical Activity – Handout 7

Stay fit even at work

EVERY MOVE COUNTS

Homework

- Each day, keep track of when and what you ate and drank by writing it in your food and physical activity dairy
- Keep track of any physical activity you completed in your food and physical activity dairy
- Bring your completed food and physical activity dairy and your participant back to class with you next week

Does anyone have any questions? Please can you complete the evaluation form.

Thank you and I look forward to seeing you next week.

EVERY MOVE COUNTS

LESSON 2: MOVE YOUR MUSCLES

Handout

How Active Are You?

Before you begin a new physical activity routine, it is important to know how much activity you do now. It is also important to figure out what type of activity is best for you and how much. Answer these questions about how active you are right now.

1. How active are you now?
   What do you do? Where you do it? Whom do you do it with? How long do you do it? How often do you do it?

2. What activities have you done in the past?

3. Why did you stop?

4. What do you like and not like about being active or being inactive?

	What I like about	What I do not like about
Being Active		
Not Being Active		

Handout

Getting Started!

It is not always easy to start being more active. But we are here to help,and we will do it together!

- Tips for making physical activity easier:
  - ✔ Walk or do physical activity with another person.
  - ✔ Have fun!

- Plan activities you LIKE to do

We suggest **brisk walking**. It is easy to do and good for you.What other activities might you like to do?

____

____

____

To-Do Next Week

During the next week I will —

- Be active for______________________minutes.
  - ✔ Ask a friend or family member to walk with me.
  - ✔ Plan activities I *like* to do.
- Keep track of my physical activity.

Day	What I will do	Minutes
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		
	Total minutes for the week:	

❑ **Keep track of my weight, eating, and activity.**

- ✔ Use my *Food and Physical activity diary*.

Record only the time

Physical Activity Goal

Goal: 150 minutes of physical activity each week.

- ✔ Work up to this goal *slowly*. It will take about 4 weeks.
- ✔ 150 minutes of activity will burn about 2000 kilojoules per week.
- ✔ Pick activities you *like*.
- ✔ Choose moderate kinds of activity, such as brisk walking.
- ✔ Spread the weekly total over 3, 4, or more days per week.

Improving Your Aerobic Fitness

So far, we have focused on the “time” part of your physical activity program.

Your goal was to achieve at least 150 minutes of physical activity, spread outover the week. But how about ***intensity,*** or how hard you are working? The ***intensity*** of physical activity is the level of effort we use during the activity.

Heart rate is a good measure of intensity. Raising the intensity of our physical activity increases our heart rate and improves how well our heart works.

The heart is a muscle. And just as with any muscle, we must exercise it to make it stronger. We exercise the heart by making it beat faster than normal.

As your heart becomes stronger, you’ll notice that it's easier for you to do things, like walking upstairs while carrying groceries. The reason is that, as your heart becomes stronger, your aerobic fitness improves. **Aerobic fitness** means that your heart does a good job of pumping oxygen through your blood to your other muscles (for example, the muscles in your arms and legs).

F.I.T.T. Principles

Not all forms of activity will strengthen your heart. Only activities that are “F.I.T.T." will work the heart muscle. The following principles describe how the activity should take place to get the most benefit.

Now we will focus on intensity: how hard your heart is working. This is the final part of this aerobic puzzle

F.I.T.T. Principle	Making it Work
Frequency How often you are active	Try to be active most days. We suggest being activeat least 3 days a week, but 5 to 7 days is even better. Increase the frequency slowly.
Intensity How hard you work while active: how fast your heartbeats	While you’re active, you should breathe fast enough so that you can talk but not sing. If you can sing, go faster! If you have trouble breathing and talking, slow down. As you do regular activity over time, your heart will not beat as fast, and you will need to do a more challenging activity in order to get the same benefits.
Time How long you are active	Stay active for at least 10 minutes at a time. Slowly increase to 20 minutes or more at a time. You wantto continue increase your activity time slowly. The total minutes of physical activity per week should add up to your activity goal of 150 minutes ormore per week.
Type What you are doing	Do activities that make you breathe faster for at least10 minutes each day. One way to do this is to walk fast. Any ***intense*** activity that uses large muscles, such as legs and arms, will make your heartbeat faster.

How hard are you working?

By paying attention to our bodies, most of us can tell how hard we are working.Rate yourself on the scale below, by checking the box that shows how you feel when you are active.

How hard are you working?			
Intensity	**Rating**	**Description**	**F.I.T.T. Range**
Very, Very Light		"I am not working hard at all. I can talk and even sing easily."	Try working a little harder.
Very Light			
Fairly Light		"I am working and breathing a little harder than usual. I can still talk easily."	**Stay in this range.**
Some what Hard		"I am working and breathing somewhat hard. I can talk fairly easily."	
Hard		"I'm working hard and breathing deeply. I can still talk."	
Very Hard		"I'm working very hard. I cannot catch my breath or talk."	Slow down. Rest for a while.
Very, Very Hard			

WARM-UP & STRETCHING EXERCISES

Note: After this class, participants will be advised to start walking 30 minutes/every day with proper stretching exercises. The stretches will be as detailed below.

Neck Stretch:
Look straight ahead. Do not let your chin drop down. Raise your left arm and place it above your right ear. Now move your left ear towards your left shoulder with gentle pressure from the fingers of the left hand. Don't lift your shoulders. Hold for 15 counts. Repeat on the other side

Upper Back Stretch:
Stand with the arms extended to the front at shoulder height with the thumbs interlocked and palms facing outward. Move forward in this position as if trying to reach out. Remember only the upper body must move. Hold this position for 15 counts. Return to the starting position

Oblique Stretch:
Assume a standing position with your arms at your sides and your legs slightly open. Now raise your right arm so that it goes over your head while you bend your waist to the left. Hold the stretch for 15 counts and then return slowly to the starting position. Repeat with the other arm/side.

Thigh Stretch:
Stand with feet together and with your left arm on a chair for support. Now lift your right foot behind you and grab your right ankle with your right hand. Pull your foot towards your bottom until you feel tension in your thigh, make sure that your knee is pointing towards the ground. Release and repeat on the other side.

Hamstring stretch:
Stand straight with your right leg extended forward with toe facing upwards. Now slowly press your heal and push your torso down to feel the stretch behind your thigh. Hold for 15 counts. Repeat with the other leg.

Calf Stretch:
Standing facing a wall place your foot up against the wall. Keeping your knee straight, lean forward until you feel a stretch in the calf. Hold the stretch for 15 counts. Repeat with other leg.

ERGONOMIC EXERCISES

Neck Movement:

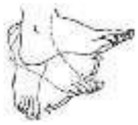
Move your head as far as you can to one side, hold for 15 counts, and then to the other side. Do this 3 times

Hands up and down:
Stand straight with your arms by your side. Now slowly raise your left arm straight over your head with palm facing forwards keep the right arm by your side. Now change sides by bringing your right arm over your head. Do this for 15 counts.

Shoulder Stretch:
Stand straight while maintaining the natural arch in your lower back. With your shoulders down and relaxed, cross your left arm over your chest towards your right shoulder. Your arm should be parallel to the floor with palm facing downwards. With the right hand support the left arm at the elbow. Gently pull your elbow in toward your chest. Hold for 15 counts. Repeat on the other side.

Scapula Squeeze:
Stand straight while maintaining the natural curvature in your back. Raise both palms to chest level by bending the elbows. Palms must face down and elbows must be at shoulder height now squeeze your shoulder blades together the palm will separate. Take care to see that palms and elbows don't droop down. Release with control and return to the starting position. Do this for 15 counts.

Leg Extension:
Sit on a stool or chair. Straighten one of your legs and raise it parallel to the ground, keeping your foot pointed upwards. Squeeze the muscles of your thigh while lifting. Maintain this pose for 15 counts.
Change to the other leg and repeat.

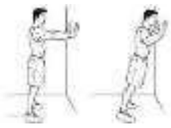


Ankle up and down:
Stand straight sit on a chair. Move one leg forward and raise your ankle up and down slowly for 15 counts.
Repeat with the other leg.

BASIC STRENGTH TRAINING WITH WATER BOTTLES OR SANDBAGS FOR BOTH MEN AND WOMEN

All = 8 counts * 2 sets

Pushups:
Lie on your stomach. Now place your hands firmly on the ground, directly under shoulders. Push up such that your body weight is balanced on your shoulders and toes. Elbows should be fully extended. Abs must be tucked in. Begin to lower your body, keeping your back flat and eyes focused about three feet in front of you until your chest grazes the floor. Push back up.



Modified Pushups:
Stand in front of a bare wall and lift your arms up to shoulder level with elbows slightly bent. Feet must be together and abs tucked in.. Inhale and move your chest towards the wall, bending the elbows. Exhale as you push off the wall until your arms are in the outstretched position again.

Shoulder press:
While holding a weight / water bottle in each hand, stand with your feet shoulder width apart. Now raise the weights / bottles to shoulder height. This is your starting position. Now, exhale and push the weights / bottles upward until they touch at the top. Then, after a brief pause at the top, slowly lower them back down to the starting position while inhaling.

Biceps Curl:
Stand up straight with a water bottle in each hand. Keep your elbows extended close to your body with the palms of your hands facing forwards. This will be the starting position. Now, keeping the upper arms stationary, exhale and bend your elbows while contracting your biceps. Go back to the starting position.

Triceps extension:
Stand with your feet shoulder width apart while holding a water bottle with both of your hands above your head. Lower the bottle behind your head until your elbows are at 90 degrees, or as far as you can go. Now raise the bottle back to the starting position. Remember elbows must stay near your ears.

Squats:
Keep your back straight, with your spine in the neutral position and your chest and shoulders up. Keep looking straight ahead at a spot on the wall with your arms extended in front of you. Squat down as if sitting on as imaginary chair. Focus on keeping your knees in line with your feet go as low as you can.
Return to the starting position.

Calf raise:
Stand with feet shoulder-width apart with a water bottle in each hand at arm's length. Breathe out and slowly stand on your tiptoes, as high as possible, stretching your calves. Hold for 1 second. Breathe in as you slowly lower your heels to the floor.

ABDOMEN EXERCISES AND BACK EXERCISES

All - 10 counts * 2 sets

Upper Ab Crunch:
Lie flat on your back on the floor using a mat. Bend your knees, keeping your feet flat on the floor. Keep your hands on your ears. Then lift your shoulders towards the ceiling using your abdominal muscles. Do not lift your entire back off the floor or strain your neck. Do not tilt your head forward. Exhale and contract your abs as you move up and ease back down slowly as you inhale.

Lower Abs Reverse Curl
Lie flat on your back on the floor with your arms extended out and flat by your sides with palms facing downwards. Then lift both of your knees at a 90-degree angle to your back. Now extend your knees making an arc as your legs become straight and parallel to the floor. Pull your knees back towards your chest and repeat.

Knee to Chest Hold:
Lie on you back with your knees extended and your feet flat on the floor. Bring one knee to your chest and hold it, keeping the other foot flat on the floor. Keep your lower back pressed to the floor. Relax and lower the knee to the starting position and repeat with the other leg.

McKenzie:
Lie on your stomach on the floor with arms by your sides and palms facing down. Keep the top part of your feet flat against the floor and slightly apart. Take a few deep breaths to help you relax and feel comfortable.
Now bring your forearms forward and with elbows close to your sides raise yourself up with your forearms.
Keep your elbows bent and your forearms and hands on the floor. Lift your chest, while the rest of your

LOW IMPACT CIRCUITS TO INCREASE ENDURANCE
 * 2 SETS

Spot Walk:
Stand with your feet hip-width apart and your knees slightly bent. Arms are by your sides. Starting with the left leg, lift your knee, then your ankle, then your heel, then your toes. Lifting the toes 2-3 inches from the floor is sufficient - do not raise the knee more than waist height. At the same time, swing the right arm forward, and the left arm backward. Now keep marching on the spot. Keep the upper body straight and keep control of the arms. The easiest way to keep the upper body straight is to engage the abdominal muscles, and keep the spine stretched out to its fullest: no slouching! Do this for 30 seconds.

Elbow to Knee
Stand tall with your elbows bent and hands behind your head. Draw your left leg up while you twist your upper body such that the right elbow meets the left knee. Repeat on the other side. Do 10 counts on each side.

Knee to Chest
Stand tall with arms by your side and feet shoulder-width apart. Begin the exercise by holding below your left knee and pulling it to your chest as high as you can. Repeat on the other side. You can walk forward as you do this. Do this for10 counts on each side.

Knee Raise
Stand up straight, and slowly lift one foot off the floor, aiming the knee toward your chest. Lift the knee as high up as you can,. Slowly lower the foot to the floor, and repeat with the other leg.
Complete 10 counts on each side.

Dumbbell Side Bends
Stand up tall with your feet shoulder -width apart. Hold a dumbbell in your right hand. Place your left hand behind your head. Bend your right side, as far as comfortable. Repeat for 10 counts and then switch sides.

LOW IMPACT CIRCUITS TO INCREASE ENDURANCE

* 3 SETS

Crawl Kick
Stand with your back straight and both your arms lifted straight above your head shoulder width apart and with elbows slightly bent.. Now slowly lower your arms towards your chest with elbows pointing downwards. Simultaneously lift your left knee towards your left elbow. Lower the knee and straighten the arms back above the head. Repeat on the other side. Do this for 30 seconds.

Running Drills: (Butt Kick)
Run in place, making sure to bend your knee enough to touch your butt with your foot. Do this for
30 seconds.

Squats:
Keep your back straight, with your spine in the neutral position and your chest and shoulders up. Keep looking straight ahead at a spot on the wall with your arms extended in front of you. Squat down as if sitting on as imaginary chair. Focus on keeping your knees in line with your feet go as low as you can.
Return to the starting position.

Alternate Leg & Hand Raise:
Stand straight with arms by your sides. Now stand on your right leg and raise your left leg as high as you can without bend your knee. Touch the left leg with the right hand by mildly twisting your torso. Then return to the starting position and repeat with the other leg. Do this 10 times for each leg.

Spot Jog:
Jog on the spot. Move your arms as you jog. The more you move your body, the more calories you'll burn as you work out. Lift your knees higher to increase your heart rate. Increase your speed as well. The faster you jog in place, the more intense your workout will be. Do this for 30 seconds

LOW IMPACT CIRCUITS TO INCREASE ENDURANCE
* 4 SETS

Knee to Chest
Stand tall with arms by your side and feet shoulder-width apart. Begin the exercise by holding below your left knee and pulling it to your chest as high as you can. Repeat on the other side. You can walk forward as you do this. Do this for 10 counts on each side.

Shoulder Lat and Front Raise (Combo)
In a standing position, hold a pair of water bottles (1litre) / weights by your side. This will be your starting position. Keeping your elbows slightly bent, raise the weights / water bottles directly in front of you to shoulder height, avoiding any swinging. Lower the weights / bottles to the starting position in a controlled manner. Then raise the weights laterally to your sides at shoulder height, keeping the elbows bent Lower the weights / water bottles to the starting position. Complete of the combo 10 repetitions.

Leg Diagonal Raise
Standing with your hands by your sides, Raise one leg diagonally behind you, Hold there for a few seconds and release. Do this for 10 counts and then repeat with the other leg.

Triceps extension:
Stand with your feet shoulder width apart while holding a water bottle with both of your hands above your head. Lower the bottle behind your head until your elbows are at 90 degrees, or as far as you can go. Now raise the bottle back to the starting position. Remember elbows must stay near your ears.

Calf raise:
Stand with feet shoulder-width apart with a water bottle in each hand at arm's length. Breathe out and slowly stand on your tiptoes, as high as possible, stretching your calves. Hold for 1 second. Breathe in as you slowly lower your heels to the floor.

BASIC STRENGTH TRAINING WITH WATER BOTTLES OR SANDBAGS FOR BOTH MEN AND WOMEN

All - 15 counts * 2 sets

Modified Pushups:
Stand in front of a bare wall and lift your arms up to shoulder level with elbows slightly bent. Feet must be together and abs tucked in.. Inhale and move your chest towards the wall, bending the elbows. Exhale as you push off the wall until your arms are in the outstretched position again.

Shoulder press:
While holding a weight / water bottle in each hand, stand with your feet shoulder width apart. Now raise the weights / bottles to shoulder height. This is your starting position. Now, exhale and push the weights / bottles upward until they touch at the top. Then, after a brief pause at the top, slowly lower them back down to the starting position while inhaling.

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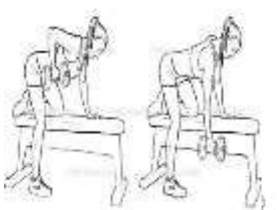
Stand up straight with a water bottle in each hand. Keep your elbows extended close to your body with the palms of your hands facing forwards. This will be the starting position. Now, keeping the upper arms stationary, exhale and bend your elbows while contracting your biceps. Go back to the starting position

Triceps extension:
Stand with your feet shoulder width apart while holding a water bottle with both of your hands above your head. Lower the bottle behind your head until your elbows are at 90 degrees, or as far as you can go. Now raise the bottle back to the starting position. Remember elbows must stay near your ears.

One arm row:
Standing, move your right leg forward slightly bend the knee. Hold a water bottle in your left hand keeping the left elbow extended. Bend your torso forward from the waist until your upper body is almost parallel to the floor, Place your right forearm on your right knee for support. Lift the water bottle with your left hand by moving the left shoulder keep the elbow bent and closer to the body as it move upwards. Now extend the elbow and bring the bottle down again.



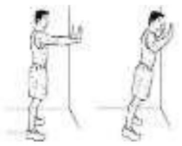
Shoulder Lat and Front Raise (Combo)
In a standing position, hold a pair of water bottles (1litre) / weights by your side. This will be your starting position. Keeping your elbows slightly bent, raise the weights / water bottles directly in front of you to shoulder height, avoiding any swinging . Lower the weights / bottles to the starting position in a controlled manner. Then raise the weights laterally to your sides at shoulder height, keeping the elbows bent Lower the weights / water bottles to the starting position. Complete of the combo 10 repetitions.

MEDIUM IMPACT CIRCUITS TO INCREASE ENDURANCE
*5 SETS

Spot Walk:
Stand with your feet hip-width apart and your knees slightly bent. Arms are by your sides. Starting with the left leg, lift your knee, then your ankle, then your heel, then your toes. Lifting the toes 2-3 inches from the floor is sufficient - do not raise the knee more than waist height. At the same time, swing the right arm forward, and the left arm backward. Now keep marching on the spot. Keep the upper body straight and keep control of the arms. The easiest way to keep the upper body straight is to

engage the abdominal muscles, and keep the spine stretched out to its fullest: no slouching! Do this for 30 seconds.

Elbow to Knee:
Stand tall with your elbows bent and hands behind your head. Draw your left leg up while you twist your upper body such that the right elbow meets the left knee. Repeat on the other side. Do 10 counts on each side.



Modified Pushups:
Stand in front of a bare wall and lift your arms up to shoulder level with elbows slightly bent. Feet must be together and abs tucked in.. Inhale and move your chest towards the wall, bending the elbows. Exhale as you push off the wall until your arms are in the outstretched position again.

Knee Raise:
Stand up straight, and slowly lift one foot off the floor, aiming the knee toward your chest. Lift the knee as high up as you can,. Slowly lower the foot to the floor, and repeat with the other leg.
Complete 10 counts on each side.

Dumbbell Side Bends:
Stand up tall with your feet shoulder -width apart. Hold a dumbbell in your right hand. Place your left hand behind your head. Bend your right side, as far as comfortable. Repeat for 10 counts and then switch sides.

MEDIUM IMPACT CIRCUITS TO INCREASE ENDURANCE *5 SETS

Knee Raise:
Stand up straight, and slowly lift one foot off the floor, aiming the knee toward your chest. Lift the knee as high up as you can,. Slowly lower the foot to the floor, and repeat with the other leg.
Complete 10 counts on each side.

Running Drills: (Butt Kick)
Run in place, making sure to bend your knee enough to touch your butt with your foot. Do this for 30 seconds.

Squats:
Keep your back straight, with your spine in the neutral position and your chest and shoulders up. Keep looking straight ahead at a spot on the wall with your arms extended in front of you. Squat down as if sitting on as imaginary chair. Focus on keeping your knees in line with your feet go as low as you can.
Return to the starting position.

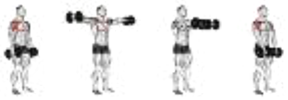
Alternate Leg & Hand Raise:
Stand straight with arms by your sides. Now stand on your right leg and raise your left leg as high as you can without bend your knee. Touch the left leg with the right hand by mildly twisting your torso. Then return to the starting position and repeat with the other leg. Do this 10 times for each leg.

Spot Walk:
Stand with your feet hip-width apart and your knees slightly bent. Arms are by your sides. Starting with the left leg, lift your knee, then your ankle, then your heel, then your toes. Lifting the toes 2-3 inches from the floor is sufficient - do not raise the knee more than waist height. At the same time, swing the right arm forward, and the left arm backward. Now keep marching on the spot. Keep the upper body straight and keep control of the arms. The easiest way to keep the upper body straight is to engage the abdominal muscles, and keep the spine stretched out to its fullest: no slouching! Do this for 30 seconds.

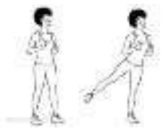
Spot Jog:
Jog on the spot. Move your arms as you jog. The more you move your body, the more calories you'll burn as you work out. Lift your knees higher to increase your heart rate. Increase your speed as well. The faster you jog in place, the more intense your workout will be. Do this for 30 seconds

MEDIUM IMPACT CIRCUITS TO INCREASE ENDURANCE
*5 SETS

Running Drills: (Butt Kick)
Run in place, making sure to bend your knee enough to touch your butt with your foot. Do this for 30 seconds.

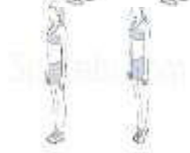


Shoulder Lat and Front Raise (Combo)
in a standing position, hold a pair of water bottles (1litre)/ weights by your side. This will be your starting position. Keeping your elbows slightly bent, raise the weights / water bottles directly in front of you to shoulder height, avoiding any swinging. Lower the weights / bottles to the starting position in a controlled manner. Then raise the weights laterally to your sides at shoulder height, keeping the elbows bent Lower the weights / water bottles to the starting position. Complete of the combo 10 repetitions.



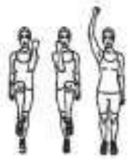
Leg Diagonal Raise:
Standing with your hands by your sides, Raise one leg diagonally behind you, Hold there for a few seconds and release. Do this for 10 counts and then repeat with the other leg.

Triceps extension:
Stand with your feet shoulder width apart while holding a water bottle with both of your hands above your head. Lower the bottle behind your head until your elbows are at 90 degrees, or as far as you can go. Now raise the bottle back to the starting position. Remember elbows must stay near your ears.



Calf raise:
Stand with feet shoulder-width apart with a water bottle in each hand at arm's length. Breathe out and slowly stand on your tiptoes, as high as possible, stretching your calves. Hold for 1 second. Breathe in as you slowly lower your heels to the floor.

MEDIUM IMPACT CIRCUITS TO INCREASE ENDURANCE
*6 SETS



Crawl Kick
Stand with your back straight and both your arms lifted straight above your head shoulder width apart and with elbows slightly bent.. Now slowly lower your arms towards your chest with elbows pointing downwards. Simultaneously lift your left knee towards your left elbow. Lower the knee and straighten the arms back above the head. Repeat on the other side. Do this for 30 seconds.

Knee to Chest
Stand tall with arms by your side and feet shoulder-width apart. Begin the exercise by holding below your left knee and pulling it to your chest as high as you can. Repeat on the other side. You can walk forward as you do this. Do this for10 counts on each side.

Spot Jog
Jog on the spot. Move your arms as you jog. The more you move your body, the more calories you'll burn as you work out. Lift your knees higher to increase your heart rate. Increase your speed as well. The faster you jog in place, the more intense your workout will be. Do this for 30 seconds

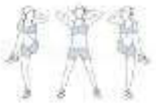
Running Drills: (Butt Kick)
Run in place, making sure to bend your knee enough to touch your butt with your foot. Do this for 30 seconds.

Upper Ab Crunch:
Lie flat on your back on the floor using a mat. Bend your knees, keeping your feet flat on the floor. Keep your hands on your ears. Then lift your shoulders towards the ceiling using your abdominal muscles. Do not lift your entire back off the floor or strain your neck. Do not tilt your head forward. Exhale and contract your abs as you move up and ease back down slowly as you inhale.

MEDIUM IMPACT CIRCUITS TO INCREASE ENDURANCE
*6 SETS

Shoulder press:
While holding a weight / water bottle in each hand, stand with your feet shoulder width apart. Now raise the weights / bottles to shoulder height. This is your starting position. Now, exhale and push the weights / bottles upward until they touch at the top. Then, after a brief pause at the top, slowly lower them back down to the starting position while inhaling.

Lunges:
Keep your upper body straight, with your shoulders and back relaxed and you chin up (pick a point to stare at in front of you so you don't keep looking down), Engage your core by pulling your tummy in.. Step forward with one leg, lowering your hips until both knees are bent at about a 90-degree angle. Come back to the standing position and repeat on the other side. Complete 2 sets of 15 counts each.



Elbow to Knee
Stand tall with your elbows bent and hands behind your head . Draw your left leg up while you twist your upper body such that the right elbow meets the left knee. Repeat on the other side. Do 10 counts on each side
.

Running Drills: Butt Kick)
Run in place, making sure to bend your knee enough to touch your butt with your foot. Do this!
30 seconds.

Leg Diagonal Raise
Standing with your hands by your sides, Raise one leg diagonally behind you, Hold there for a few seconds and release. Do this for 10 counts and then repeat with the other leg.

YOUR SUGGESTIONS ARE IMPORTANT

Thank you for your cooperation. We value your feedback and it will help us enhance the upcoming sessions.

Date: dd/mm/yyyy ________________ Time: hh:mm am/pm ___________________________

Site: ______________________________ Name____

After attending the session, please respond to the following questions, circle your answer:

1. Do you think the program has helped you understand how frequently you need to perform physical activity?
    - Yes
    - No
2. Do you think you are now able to determine the intensity of your activity and exertion level?
    - Yes
    - No
3. Do you think the program has helped you in determining the time duration you need to be active in a week?
    - Yes
    - No
4. Do you think the program has helped you to understand the benefits of aerobic exercise?
    - Yes
    - No
5. Do you think the program has helped you to understand the benefits of strength training exercises?
    - Yes
    - No
6. Do you think the program has provided you with a variety of ways to maintain motivation and present boredom from physical activity?
    - Yes
    - No
7. How easy was the trainer's language to understand during today's session?
    - Trainer's language was not at all easy to understand
    - Trainer's language was a little easy to understand
    - Trainer's language was somewhat easy to understand
    - Trainer's language was very much easy to understand
    - Trainer's language was extremely easy to understand
8. For the following points, please rate your level of satisfaction:
    - Session arrangement- *Very unsatisfied, Unsatisfied, Neutral, Satisfied, Very Satisfied*
9. On a scale of 0 to 10, how easy or difficult was the program?

0=extremely easy *10= extremely difficult*

0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*

Thank you😊

WORKSITE MULTICOMPONENT LIFESTYLE INTERVENTION STUDY (WMLIS)

LIVE HEALTHY GET FIT

Diabetes and Hypertension Prevention Programme

DUT
DURBAN UNIVERSITY OF TECHNOLOGY

SAMRC

HARVARD

YALE

RETAILABILITY

Unilever

LESSON 3:HEALTHY EATING AND PORTION SIZES

Rules

- Be on time to the lifestyle classes.
- Switch phones onto silent.
- Let us know if you can't make a meeting, we will assist you to find another slot.
- Complete the things you are supposed to do at home. Homework outside the group meetings is the **most important factor** in your success.

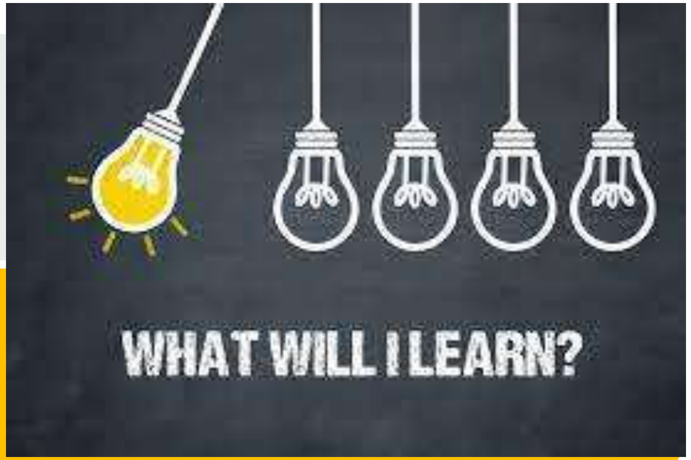
Welcome and introductions

Thobekile
Dlamuka
Lifestyle coach

Evonne Singh
Lead researcher

Shannon Pillay
Research assistant

Objectives



In this session, you will:

- Discuss healthy eating; the SAFBDG, Healthy eating plate (Harvard Plate- My Plate), Eatwell Plate (Cambridge Plate), Plate of Nation (PONA)
- Review how to plan your plate
- Identify healthier alternatives to common foods and how to lower fat and reduce carbohydrates
- Discuss portion sizes and the importance of portion sizes

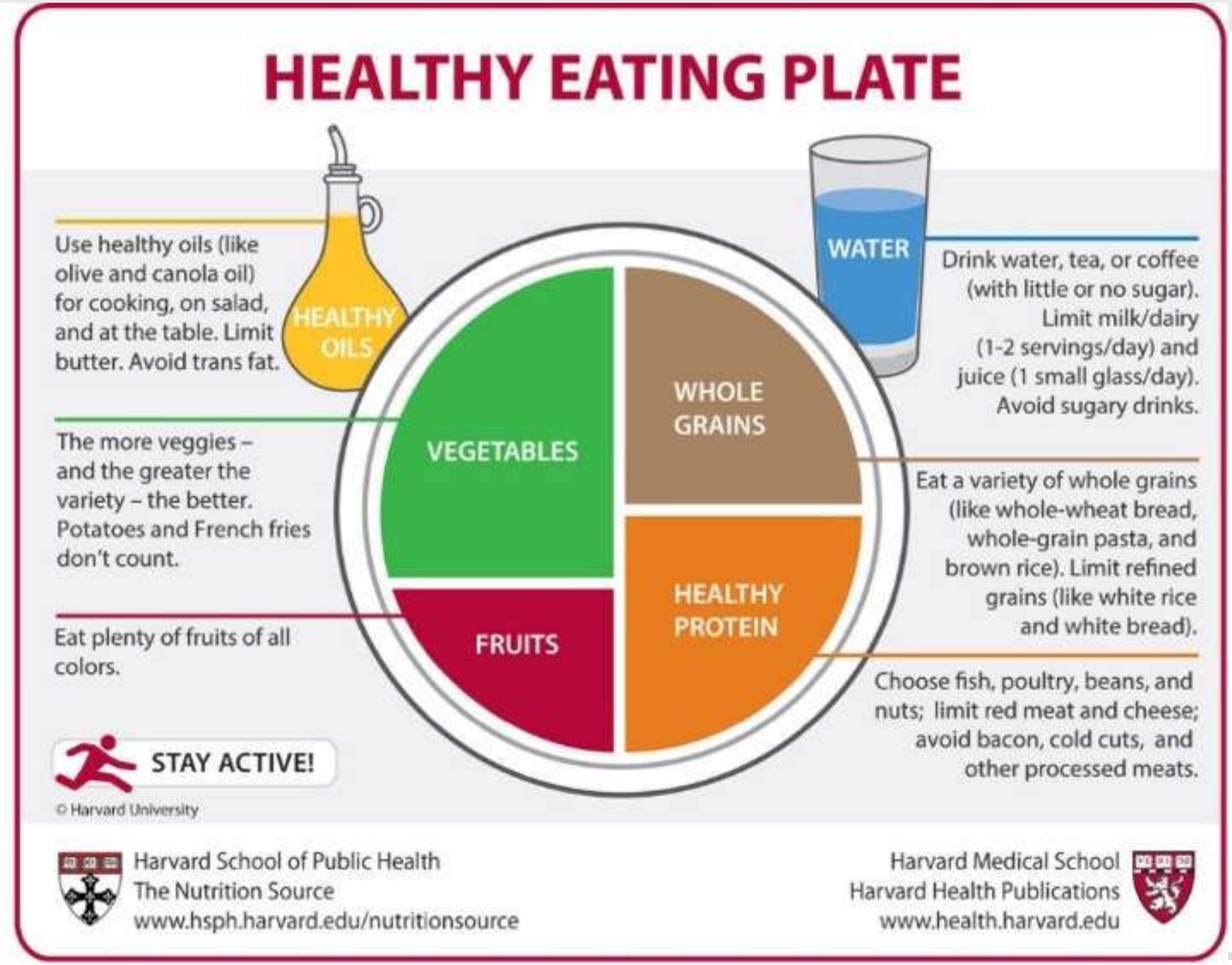
The SAFBDG


South African Food Guide
Keys
Food Group
Nutrients
Nutrient Functions
Water
Essential Minerals
Hydration : 6-8 Glasses a day
Milk & Dairy Products
Calcium
Builds Healthy Bones & Teeth
Meat Alternatives
Plant Protein
Growth & Repair
Cereal & Grain Products
Carbohydrates: Starch & Fibre
Provides Energy
Fruit & Vegetables
Vitamins, Minerals & Water
Protection
Fats & Oils
Lipids & Sugar
Provides Energy
Meat
Animal Protein
Growth & Repair

The SAFBDG

- Enjoy a variety of foods.
- Be active!
- Make starchy foods part of most meals.
- Eat plenty of vegetables and fruit every day.
- Eat dry beans, split peas, lentils and soya regularly.
- Have milk, *maas* or yoghurt every day.
- Fish, chicken, lean meat or eggs can be eaten daily.
- Drink lots of clean, safe water.
- Use fats sparingly. Choose vegetable oils, rather than hard fats.
- Use sugar and foods and drinks high in sugar sparingly.
- Use salt and food high in salt sparingly.

The Healthy Eating Plate aka…



The Eatwell Plate

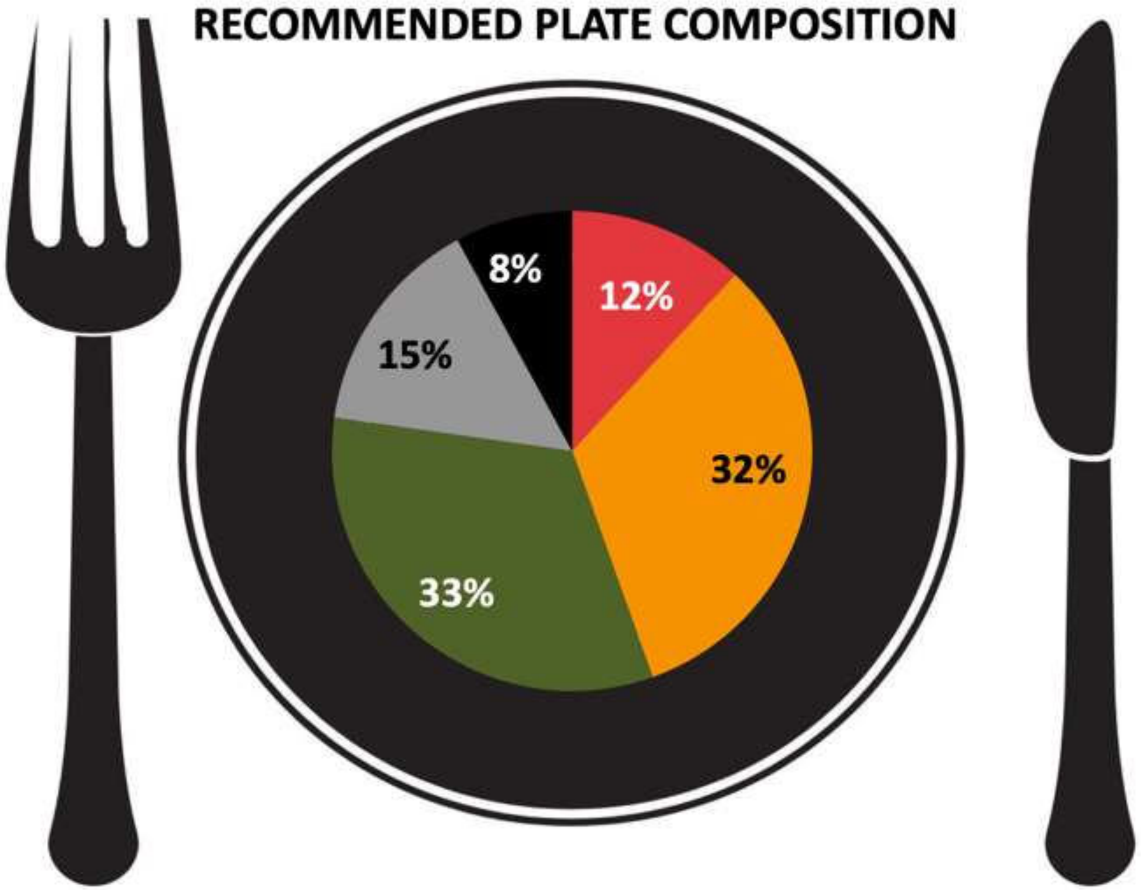
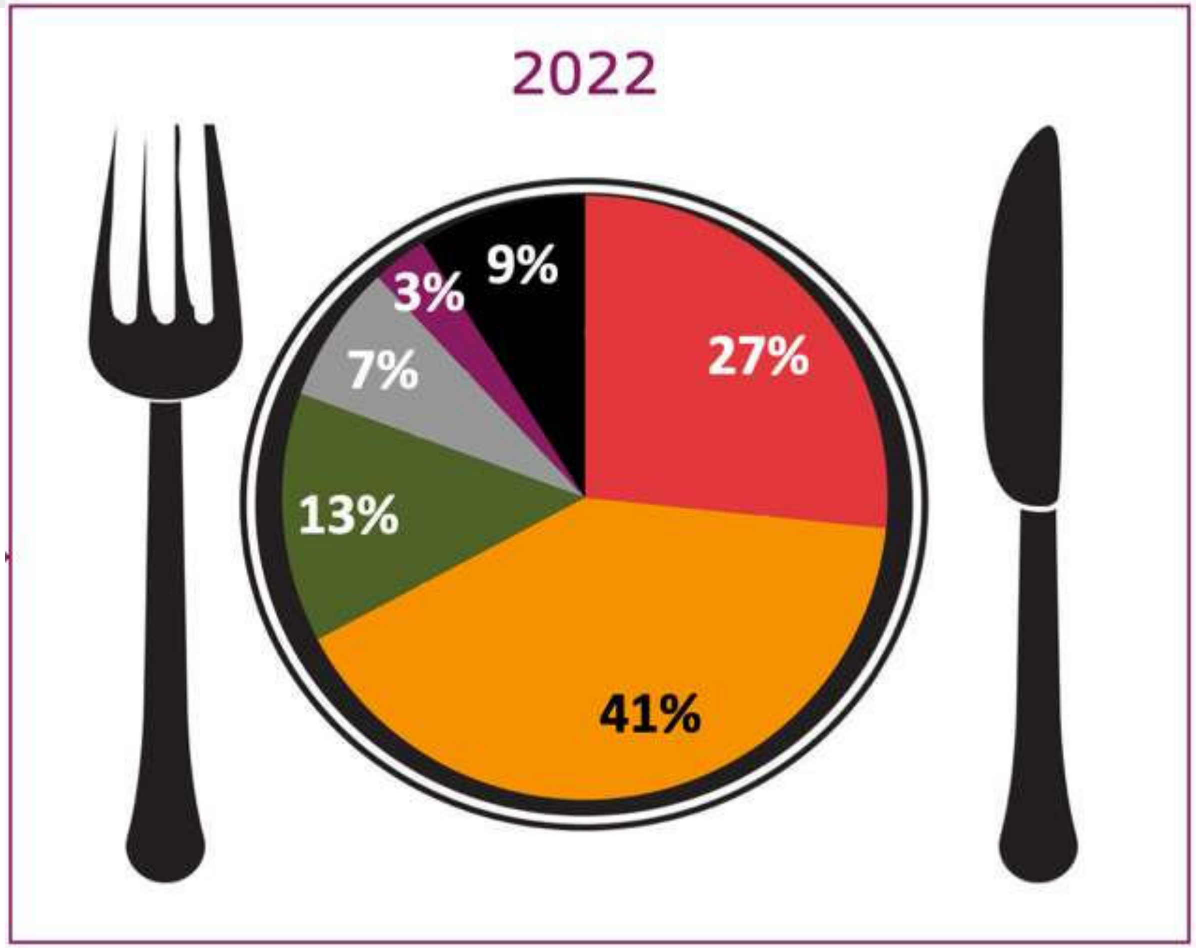


Plate of our Nation (PONA)



How to create a healthy plate

My Plate

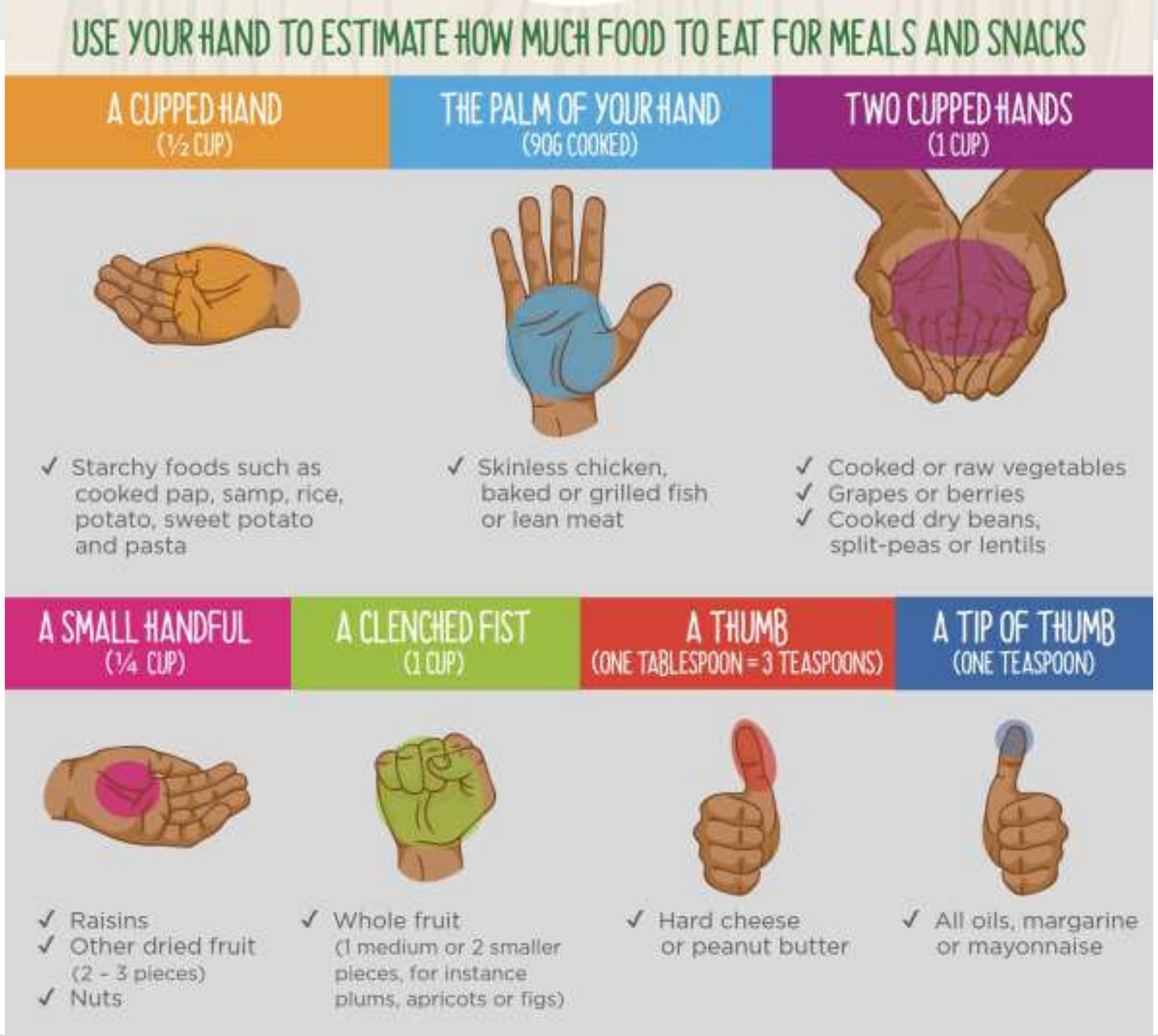
STEP 1
Divide the plate into 3 sections.
The 1st section should be half the plate.
The next two sections should be ¼ of the plate each.
½ plate
¼ plate
¼ plate
STEP 2
In the ½ section add the vegetables.
STEP 3
In one of the ¼ sections add the protein-rich food – meat, chicken, fish, egg or legumes.
STEP 4
In the other ¼ section, add a starchy food.

Steps to monitoring fat intake

- Task: Food Diary

Food and Physical Activity Diary

Measuring portion sizes



Hands and Serving Size

You can use your hands to eyeball serving size.


About 90g


About 1 tablespoon


About 1 teaspoon


About 1 cup


1 serving of fruit


About ¼ cup

Everyday Objects and Serving Size

You can use everyday objects to eyeball serving size. Here are some examples:

Serving Size	Object
2 tablespoons	 Ping-pong ball
1 ounce of cheese	 4 dice
3 ounces of meat or poultry	 Palm of your hand, or a deck of cards
¼ cup	 Golf ball
½ cup	 Tennis ball
1 cup	 Baseball
1 medium baked potato	 Computer mouse
1 medium apple	 Tennis ball
1 medium waffle	 CD

Homework

- Each day, keep track of when and what you ate and drank by writing it in your food and physical activity dairy
- Keep track of any physical activity you completed in your food and physical activity dairy
- Bring your completed food and physical activity dairy and your participant back to class with you next week

Does anyone have any questions? Please can you complete the evaluation form.

Thank you and I look forward to seeing you next week.

Physical Activity

Lesson 3: Healthy Eating and Measuring Portion sizes

Plan Your Plate

- About 1/4 of your plate should be filled with grains or starchy foods (carbohydrates) such as rice, pasta, potatoes, breads, corns, or peas.
- About 1/4 of your plate should be protein – foods like meat, fish, poultry, tofu, or legumes.
- About 1/2 of your plate should be filled with non-starchy vegetables like carrots, cucumbers, salad, tomatoes, or cauliflower.
- Add a glass of low-fat milk or yogurt and a piece of fruit for a balanced meal.

Make Your Plate

Write the number of the correct food group on each line. Then create a healthy meal by listing items that you like. You can use "Foods to Choose" on pages 5-7 for ideas.

Food Groups

1. Non-starchy veggies
2. Grains and starchy foods
3. Protein foods
4. Dairy foods
5. Fruit
6. Drink

Foods to Choose

Non-starchy veggies:

- Cabbage
- spinach
- Broccoli
- Carrots
- Celery
- Cucumbers
- Leafy greens
- Mushrooms
- Onions
- Peppers
- Tomatoes
- Your favourites:

____

____

____

Grains and starchy foods:

- 100% whole grain cereal
- 100% whole wheat bread
- Black beans
- Brown rice
- Corn
- Green peas
- Lentils
- Oatmeal
- Popcorn
- Potatoes
- Pumpkin
- Yams
- Your favourites:

____

____

____

Protein foods:

- Eggs (but limit yolks)
- Fish and seafood (catfish, cod, shrimp)
- Lean meat (lean ground beef, chicken and turkey without skin, pork loin)
- Nuts (limit because high in fat)
- Your favourites:

____

____

____

Dairy foods:

- Low-fat cheese
- Plain low-fat soy or almond milk
- Plain non-fat or low-fat yogurt
- Skim or low-fat milk
- Your favourites:

____

____

____

Fruit:

- Apples
- Banana
- Oranges
- Grapes
- Pears
- Strawberries
- Kiwi
- Plums
- Granadilla
- Apricots
- Mangoes
- Blueberries
- Dates
- Grapefruit
- Your favourites:

____

____

____

Drinks:

- Coffee without sugar
- Sparkling water
- Tea without sugar
- Water
- Your favourites:

____

____

____

Foods to Limit

Fatty foods:

- Butter
- Creamy salad dressing
- Deep fried foods (French fries)
- Fatty meat (bacon, regular ground beef)
- Full-fat cheese
- Lard
- Fried Chicken
- Whole milk
- Other examples:

____

____

____

Sweet foods:

- Sweets
- Biscuits
- Honey
- Ice cream
- Processed snack foods
- Sugar
- Other examples:

____

____

____

Visualising serving sizes

Hands and Serving Size

You can use your hands to eyeball serving size.

About 90g

About 1 tablespoon

About 1 teaspoon

About 1 cup

1 serving of fruit

About ¼ cup

Everyday Objects and Serving Size

You can use everyday objects to eyeball serving size. Here are some examples:

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¼ cup	 Golf ball
½ cup	 Tennis ball
1 cup	 Baseball
1 medium baked potato	 Computer mouse
1 medium apple	 Tennis ball
1 medium waffle	 CD

Measurement	Abbreviation	Equivalent
Cup	c	16 tablespoons
Tablespoon	T or Tbsp	3 teaspoons
Teaspoon	t or tsp	The amount in a regular size spoon
Ounce	oz	28 grams
Gram	g	The weight of a paper clip

Tips for Weighing and Measuring Food

Weighing and measuring foods is important for keeping track of how much you eat. Use the following tips to figure out the most exact amount.

Use a plastic measuring cup for solid foods.

- ✓ Fill and level off the ingredient before you write down the amount.

Use a measuring cup for liquids.

- ✓ Read the line showing how much is in the cup at eye level.

Use a scale for meat, fish, cheese, bread, pasta, rice.

- ✓ Weigh meat after it is cooked.
- ✓ Remove the fat and bone before you weigh meat or fish.

Use measuring spoons for both solids and liquids.

- ✓ Level off solid ingredients before you write down the amount

How to Cope with Challenges

It can be challenging to shop, cook, and eat well. Here are some common challenges and ways to cope with them. Write your own ideas in the column that says, "Other Ways to Cope." Check off each idea you try.

Challenges	Ways to Cope	Other Ways to Cope
Shopping this way costs too much.	☐Use coupons ☐Buy in bulk ☐Buy things on sale ☐Grow your own veggies and fruit. ☐Buy frozen veggies and fruit. ☐Buy veggies and fruit in season.	☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________
Shopping and cooking this way take up too much time.	**To free up time in general:** ☐Be more organised. ☐Ask friends or family to help you get things done. ☐Take your kids with you to the grocery store and turn it into a fun field trip. **To find time to shop for healthy food:** ☐Shop on the weekend. ☐Shop in bulk ☐Use a list to make sure you get everything you need. ☐Buy healthy convenience items, like prewashed salad. **To find time to cook healthy food:** ☐Look for recipes for fast, healthy meals.	☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________ ☐ ____________

Challenges	Ways to Cope	Other Ways to Cope
I don't like the way this food tastes.	☐Change your favourite dishes to make them healthier. ☐Choose cheeses that are strong tasting and low in fat, such as Parmesan and feta. ☐Choose good quality items. ☐Choose items with a variety of flavours, textures, scents, and colours. ☐Cook veggies like green beans and broccoli lightly, so they stay crisp and colourful. ☐Dress up food with herbs, spices, low-fat salad dressing, lemon juice, vinegar, hot sauce, plain non-fat yogurt, and salsa. ☐Grill or roast veggies and meat to bring out the flavour.	☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________
It's unpleasant/ boring/hard to shop, cook, and eat this way.	☐Shop, cook, and eat healthy with friends and family. ☐Learn new cooking methods and recipes from books, articles, and videos. Or take a healthy cooking class. ☐Try new ingredients.	☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________ ☐ ________________

Quick Track

Check every time you eat ANY AMOUNT of these high-fat foods, including in mixed dishes.

Try to LIMIT these foods.

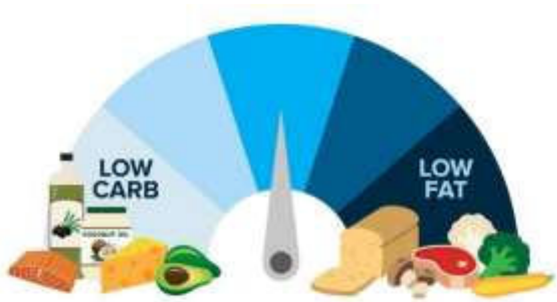
CAUTION! High Fat Foods	**Mon**	**Tue**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**
Added Fats							
Dairy Foods							
Meats, Main Dishes							
Side Dishes, Breads							
Snacks and Desserts							

Other							

Ways to Eat Fewer Fats and Carbs + Swaps

1. Eat high fat and high carb foods *less often*

Example:



2. Eat *smaller amounts* of high fat and high carb foods. Cutting back even a little on the amount you eat can make a big difference.

Example: If you see a tray of sweets at a party, have only one piece of your favourite, instead of trying many different things. Eat it slowly and really enjoy the flavour. Sometimes having a small piece of the sweet or half of a big piece also does the trick.

3. Eat lower fat and lower carb foods instead.

Example: Instead of eating potato chips, have a nutty salad instead or cut up a crunchy apple or other healthy fruits for a snack.

Other low-fat options include:

- Raw, grilled, or roasted vegetables
- Steamed, boiled, baked, or roasted foods
  (Rather than fried foods)
- If you eat meat, remove the skin from the chicken and cut off any visible fat from your meat before eating

How can we increase our intake of healthier fats and carbs?

Swap	**For**
Fatty cuts of meat	Lean cuts with no visible fat
Fried foods	Grilled, steamed, or baked foods
Cake, biscuits, and pastries	A handful of unsalted nuts or fresh fruits

Handout- Please fill in the following:

1.What type of oil are you using at your household?

____

2. How can you measure the appropriate serving size of rice using your hand?

____

3. Out of the following 3 pairs, which item is lower in fat in each pair?

Chicken (Fried) **OR** **Grilled Chicken**

Vegetables (Fried) **OR** **Steamed Vegetables**

A cupcake **OR** **A handful of Nuts and Raisins**

Food choices

This table shows examples of low-fat and high-fat/high-kilojoules foods for each group.

Food group	**Low-fat and low-kilojoules foods (in ounce or cups)**	**High-fat, high-kilojoules, or high-sugar foods**
Grains	• 1 slice whole wheat bread • ½ bagel, English muffin, pita bread • 4 to 6 low-fat crackers • ½ cup cooked cereal, whole wheat pasta, bulgur, or brown rice • 1 cup dry, whole wheat cereal	• Croissants, sweet rolls, doughnuts, muffins, Danish pastries, biscuits, high-fat crackers, regular tortilla chips, fried tortillas • Granola-type cereals or sugar-coated cereals
Vegetables	½ cup serving equals — • 1 cup raw leafy vegetables • ½ cup cooked vegetables • ½ cup vegetable juice	• Vegetables with butter or margarine, cream, or cheese sauces • Fried vegetables
Fruits	½ cup serving equals — • 1 small fresh fruit (2.5” diameter) • ½ cup canned fruit or 100% fruit juice • ¼ cup dried fruit	• Fruits in pastry (example: fruit pies) • Coconuts • Dried fruit • Juices or drinks sweetened with sugar • Fruit canned in syrup • Large amounts of any fruit juice

Dairy	• 1 cup skim or 1% milk • 1 cup low-fat soy milk or lactose-free milk • low-fat yoghurt • low-fat cheese	• 2% or whole milk • Regular cheese • Yoghurt with sugar
Proteins	• lean meat, poultry (without skin), or fish • ½ cup tuna canned in water • ¼ cup cooked dry beans, lentils, or peas • 1 egg or ¼ cup egg substitute • 1 Tablespoon peanut butter • nuts or seeds	• Bacon, sausage, hot dogs, hamburgers, luncheon meats, most red meats (except lean, trimmed cuts) • Chicken or turkey with skin • Tuna canned in oil • Beans cooked in lard or salt pork

My Plate: Low-Fat and Low-Kilojoules Choices

The food groups of My Plate are listed below. Write down your ideas for low-fat food choices in each of these food groups.

Grains

________________________________ ________________________________

________________________________ ________________________________

________________________________ ________________________________

Vegetables

________________________________ ________________________________

________________________________ ________________________________

________________________________ ________________________________

Fruit

________________________________ ________________________________

________________________________ ________________________________

________________________________ ________________________________

Dairy

________________________________ ________________________________

________________________________ ________________________________

________________________________ ________________________________

Protein

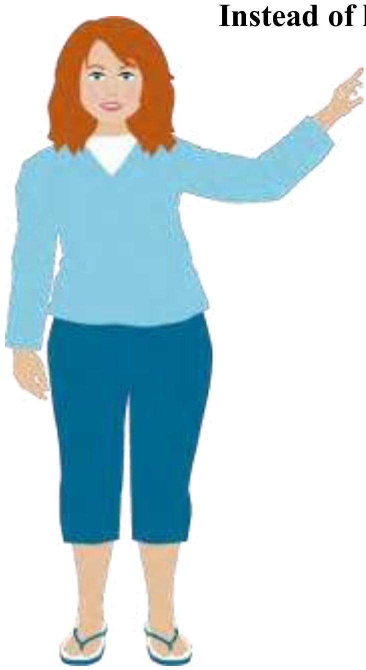
________________________________ ________________________________

________________________________ ________________________________

________________________________ ________________________________

Handout: My Food Substitutions

Here are some choices we could make instead of high-fat or high-kilojoules foods:



Instead of high-fat foods –

Pick low-fat foods

- Choose fresh fruit and vegetables for snacks.
- Serve vegetarian dinners several times a week.
- Eat fruit for dessert.

Use low-fat versions of foods

- Use low-fat or fat-free margarine, mayonnaise, cheese, cream cheese, salad dressing, frozen yogurt, sour cream
- Use skim or 1% milk
- Use low-fat flavourings

To flavour these foods	Use these low-fat flavourings
Vegetables, potatoes	Low-fat margarine (small amount), non-fat sour cream, non-fat broth, low-fat or fat-free plain yogurt, salsa, herbs, mustard, lemon juice
Bread	Non-fat cream cheese, low-fat margarine (small amount), all-fruit jams
Pancakes	Fruit, low-calorie syrup, unsweetened applesauce, crushed berries
Salads	Non-fat or low-fat salad dressing, lemon juice, vinegar
Pasta, rice	Spaghetti sauce with low-fat protein, chopped vegetables, white sauce made with skim or 1% milk

My Food Substitutions (continued)

Instead of high-fat foods –

- **find ways to lower the fat in the meats you eat**
  - Buy lean cuts (round, loin, sirloin, leg).
  - Trim all the fat you can see.
  - Remove the skin from chicken and turkey. This can be done before or after cooking.
  - Choose white meat poultry.
  - Drain-off fat after cooking meat, and blot the meat with a paper towel. Put ground beef in a colander after cooking and rinse it with hot water.
  - Flavour meats with low-fat flavourings, such as BBQ sauce, hot sauce, lemon juice, or Worcestershire sauce.

- **Avoid frying foods. Cook in healthier ways:**
  - Poach or boil eggs or egg whites, or scramble them with vegetable cooking spray.
  - Use two egg whites instead of a whole egg.
  - Microwave, steam, or boil vegetables in a small amount of water.
  - Cook meats without adding fat (see ideas above).
  - Bake, roast, broil, barbecue, or grill instead of frying.
  - Stir-fry: Heat pan to high heat. Add no more than 1 teaspoon oil or use vegetable cooking spray or fat-free broth. Add thinly sliced meat. Stir until cooked through.

YOUR SUGGESTIONS ARE IMPORTANT

Thank you for your cooperation. We value your feedback and it will help us enhance the upcoming sessions.

Date: dd/mm/yyyy ________________ Time: hh:mm am/pm ____________________________

Site: ______________________________ Name____

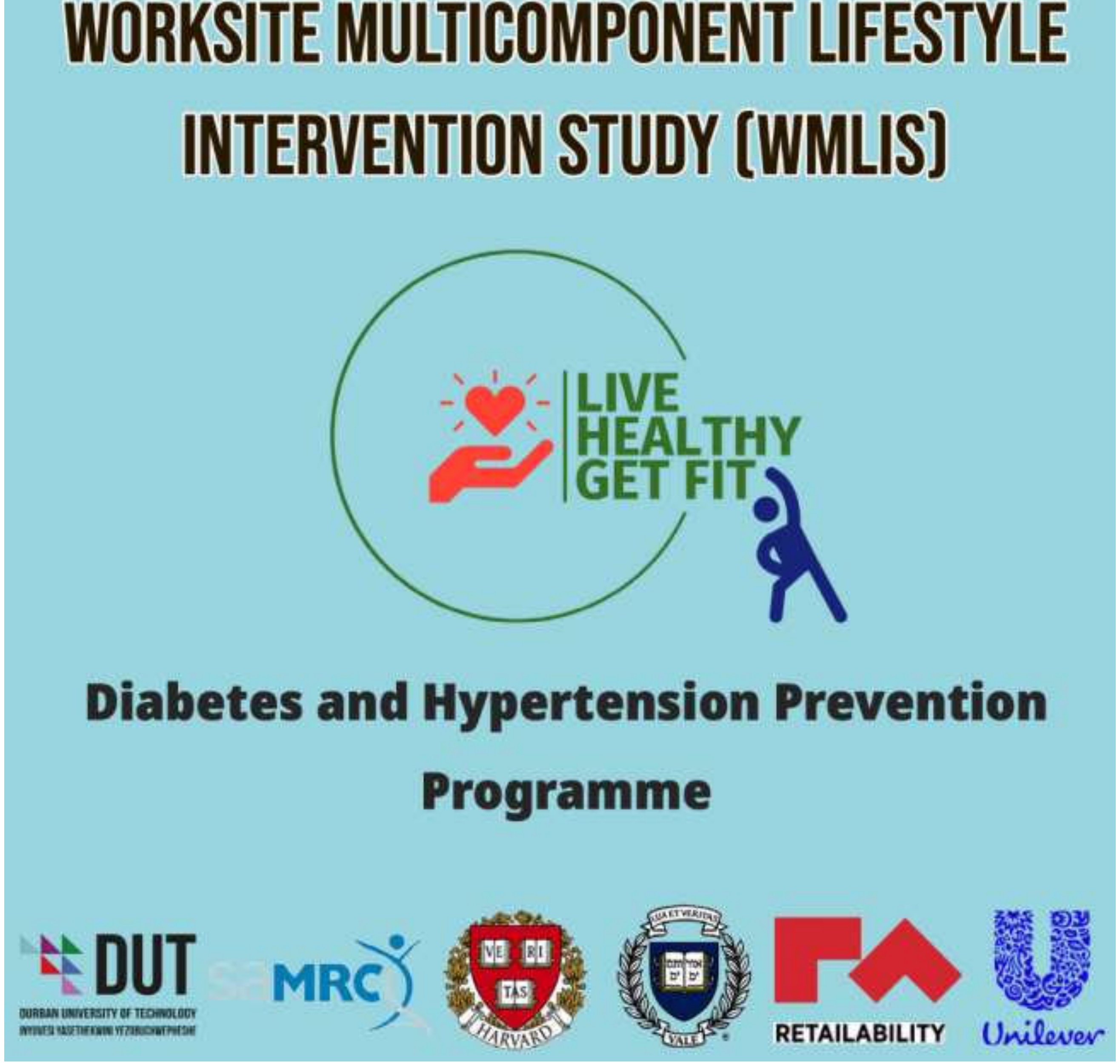
After attending the session, please respond to the following questions, circle your answer:

1. Has the program helped you understand how to plan your plate?
   - Yes
   - No
2. Do you think you are now able to identify examples of non-starchy vegetables?
   - Yes
   - No
3. Do you think you are now able to identify examples of grains and starchy foods?
   - Yes
   - No
4. Do you think you are now able to understand which foods to limit?
   - Yes
   - No
5. Do you think the program has helped you to identify ways to cope with the challenge of shopping, cooking and eating well?
   - Yes
   - No
6. Do you think the program has provided you with suitable suggestions on how to decrease fats and carbs?
   - Yes
   - No
7. Do you think the program has provided you with clear examples of low-fat low kilojoule foods vs high fat high kilojoules foods for each food group?
   - Yes
   - No
8. How easy was the trainer's language to understand during today's session?
   - Trainer's language was not at all easy to understand
   - Trainer's language was a little easy to understand
   - Trainer's language was somewhat easy to understand
   - Trainer's language was very much easy to understand
   - Trainer's language was extremely easy to understand
9. For the following points, please rate your level of satisfaction:
   - Session arrangement- *Very unsatisfied, Unsatisfied, Neutral, Satisfied, Very Satisfied*
10. On a scale of 0 to 10, how easy or difficult was the program?

0=extremely easy *10= extremely difficult*

0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*

Thank you😊



LESSON 4:IDENTIFYING FATS AND CARBS AND REDUCING SALT INTAKE

Rules

- Be on time to the lifestyle classes.
- Switch phones onto silent.
- Let us know if you can't make a meeting, we will assist you to find another slot.
- Complete the things you are supposed to do at home. Homework outside the group meetings is the **most important factor** in your success.

Objectives

In this session, you will:

- Learn about types of fat and why some fats are different than others
- Learn about the differences between types of carbohydrates
- Learn basic principles of self-monitoring fat grams and reasons to do so
- Practice finding foods that are lower in fat
- Practice reading food labels
- Learn how to reduce salt intake

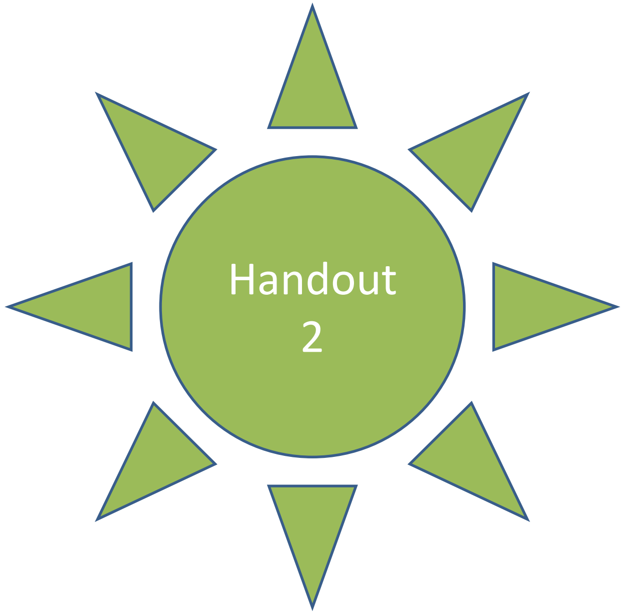
BE A FAT AND CARBOYHDRATE DETECTIVE

NUTRITIONAL FACTS

Nutrients	Per 100 g	Per 36 g
Energy (kJ)	2203	793
Energy (kcal)	527	190
Protein (g)	7,4	2,7
Carbohydrate (g)	46	17
of which total sugar (g)	0,7	0,3
Total fat (g)	35,0	12,6
of which saturated fat (g)	13,6	4,9
Dietary fibre# (g)	4,8	1,7
Total sodium (mg)	850	306

FATS

- **Fat is related to heart disease and diabetes.** Research has shown that eating a lot of fat can increase your cholesterol level. Cholesterol is one measure of the amount of fat in your blood. The higher your cholesterol, the greater your chances of having a heart attack. Excess fat consumption can also increase your risk for diabetes.
- One way to recognise fats in food is to know which types of food are always or often high in fat. A lot of fat is typically used when making foods and is not visible. They are called hidden fats. These include the fats seen mostly in baked goods such as cookies and cakes.
- What are other types of foods that you think are high in fat? (Activity)



THE FACTS ON FAT HOW MUCH FAT DO YOU NEED?

Fat intake should provide 20-30% of our total energy intake.
If you are an adult woman who requires
a total energy intake of 8,400 kJ per day,
then 20% = 1680 kJ should be provided by fat intake.
Each gram of fat provides 37 kJ, so 1680/37 = 44 g of fat per day.

If we do this calculation for the higher intake of 30% of total energy,
then 30% of 8,400 kJ (2000 kcal) = 2,520 kJ (600 kcal) per day
which works out to 2,520/37 (600/9) = about 68 g of fat per day.
The adult woman would, therefore,
be able to eat between 44 and 68g of fat in total per day.

LOVE IT	LIMIT IT	LOSE IT
MONOUNSATURATED & POLYUNSATURATED FATS	**SATURATED FATS**	**HYDROGENATED OILS & TRANS FATS**
• Can lower bad cholesterol levels • Can lower risk of heart disease & stroke • Can provide essential fats that your body needs but can't produce itself.	• Can raise bad cholesterol levels • Can lower good cholesterol levels • Can increase risk of heart disease & stroke	• Can raise bad cholesterol levels • Can lower good cholesterol levels • Can increase risk of heart disease & stroke • Can increase risk of T2 diabetes
SOURCE	**SOURCE**	**SOURCE**
Plant-based liquid oils, nuts, seeds and fatty fish	Most saturated fats come from animal sources, including meat and dairy, and from tropical oils	Processed foods made with partially hydrogenated oils
EXAMPLES	**EXAMPLES**	**EXAMPLES**
Oils (such as canola, olive, peanut, safflower and sesame) Avocados Fatty Fish (such as tuna, herring, lake trout, mackerel, salmon and sardines) Nuts & Seeds (such as flaxseed, sunflower seeds and walnuts)	Beef, Pork & Chicken Fat Butter Cheese (such as whole milk cheeses) Tropical Oils (such as coconut, palm kernel and palm oils)	Partially Hydrogenated Oils Some Baked Goods Fried Foods Stick of Margarine

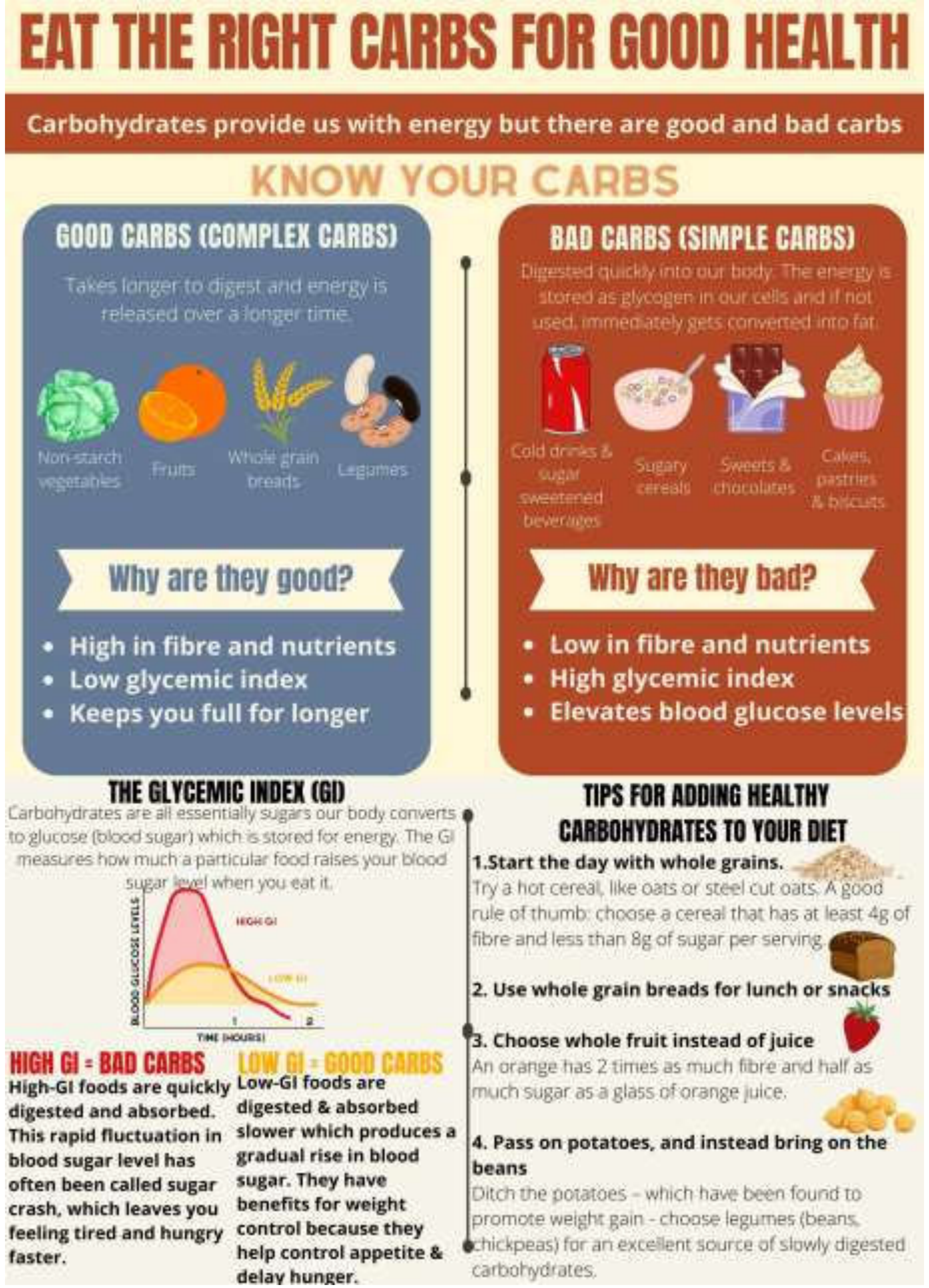
EAT SMART: REPLACE SATURATED FAT WITH UNSATURATED FAT AS PART OF HEALTHY LIVING.

EAT A DIET THAT:		
Includes GOOD FATS (Nuts, seeds, fatty fish, non-tropical oils)	Limits *saturated fats* to no more than 5-6% of calories	Keeps *trans fats* as LOW as possible

Carbohydrates

- Carbohydrates are another very important part of the South African diet. Whether mealie meal bread or rice, the staple food of the majority of South Africans is usually in the form of a carbohydrate.
- There are two types of carbohydrates: refined and unrefined. Let's talk about these.
- Carbohydrates start off in the unrefined state. They are rich in fibre, vitamins and minerals. Natural food fibre is very important to maintain healthy blood sugar levels and controlling appetite. The recommended intake of fibre is between 20-45 grams.
- What is the Glycaemic Index

Handout 4



EAT THE RIGHT CARBS FOR GOOD HEALTH

Carbohydrates provide us with energy but there are good and bad carbs

KNOW YOUR CARBS

GOOD CARBS (COMPLEX CARBS)

Takes longer to digest and energy is released over a longer time.

Non-starch vegetables
Fruits
Whole grain breads
Legumes

Why are they good?

- High in fibre and nutrients
- Low glycemic index
- Keeps you full for longer

BAD CARBS (SIMPLE CARBS)

Digested quickly into our body. The energy is stored as glycogen in our cells and if not used, immediately gets converted into fat.

Cold drinks & sugar sweetened beverages
Sugary cereals
Sweets & chocolates
Cakes, pastries & biscuits

Why are they bad?

- Low in fibre and nutrients
- High glycemic index
- Elevates blood glucose levels

THE GLYCEMIC INDEX (GI)

Carbohydrates are all essentially sugars our body converts to glucose (blood sugar) which is stored for energy. The GI measures how much a particular food raises your blood sugar level when you eat it.

BLOOD GLUCOSE LEVELS
HIGH GI
LOW GI
1
2
TIME (HOURS)

HIGH GI = BAD CARBS

High-GI foods are quickly digested and absorbed. This rapid fluctuation in blood sugar level has often been called sugar crash, which leaves you feeling tired and hungry faster.

LOW GI = GOOD CARBS

Low-GI foods are digested & absorbed slower which produces a gradual rise in blood sugar. They have benefits for weight control because they help control appetite & delay hunger.

TIPS FOR ADDING HEALTHY CARBOHYDRATES TO YOUR DIET

1.Start the day with whole grains.
Try a hot cereal, like oats or steel cut oats. A good rule of thumb: choose a cereal that has at least 4g of fibre and less than 8g of sugar per serving.

2. Use whole grain breads for lunch or snacks

3. Choose whole fruit instead of juice
An orange has 2 times as much fibre and half as much sugar as a glass of orange juice.

4. Pass on potatoes, and instead bring on the beans
Ditch the potatoes - which have been found to promote weight gain - choose legumes (beans, chickpeas) for an excellent source of slowly digested carbohydrates.

SUGAR

- 25 grams for women
- 36-37 grams for men

Handout 5

LIFE IS SWEETER WITH LESS SUGAR

DAILY ADDED SUGAR LIMIT

25 GRAMS	37 GRAMS
WOMEN	MEN

WAYS TO CUT DOWN SUGAR

1. Read food labels: A fat-free or low-fat product like yoghurt is often high in sugar. Check the label for "Sugar" listed under carbohydrates
2. Choose naturally sweet foods like fruits.
3. Add protein to your meals- your blood sugar levels will be more constant; you will feel fuller for longer.
4. Reduce sauces like tomato sauce and chutney (they contain sugar).
5. Start small-if you take sugar in your tea or coffee, reduce the amount of sugar over time until you can go without or very little

SUGAR CONTENT ON A FEW EVERYDAY FOOD ITEMS

CORN FLAKES
1 teaspoon per 40g

ORANGE JUICE
3 teaspoons per 100ml

DOUGHNUTS
4 teaspoons per 50g

CHOCOLATE
6 teaspoons per 50g

FIZZY DRINK
8 teaspoons per 330ml

SWEETENED YOGHURT
2.5 teaspoons per 100g

TOMATO SAUCE
4 teaspoons per 100ml

1 SLICE OF TOAST WITH JAM
2.5 teaspoons

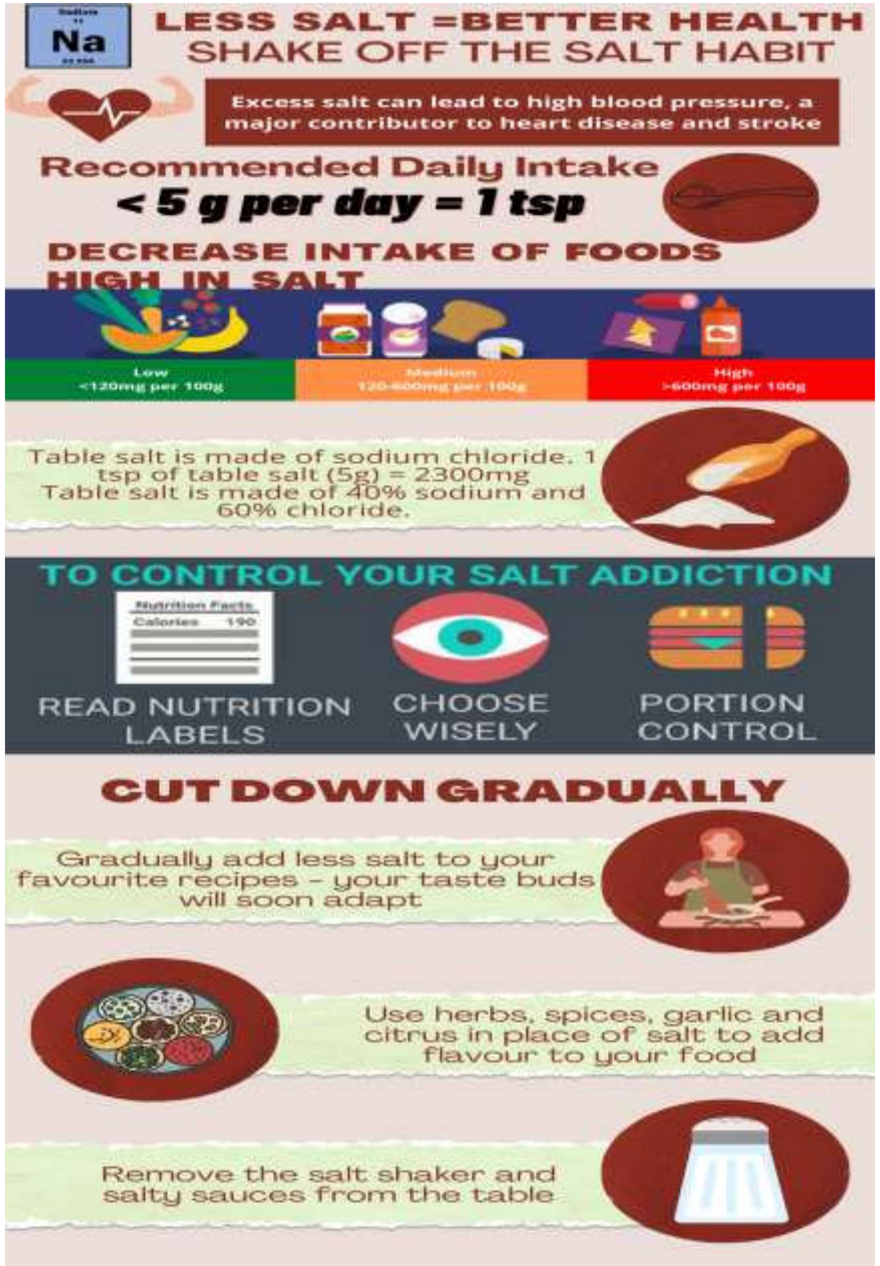
WHITE WINE
1 teaspoon per 330ml

STACKING UP THE SUGAR WITH BEVERAGES

SALT INTAKE

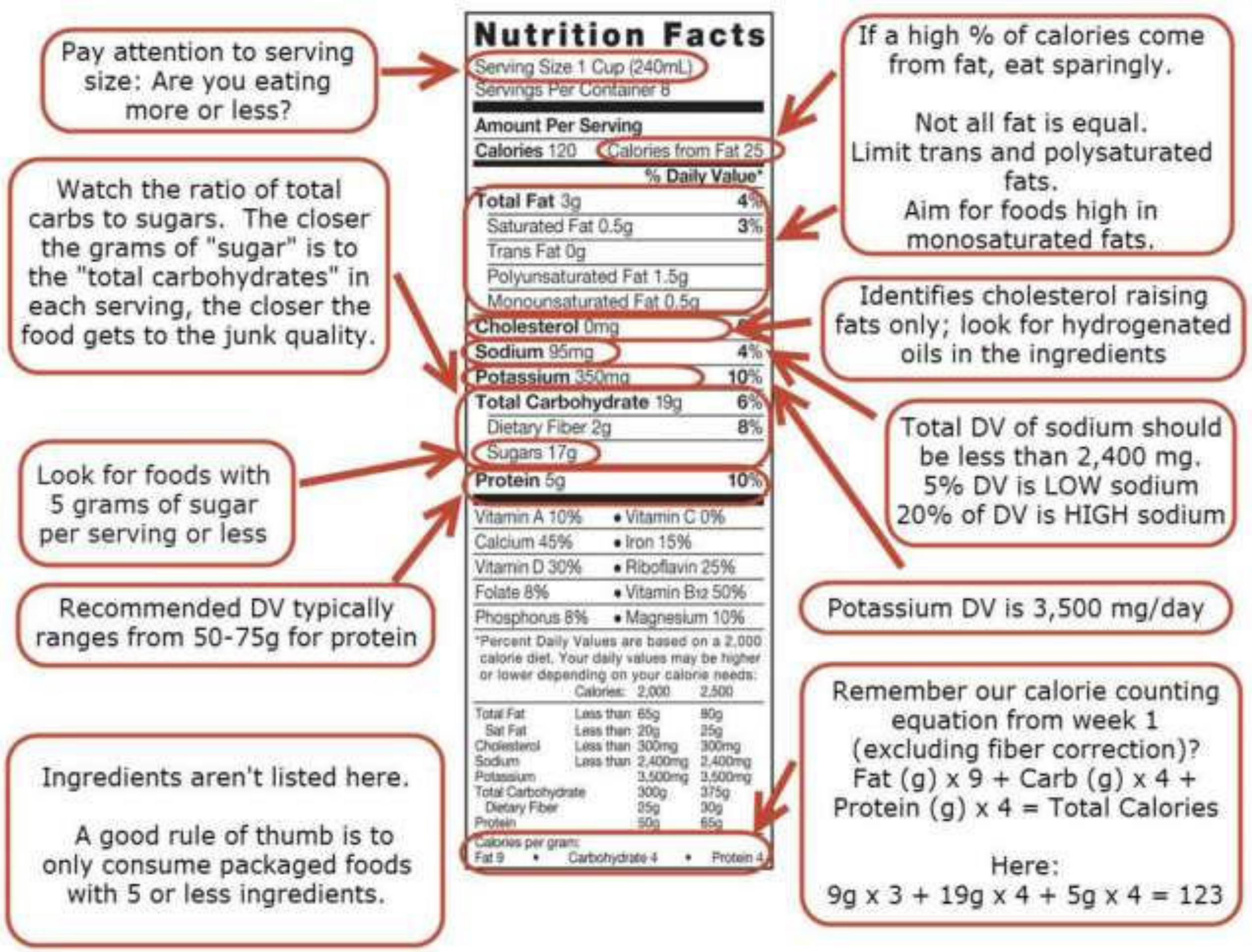
- Recommended daily intake: <5g per day= 1tsp

Handout
6



Na
LESS SALT =BETTER HEALTH
SHAKE OFF THE SALT HABIT
Excess salt can lead to high blood pressure, a major contributor to heart disease and stroke
Recommended Daily Intake
< 5 g per day = 1 tsp
DECREASE INTAKE OF FOODS HIGH IN SALT
Low
<120mg per 100g
Medium
120-600mg per 100g
High
>600mg per 100g
Table salt is made of sodium chloride. 1 tsp of table salt (5g) = 2300mg
Table salt is made of 40% sodium and 60% chloride.
TO CONTROL YOUR SALT ADDICTION
Nutrition Facts
Calories 190
READ NUTRITION LABELS
CHOOSE WISELY
PORTION CONTROL
CUT DOWN GRADUALLY
Gradually add less salt to your favourite recipes - your taste buds will soon adapt
Use herbs, spices, garlic and citrus in place of salt to add flavour to your food
Remove the salt shaker and salty sauces from the table

READING LABELS



How do I read food labels?

Knowing how to read labels is very important in making the healthier choice when choosing foods. This can be done by reading the ingredients list and looking at the nutritional information table.

Ingredients list

The ingredients are listed in order of **highest quantity to lowest quantity.**

Foods high in sugar, salt or fat usually will have these listed as one of the **first three ingredients.**

Ultra-processed foods often have difficult to pronounce words and even strange numbers (that are usually the additives) in the ingredients list.

Here are some of the common words to look out for:

Sugar: sucrose, glucose, fructose, dextrose, syrup, cane sugar, fruit juice concentrate, honey, maltodextrin, maltose

Salt: sodium, monosodium glutamate (MSG), sodium bicarbonate (baking soda), anything with 'sodium', flavour enhancers, soy sauce, brine

Fat: oil, vegetable fat, palm fruit, hydrogenated fat, coconut, cream, lard, shortening , butter, cocoa butter

Remember: Fried ready-to-eat meals and fast foods can be high in trans fats, which are unhealthy.

Nutritional information table

Look at the nutritional information table to find out how much sugar, salt or fat is in a food.

Use the following cut-off points when looking for foods that are lower in saturated fat, total sugar and sodium (salt) and higher in fibre:

Per 100g food or drink (not per serving):	
Total Sugar:	<5g per 100g food <2.5 g per 100ml drink
Saturated fat:	<2.5g per 100g food or drink
Total sodium:	<120mg per 100g food or drink
Dietary fibre:	>3g per 100g food or drink

Be careful of low-sugar, reduced-fat or other such health claims. Read all the nutrition information and compare with the values as given above. Sometimes the fat is replaced with sugar or vice versa (also not healthy), or it might be high in salt.

Remember: Fresh whole foods that require no food label are better for health.

Homework

- Complete Handout 9 (Compare: grams of fat)
- Each day, keep track of when and what you ate and drank by writing it in your food and physical activity dairy
- Keep track of any physical activity you completed in your food and physical activity dairy
- Bring your completed food and physical activity dairy and your participant back to class with you next week

Does anyone have any questions? Please can you complete the evaluation form.

Thank you and I look forward to seeing you next week.

Lesson 4 workout

Lesson 5: Identifying Fats and Carbs and reducing Salt intake

Objectives:

- Learn about types of fat and why some fats are different than others
- Learn about the differences between types of carbohydrates
- Learn basic principles of self-monitoring fat grams and reasons to do so
- Practice finding foods that are lower in fat
- Practice reading food labels
- Learn how to reduce salt intake

*[***Handout 1, Be a Fat Detective***]*

To help you lose weight, we'll help you build healthy eating habits

Healthy eating involves eating fewer kilojoules, less fat and less unhealthy fat

Take look at the following labels and let complete the table together.

NUTRITIONAL FACTS

Nutrients	Per 100 g	Per 36 g
Energy (kJ)	2203	793
Energy (kcal)	527	190
Protein (g)	7,4	2,7
Carbohydrate (g)	46	17
of which total sugar (g)	0,7	0,3
Total fat (g)	35,0	12,6
of which saturated fat (g)	13,6	4,9
Dietary fibre# (g)	4,8	1,7
Total sodium (mg)	850	306

Compare	Kilojoules	Fat grams
36g Simba Salt & Vinegar Flavoured chips		

[Handout 2, Fat Infographic***]***

THE FACTS ON FAT HOW MUCH FAT DO YOU NEED?

Fat intake should provide 20-30% of our total energy intake.
If you are an adult woman who requires
a total energy intake of 8,400 kJ per day,
then 20% = 1680 kJ should be provided by fat intake.
Each gram of fat provides 37 kJ, so 1680/37 = 44 g of fat per day.

If we do this calculation for the higher intake of 30% of total energy,
then 30% of 8,400 kJ (2000 kcal) = 2,520 kJ (600 kcal) per day
which works out to 2,520/37 (600/9) = about 68 g of fat per day.
The adult woman would, therefore,
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LOVE IT	LIMIT IT	LOSE IT
MONOUNSATURATED & POLYUNSATURATED FATS	**SATURATED FATS**	**HYDROGENATED OILS & TRANS FATS**
• Can lower bad cholesterol levels • Can lower risk of heart disease & stroke • Can provide essential fats that your body needs but can't produce itself.	• Can raise bad cholesterol levels • Can lower good cholesterol levels • Can increase risk of heart disease & stroke	• Can raise bad cholesterol levels • Can lower good cholesterol levels • Can increase risk of heart disease & stroke • Can increase risk of T2 diabetes
SOURCE	**SOURCE**	**SOURCE**
Plant-based liquid oils, nuts, seeds and fatty fish	Most saturated fats come from animal sources, including meat and dairy, and from tropical oils	Processed foods made with partially hydrogenated oils
EXAMPLES	**EXAMPLES**	**EXAMPLES**
Oils (such as canola, olive, peanut, safflower and sesame) Avocados Fatty Fish (such as tuna, herring, lake trout, mackerel, salmon and sardines) Nuts & Seeds (such as flaxseed, sunflower seeds and walnuts)	Beef, Pork & Chicken Fat Butter Cheese (such as whole milk cheeses) Tropical Oils (such as coconut, palm kernel and palm oils)	Partially Hydrogenated Oils Some Baked Goods Fried Foods Stick of Margarine

EAT SMART: REPLACE SATURATED FAT WITH UNSATURATED FAT AS PART OF HEALTHY LIVING.

EAT A DIET THAT:		
Includes GOOD FATS (Nuts, seeds, fatty fish, non-tropical oils)	Limits ***saturated fats*** to no more than 5-6% of calories	Keeps ***trans fats*** as LOW as possible

Handout 3

Types of Fats and Carbs

SATURATED FATS	MONOUNSATURATED FATS (MUFAS)	POLYUNSATURATED FATS (PUFAS)	TRANS FATS
Eating too much can Raise levels of "bad" cholesterol in the blood (LDL or low-density lipoproteins)	Can lower total cholesterol in your blood and decrease LDL	Can lower blood cholesterol	Can raise bad cholesterol (LDL) and lower good cholesterol (HDL)
May increase your risk of having a heart attack or stroke	May decrease your risk of having a heart attack or stroke	May decrease your risk of having a heart attack or stroke	May increase your risk of having a heart attack or stroke
Animal fats: Butter, cheese, whole milk, ice cream, and fatty meats **Plant fats:** coconut oil, palm, and palm kernel oil 	**Seeds or nuts:** avocado, olive, peanut, and canola oils 	Corn, sunflower, soybean, cottonseed, and sesame seed oils 	Margarines, snack foods, baked goods and fried foods 

REFINED CARBS	UNREFINED CARBS
Less fibre, more sugar, higher glycaemic index	Lower glycaemic index, more fibre
Undergone manufacturing	Natural
White sugar, white bread, white rice, white flour	Brown bread, brown rice, wheat flour

Handout 4:Carb infographic

Handout 5: Sugar

Lets' talk about daily sugar limit

Salt intake: Handout 6

Lets salt about your recommended daily intake of salt

Please look at the 2 x food labels and complete the activity:

First, find the Nutrition Facts on the label and **look at the serving size**. Is this the amount you would usually eat?

Then, look at the total kilojoules per serving and the kilojoules from fat. If a high amount of the kilojoules come from fat, this food should be eaten sparingly.

Next, **check for the amount of fat grams.** If there is high fat content, check the breakup of fat to see whether the majority is "good"(polyunsaturated or monounsaturated) or "bad"(saturated or trans).

Next, you should check the carbohydrates. fibre is good and helps get rid of cholesterol from the body. Sugars, on the other hand, should be ideally lower than 5 grams. The closer the amount of sugar is to the total carbohydrate, the poorer in quality the food is.

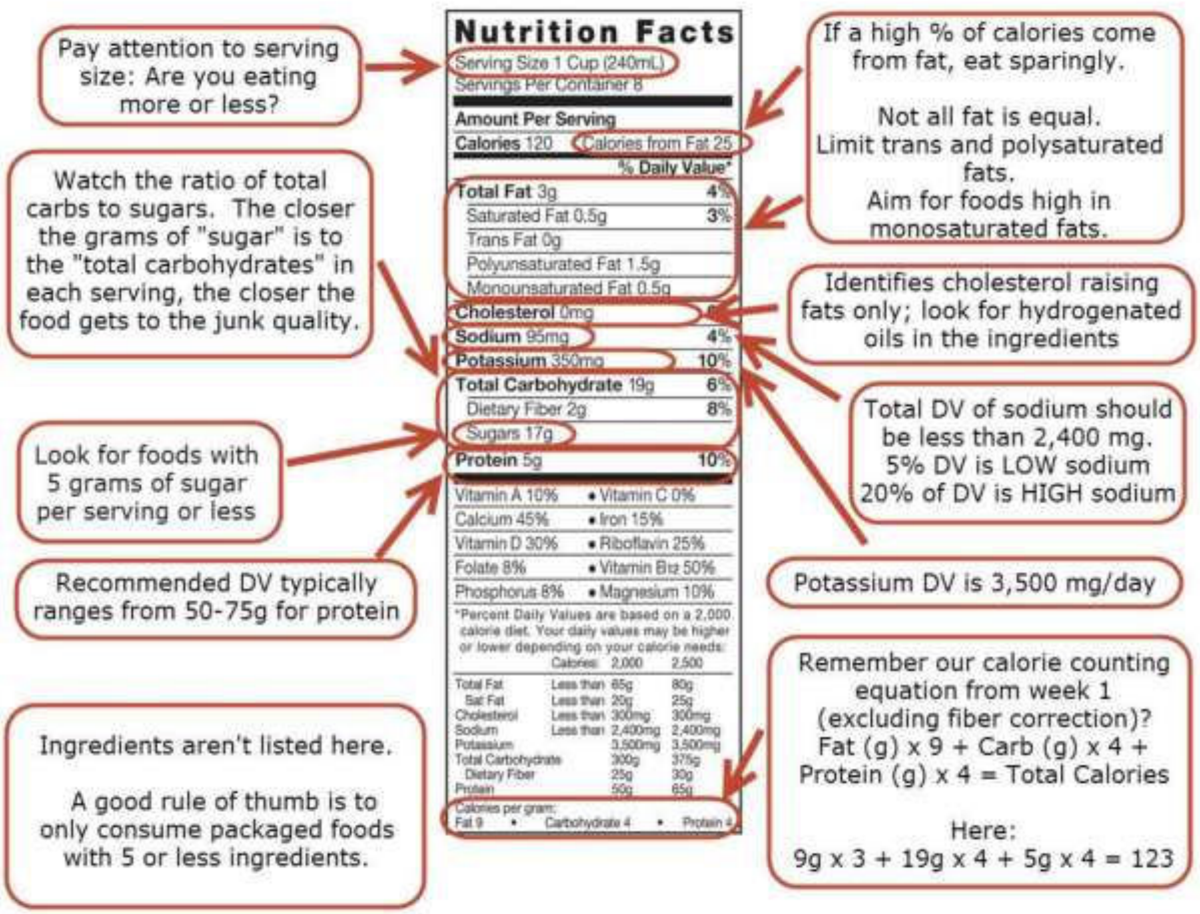
Next, check the protein. The protein should be anywhere from 50-75 g per day, based on your recommended daily allowances (based on how much you weigh and how much you exercise).

Next, check the sodium

Finally, check the vitamin content to see if the food contains a lot of vitamins. **Check the ingredients** to see what is in what you eat. Ideally, try to eat foods with five or less ingredients. The ingredients are listed in order of content. For example, if sugar is the most used ingredient, it will be listed first. Avoid foods that have unhealthy ingredients like sugar or oil listed first.

Refer to the "Label Reading" Handout 7 and 8 for assistance.

[Handout 7 and 8, “Label Reading”]



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Dietary fibre:	>3g per 100g food or drink

Be careful of low-sugar, reduced-fat or other such health claims. Read all the nutrition information and compare with the values as given above. Sometimes the fat is replaced with sugar or vice versa (also not healthy), or it might be high in salt.

Remember: Fresh whole foods that require no food label are better for health.

*[***Handout 9, "Compare: Grams of Fat"***]*

Compare: Grams of Fat

Ways to Eat Lower-Fat Foods Instead	Compare	Grams of Fat
Instead of high-fat foods, pick low-fat foods		
Instead of high-fat foods, use lower fat substitutes*		
Find ways to lower the amount of fat in meats you eat		
Instead of flavouring foods with fat, use low-fat flavourings		
Avoid frying foods; use other healthier ways to cook.		

* **Warning:** Low-fat or fat-free products still contain kilojoules. Be careful about how much you eat. In fact, some low-fat or fat-free products are very high in calories because they're loaded with sugar. Check the label.

For example:

½ cup non-fat frozen yogurt 418 kilojoules vs ½ cup regular ice cream (10-12% fat) 598 kilojoules

To-Do Next Week

Next week, I will—

- **Keep track of my weight and what I eat.**
    - ✔ Keep track of **all** the fat grams I eat each day.
    - ✔ Come as close as I can to my fat gram goal.

Make a plan to eat less fat and follow it.

- ✔ In the table below, write down five foods you that are high in fat. Circle one.
- ✔ Pick one of the three ways to eat less fat from the food you circled. Write down in the space below how you will cut fat next week. **Be sure you write something you can do.**

My top 5 high-fat foods	The 3 Ways to Eat Less Fat		
	I will eat it less often:	I will eat a smaller amount:	I will eat a lower-fat food instead:

What I will need to do to carry out this plan:____

Problems I might have cutting down on these foods, and what I will do to solve the problem:

____

Three Ways to Eat Less Fat and Fewer Kilojoules

In this session, we discuss three simple ways to eat less fat and fewer kilojoules.

1. Eat foods high in fat or kilojoules *less often.*

Example: Eat French fries once a week instead of every day. That would mean about 132 fewer grams of fat per week!

2. Eat *smaller amounts* of high-kilojoule foods. Cutting back even a little on the amount you eat can make a big difference.

Example: At the salad bar, use a regular spoon instead of the ladle to pour on salad dressing. Most ladles hold 4 tablespoons, but most spoons hold 1 tablespoon or less. So you'll eat only a quarter of the fat. You'll eat 24 fewer grams of fat!

3. Eat *lower-fat* and *lower-kilojoule* foods instead.

Example: Choose non-fat milk instead of whole milk.

Three Ways to Eat Less Fat and Fewer Kilojoules (continued)

Use the table below to help you find examples of lower-fat and lower-calorie foods.

Instead of this food:	Fat (g)	Kilojoules	Choose this food:	Fat (g)	Kilojoules
Potato chips, 1 x 28g bag	11	674	Pretzels 1x 28g bag	1	1897
Regular margarine,1 tsp	4	142	Low-fat margarine, 1 tsp	2	71
Roast beef (chuck), untrimmed, 85g	22	1197	Roast beef (top round), trimmed, 85g	4	640
Baked potato with2 Tbsp sour cream	6	234	Baked potato with 2 Tbsp salsa	0	33
Chicken breast, with skin, breaded,fried	24	1837	Chicken breast without skin, grilled	9	858

Warning: Low-fat or fat-free products often contain a lot of kilojoules.

For example —

½ cup low-fat frozen yogurt can have between 110- 180 kilojoules.

Some low-fat or fat-free products are *very* high in calories because they're loadedwith sugar. Be careful. Check the label.

Menu Makeover

These examples show how small changes make big differences in fat grams and kilojoules.

High-fat, high-kilojoule meal	Makeover meal	Fat grams saved	Kilojoules saved
Breakfast			
Fried eggs, 2	Corn flakes, 1 cup	15	90
Whole milk, 1 cup	Skim milk, 1 cup	8	60
Toast, 1 slice, with 1 tsp margarine or butter	Toast, 1 slice, with 1 tsp jam or jelly	4	17
Coffee, 1 cup, with 2 Tbsp half & half	Coffee, 1 cup, with 2 Tbsp nonfat creamer	4	20
Snack			
Doughnut, glazed, yeast, 1 (4" diam.)	Apple, 1 (2-3/4"diam.)	12	180
Lunch			
2 slices bread, with 1 Tbsp mayonnaise	2 slices bread, with 1 tsp mayonnaise	4	64
Bologna, beef, or pork, 28g	Turkey breast, 1 28g	7	60
American cheese, 28g	American cheese, low-fat, 28g	5	40
Potato chips, 28g bag	Potato chips, ½ of a 28g bag	5	75
Dinner			
Flounder, deep fried, 85g	Flounder, baked without fat, 85g	4	64
Mashed potatoes, ½ cup with milk and butter	Mashed potatoes, ½ cup, with milk, no butter	4	35
Gravy, ¼ cup	Gravy, from mix, using water, ¼ cup	4	80
Green beans, with bacon, ½ cup	Green beans, with nonfat broth, ½ cup	2	15
Salad with 2 Tbsp French dressing	Salad with 2 Tbsp fat-free dressing	11	100
Dessert			
Ice cream, premium, ½ cup	Orange, 1 (Eat ice cream rarely)	18	210
	Total Daily Savings:	**107**	**1,110**

Menu Makeover Practice Sheet

Next week, use this table to practice cutting the fat and calories from meals and snacks.

Meal	High- fat, high-kilojoule meal	Fat grams	Makeover meal	Fat grams	Fat grams saved
Breakfast					
Lunch					
Dinner					
Snacks					

Please come see me if you have any further questions. See you next week!

____

YOUR SUGGESTIONS ARE IMPORTANT

Thank you for your cooperation. We value your feedback and it will help us enhance the upcoming sessions.

Date: dd/mm/yyyy ________________ Time: hh:mm am/pm ___________________________

Site: ______________________________ Name____

After attending the session, please respond to the following questions, circle your answer:

1. Has the program helped you understand that there are different types of fats and how these differ:
    - Yes
    - No
2. I now understand about refined and unrefined carbohydrates:
    - Yes
    - No
3. Do you think the program has helped you to identify ways to cut down on fat intake?
    - Yes
    - No
4. Do you think the program has provided you with clear ideas on how to cut down on sugar intake?
    - Yes
    - No
5. Has the program provided you with clear examples of how to reduce salt intake?
    - Yes
    - No
6. I am now aware of how much sugar, salt and fat I should be consuming:
    - Yes
    - No
7. I have a better understanding of how to read a food label:
    - Yes
    - No
8. I feel motivated to change my carb, fat, sugar and salt intake:
    - Yes
    - No
9. How easy was the trainer's language to understand during today's session?
    - Trainer's language was not at all easy to understand
    - Trainer's language was a little easy to understand
    - Trainer's language was somewhat easy to understand
    - Trainer's language was very much easy to understand
    - Trainer's language was extremely easy to understand
10. For the following points, please rate your level of satisfaction:
    - Session arrangement- *Very unsatisfied, Unsatisfied, Neutral, Satisfied, Very Satisfied*
11. On a scale of 0 to 10, how easy or difficult was the program?

0=extremely easy *10= extremely difficult*

0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*

Thank you

WORKSITE MULTICOMPONENT LIFESTYLE INTERVENTION STUDY (WMLIS)

LIVE HEALTHY GET FIT

Diabetes and Hypertension Prevention Programme

DUT DURBAN UNIVERSITY OF TECHNOLOGY
SAMRC
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LESSON 5: TIP THE KILOJOULE BALANCE, HEALTHY WAYS TO DINE OUT AND HEALTHY COOKING

Rules

- Be on time to the lifestyle classes.
- Switch phones onto silent.
- Let us know if you can't make a meeting, we will assist you to find another slot.
- Complete the things you are supposed to do at home. Homework outside the group meetings is the **most important factor** in your success.

Objectives

In this session, you will:

- Discuss how healthy eating and being active are related in terms of kilojoule balance.
- Discuss how the kilojoule balance relates to weight loss and weight gain.
- Review the participant's progress so far in terms of:

  a). changes made in diet and activity and

  b). weight change. Discuss how this relates to the kilojoule balance.
- Review the four basic principles for healthy eating out: planning ahead, asking for what you want, taking charge of what's around you, and choosing foods carefully.
- Apply these principles in examples of social situations that they may encounter.
- Learn about quick hacks for healthy cooking.

The Kilojoule balance?

- Do you know the difference between : Calorie and Kilojoule???

SA- DPP focuses on **two kinds of lifestyle changes:**

- Healthy eating. This includes eating less fat and more whole grains, vegetables, and fruits
- Being more physically active

These changes are important, as they can help prevent diabetes and lower your risk for cardiovascular disease. They are both closely related to weight loss and together contribute to the "kilojoule balance."

Kilojoule balance is the balance between the kilojoules you take in by eating and the kilojoules you use up by being active.

When you eat food, you take in kilojoules or energy.

- Kilojoules in food come from fat, carbohydrates (starches, sugar), protein, and alcohol.
- The number of kilojoules in any food you eat depends on what is in that food. Fat has more than twice the number of kilojoules in starches, sugars, or proteins. That's one important reason why our emphasis has been on eating less fat.

Handout 1: Tip the Kilojoule Balance

SA- DPP involves:

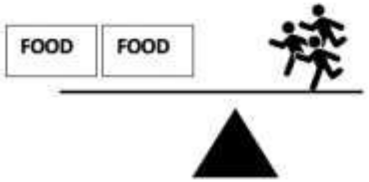
- Healthy eating. This includes eating less fat and more grains, fruits, and vegetables
- Being active

Both promote better health and weight loss.

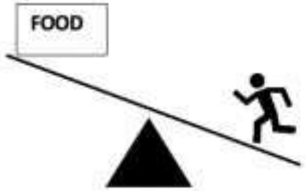
The kilojoule balance is affected by the kilojoules:

- Taken in by eating AND used up by being active

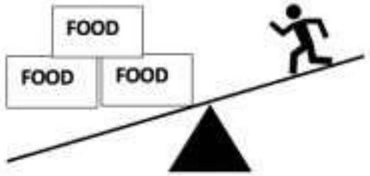
1. Your Weight Can Stay the Same



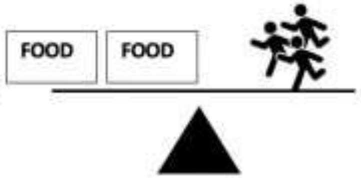
2. You Can Lose Weight



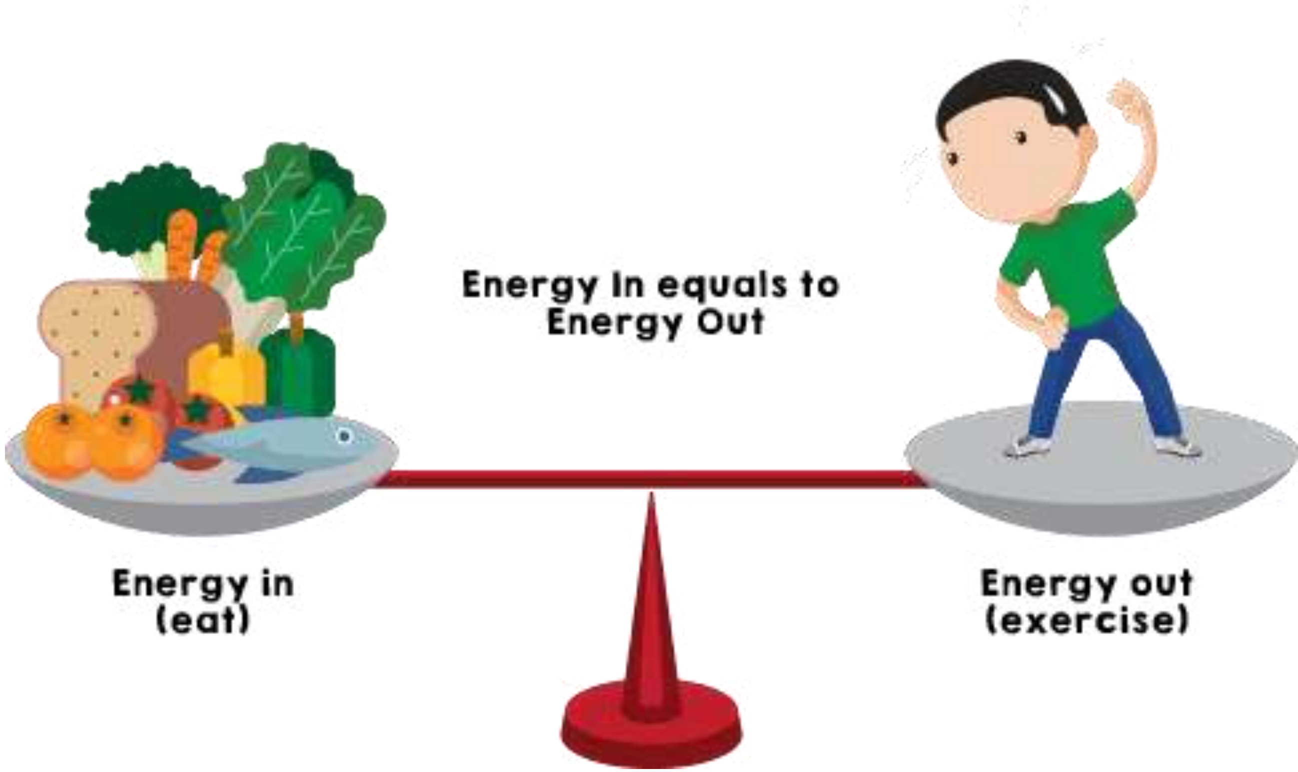
3. You Can Gain Weight



4. At Your New Weight. You Can Reach a New Balance



Now I will explain kilojoule requirements for weight loss.



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ABDOMINAL OBESITY

Abdominal obesity is especially an issue in the South African population, as most South Africans tend to put on weight near their hips and belly. There are two types of fat in the body: visceral and subcutaneous fat. Abdominal fat is harmful because it is mostly visceral fat. Visceral fat is a type of fat that surrounds your body organs. It increases the stress on the body and cardiac risk. It also is harmful because it releases fatty toxins to your liver, causing damage to organs in close proximity such as the pancreas. This plays a major role in diabetes progression.

When you started in SA- DPP, we measured your abdominal obesity level by measuring your waist circumference. We will do this again at each study testing visit. You can also measure it yourself. To do this, wrap a tape measure around your stomach at belly button level. For South Africans, we want to keep your waist circumference less than 80 centimetres for women and less than 90 centimetres for men. Waist circumference measures above this increase your risk of cardiovascular disease and diabetes.

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Handout 2

Changes You Have Made So Far:

Please complete

1. To be more active (both to reach your goal and be active in general):

____

____

2. To eat less fat (and fewer kilojoules):

____

____

3. Have these changes affected your weight?

Your weight at the start of Lifestyle Balance: ________________ Kg

Weight now: ___________________ Kg

EATING OUTSIDE HOME

There are four basic keys to healthy eating out.

First, plan ahead. Having a plan will help you to anticipate difficult situations and handle them more easily.

Second, ask for what you want. Be firm and friendly. We'll talk in a minute about how to do this, so you won't offend anyone.

Third, take charge of what's around you. Take steps to create a supportive environment.

And finally, choose foods carefully.

HEALTHY COOKING

Lets share some of our healthy cooking practices

Homework

- Each day, keep track of when and what you ate and drank by writing it in your food and physical activity dairy
- Keep track of any physical activity you completed in your food and physical activity dairy
- Bring your completed food and physical activity dairy and your participant back to class with you next week

Does anyone have any questions? Please can you complete the evaluation form.

Thank you and I look forward to seeing you next week.

[redacted]

Lesson 5: Tip the Kilojoule Balance, healthy ways to dine out and healthy cooking

Objectives:

In this session, the participant will:

- Discuss how healthy eating and being active are related in terms of kilojoule balance.
- Discuss how the kilojoule balance relates to weight loss and weight gain.
- Review the participant's progress so far in terms of

  a) changes made in diet and activity and

  b) weight change. Discuss how this relates to the kilojoule balance.
- Review the four basic principles for healthy eating out: planning ahead, asking for what you want, taking charge of what's around you, and choosing foods carefully.
- Apply these principles in examples of social situations that they may encounter.
- Learn about quick hacks with healthy cooking.

Do you know the difference between: Calorie and Kilojoule

The energy we get from food and drink is measured in kilojoules (kJ). This is the metric term for calorie. Kilojoules and calories represent the **same thing. One calorie is about 4.2 kilojoules. Multiple one calorie by 4.2 to get the kilojoule value**

Please follow along on Handout 1, "Tip the Kilojoule Balance".

SA- DPP focuses on **two kinds of lifestyle changes:**

- Healthy eating. This includes eating less fat and more whole grains, vegetables, and fruits
- Being more physically active

These changes are important, as they can help prevent diabetes and lower your risk for cardiovascular disease. Both are closely related to weight loss and together contribute to the "kilojoule balance."

Kilojoule balance is the balance between the kilojoules you take in by eating and the kilojoules you use up by being active.

When you eat food, you take in kilojoules or energy.

- Kilojoules in food come from fat, carbohydrates (starches, sugar), protein, and alcohol.
- The number of kilojoules in any food you eat depends on what is in that food. Fat has more than twice the number of kilojoules in starches, sugars, or proteins. That's one important reason why our emphasis has been on eating less fat.

Kilojoules also measure the energy you use up.

- Your body uses kilojoules to operate (breathing, your heart beating, digesting food, etc.) and for any activity you do.
- The number of kilojoules you use in a certain activity depends on several things, including the type of activity, the amount of time you are active, and how much you weigh.

Let's look at four ways the Kilojoule balance can work.

1. Your weight can stay the same. This is seen in diagram one. In this case, kilojoules in from food equal kilojoules out from activity.
2. Second, you can lose weight. Look at diagram two. Kilojoules in from food are lighter than kilojoules out from activity. You've eaten fewer kilojoules, or you've done more activity, or both. This is the best way to lose weight.
3. *Third, you can gain weight. Look at diagram three. In this case, either kilojoules have increased, or activity has decreased or both. The balance has tipped, and you gain weight.* *[Indicate direction of balance.]*
4. And finally, you can reach a new balance at a new weight. Look at diagram four. You have developed new food habits and new activity habits and they are once again balanced. This is what happens when you lose weight, and you maintain that new weight.

Handout 1: Tip the Kilojoule Balance

SA- DPP involves:

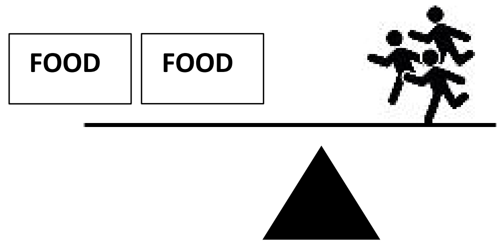
- Healthy eating. This includes eating less fat and more grains, fruits, and vegetables
- Being active

Both promote better health and weight loss.

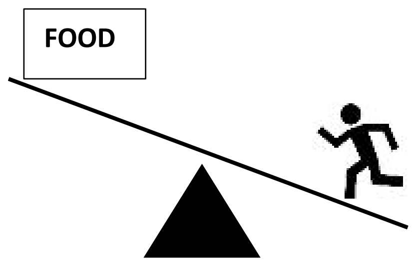
The kilojoule balance is affected by the kilojoules:

- Taken in by eating AND used up by being active

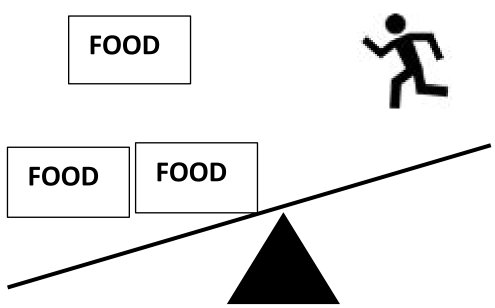
1. Your Weight Can Stay the Same



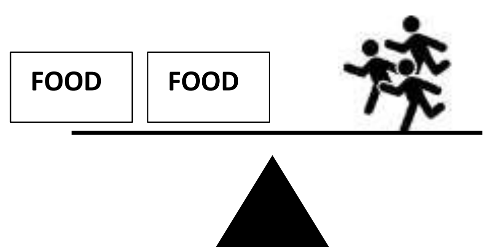
2. You Can Lose Weight



3. You Can Gain Weight



4. At Your New Weight. You Can Reach a New Balance



Handout 2

Please look at handout 2, “Changes you have made so far.”

Changes You Have Made So Far:

Please complete

1. To be more active (both to reach your goal and be active in general):

____

____

2. To eat less fat (and fewer kilojoules):

____

____

3. Have these changes affected your weight?

Your weight at the start of Lifestyle Balance: _______________ Kg

Weight now: ___________________ Kg

Handout 3 **Tips for how to plan ahead when eating out.**

- **Call restaurants or go to their websites to find out about low- fat, low-kilojoule choices on the menu.**

    - **Select a restaurant that offers low-fat, low-kilojoules choices.**

    - **Eat less fat and fewer kilojoules than usual during other meals during the day when you plan to eat out in the evening.**

    - **Eat a small, healthy snack or drink a large, low-kilojoule or kilojoule-free beverage before you go out.**

    - **Plan what to order before you get to the restaurant, and order without looking at the menu.**

    - **Do not drink alcohol before eating.**

    - **For parties or dinner parties, bring a healthy, low-fat, and low- kilojoule dish to share with others.**

Restaurants expect that people will ask for what they want, so find out about healthy food options. After all, you are paying for your meal!

- **Ask for the *foods* you want:**
    - Ask for low-fat, low-kilojoule foods.
    - Ask if foods can be cooked in a different way.
    - Do not be afraid to ask for foods that are not on the menu.

- **Ask for the *amounts* you want:**
    - Ask how large the serving size is.
    - Order salad dressing, gravy, sauces, or spreads on the side.
    - Ask for less cheese or no cheese.
    - Split a main dish or dessert with someone.
    - Order a small size (appetiser, children's size, half portion).
    - Before or after the meal, have the amount you do not want to eat put in a container to take home.

Now, let's talk about another situation using the same principles--eating at another person's home.

1. Plan ahead.

- Talk to the host or hostess before going to their house and let them know about SA- DPP and your health goals. Ask for their support in your efforts to eat healthy foods.

2. Ask for what you want. Be firm and friendly.

- Say "No, thank you. That looks lovely, though," when offered a food you'd rather not eat and suggest something you do want, like coffee or tea with no sugar or extra servings of vegetables.

3. Take charge of what's around you.

- Start a conversation when eating or eat slowly and enjoy your food so that you consciously remind yourself to eat less.

4. Choose foods carefully.

- If you do choose to eat high fat, high kilojoule foods, just try a taste.
- Look for the healthiest options offered and eat more of those.

At a wedding:

Weddings are generally hard places to stick to your diet in because of the festive atmosphere and wide array of tempting foods.

1) Plan ahead: Eat something before you go, so you aren't too hungry when you arrive.

2) Take charge of what's around you.

- At buffets or parties, stay away from the buffet or appetizer table. Choose a small plate and after serving yourself, sit at a table far away.

3) Choose foods carefully.

- Look at everything on the buffet before serving yourself. Then choose only three or four of your favourite foods, instead of trying a little of everything.

6. Healthy cooking discussion and advise that in week 6, we will be doing sensory testing of food items.

7. Physical Activity Routine 10 MIN

8. Assign home activity 5 MIN

For next week:

- Continue to keep track of your eating and activity. **Be active for 90 Minutes.**

By doing more activity, you will use more kilojoules.

About Kilojoules

There is a reason we eat kilojoules—ourbodies need them to survive. They fueleverything we do, even our breathing. The number of calories we use for an activity depends on the type of activity, the amount of time we are active, and how much we weigh. The number of kilojoules we use depends on our weightand how far and long we carryit.

The Kilojoule Balance

Kilojoule balance means that the kilojoules we take in through eating and drinking should equal the kilojoules we use through physical activity and our body's other energy needs (for example, breathing, digesting food, sleeping).

Energy Use Through Activity

A rule of thumb is that one mile of brisk walking uses about 420 kilojoules. Most people walk a mile in 15 to 20 minutes. So you can see that it would take many miles to burn off a high-fat meal.

Quick Fact

Does eating too much sugar cause type 2 diabetes?

No. Type 2 diabetes is generally caused by a combination of genes and lifestyle.

Genes: Diabetes tends to run in families. Therefore, if one or more family members have diabetes, our chances of getting diabetes are higher than for people from families with no diabetes.

Lifestyle: Being overweight and inactive also puts us at risk for type 2 diabetes.

What to do: We cannot change our genes, but we can change our lifestyle and lower our risk.

Eating healthy meals and doing regular physical activity are the best ways to lower our weight and lower our risk for type 2 diabetes.

Tipping the Balance

How many kilojoules and how much physical activity is needed to tip the balance in favour of losing weight?

The amount varies from person to person. This program has many tools to help you tip the balance in the healthy direction. Just remember, the best way to tip the balance is to *both* reduce the amount we eat and drink and increase the time we arephysically active.

This Week - Tracking Your Kilojoules

By keeping track of kilojoules , you will learn which foods are highest in kilojoules. You will also find ways to cut back.

If you haven't been tracking kilojoules in this program, begin this week. Look up the kilojoules for every food you eat, just like you look up the fat grams.

Understanding the Kilojoule Balance

The **kilojoule balance** is the balance betweenthe kilojoules (or energy) that you —

- ✔ **Take in by eating**
- ✔ **Use by being active**

Kilojoules and Food

Kilojoules are a measure of the energy value of food and drink. When we eat food, we take in kilojoules. The number of kilojoules in a food or drink depends on the amount of protein, fat, carbohydrates, and alcohol it contains. The chart below shows roughly the number of kilojoules in a gram of each kilojoule source. Note that **fat** is the highest in kilojoules per gram.

	Fat	Carbohydrates	Protein	Alcohol
Kilojoule per gram	37.7	16.7	16.7	29.4

Kilojoules and Activity

Kilojoules also measure the energy we use up. Our body uses kilojoules for all its functions, even breathing and sleeping. And of course, moving.

The rule of thumb for using up or burning kilojoules by moving is shown here.

1.6km of brisk walking (15 to 20 minutes) = about 420 kilojoules

Take Charge of What's Around You

Here are some important tips for taking charge of what is around you that will help you continue to make healthy choices when you are not eating at home.

Be the first to order.

- ✓ You will be less likely to order unhealthy meals that other people order.

Keep foods off the table that you do not want to eat.

- ✓ Ask the server to remove bread and butter from the table.

Ask the server to remove your plate as soon as you finish.

- ✓ You'll be less likely to pick at the leftover food on your plate when you're already full.

Choose Your Food Carefully

Watch out for these **high-fat words** on menus.

Au gratin
Breaded
Buttered or buttery
Cheese sauce
Creamed, creamy, cream sauce
Fried, deep fried, French fried,
Batter fried, pan fried
Gravy
Hollandaise
Parmesan
Pastry
Rich
Sautéed
Escalloped
Scalloped
Seasoned
Southern style

Look for these **low-fat words** instead.

Baked
Broiled
Boiled
Grilled
Poached
Roasted
Steamed
Stir-fried

Use these tips for choosing your foods:

- ✔ **Be cautious of sauces.**
- ✔ **Think about what you really *need* to eat.**
- ✔ **Trim fat off meat.**
- ✔ **Take skin off chicken.**

A Positive Action Plan

1. **Describe a problem you have when you eat out.**

2. **Make a positive action plan.**

I will:

When?

I will do this first:

Roadblocks that might occur:

I will handle this by:

I will do this to make my success more likely:

LESSON 5 - YOUR SUGGESTIONS ARE IMPORTANT

Thank you for your cooperation. We value your feedback and it will help us enhance the upcoming sessions.

Date: dd/mm/yyyy ________________ Time: hh:mm am/pm ___________________________

Site: ______________________________ Name____

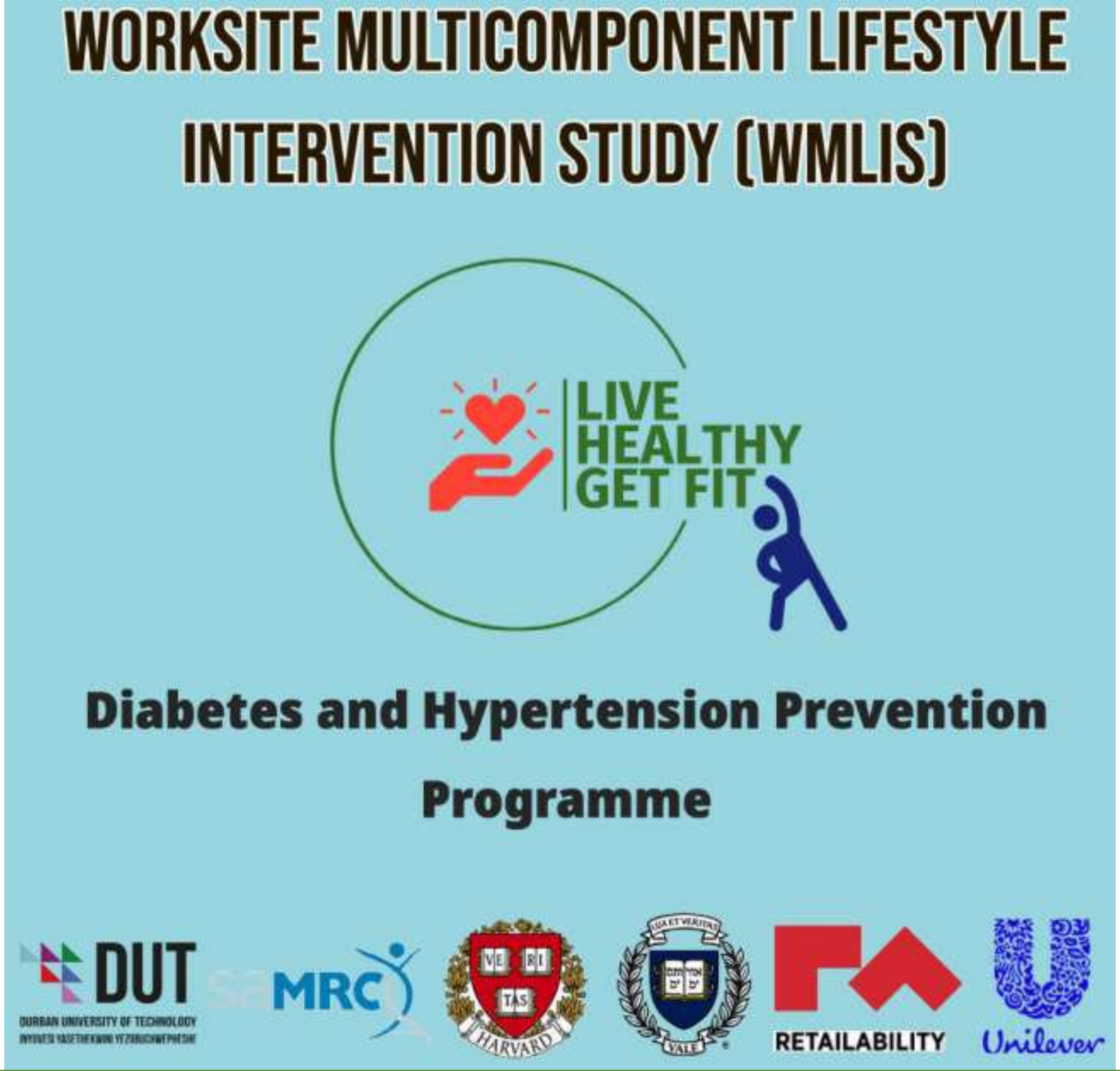
After attending the session, please respond to the following questions, circle your answer:

1. Has the program helped you understand about kilojoules and calories?
   - Yes
   - No
2. Has the program helped you understand how the kilojoule balance works?
   - Yes
   - No
3. I can now identify the changes I can make to be more active:
   - Yes
   - No
4. I can now identify the changes I can make to eat less fat and fewer kilojoules:
   - Yes
   - No
5. Has the program provided you with clear guidelines for healthy eating outside the house?
   - Yes
   - No
6. Has the program provided you with clear guidelines for healthy eating at when at another person's house:
   - Yes
   - No
7. I have a better understanding of how to include healthy cooking in my home:
   - Yes
   - No
8. I feel motivated to work towards meeting and maintaining my kilojoule balance:
   - Yes
   - No
9. How easy was the trainer's language to understand during today's session?
   - Trainer's language was not at all easy to understand
   - Trainer's language was a little easy to understand
   - Trainer's language was somewhat easy to understand
   - Trainer's language was very much easy to understand
   - Trainer's language was extremely easy to understand
10. For the following points, please rate your level of satisfaction:
    - Session arrangement- *Very unsatisfied, Unsatisfied, Neutral, Satisfied, Very Satisfied*
11. On a scale of 0 to 10, how easy or difficult was the program?

0=extremely easy *10= extremely difficult*

0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*

Thank you😊



LESSON 6:STRESS MANAGEMENT, ALCOHOL AND SMOKING AND WAYS TO STAY MOTIVATED

Rules

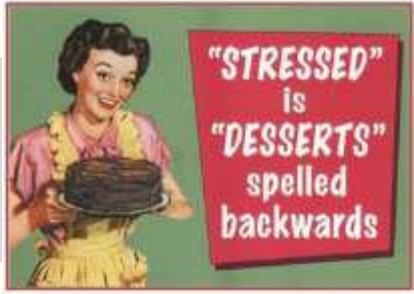
- Be on time to the lifestyle classes.
- Switch phones onto silent.
- Let us know if you can’t make a meeting, we will assist you to find another slot.
- Complete the things you are supposed to do at home. Homework outside the group meetings is the **most important factor** in your success.

Objectives

In this session, you will learn:

- How to prevent stress and cope with unavoidable stress.
- Strategies to manage stress.
- How to classify the five steps to problem solving and illustrate prioritisation of issues and how to implement strategies to address them.
- How to talk back to negative thoughts.
- The health consequences of alcohol and tobacco consumption and ways to reduce intake by substituting for healthier alternatives.
- The triggers for alcohol and tobacco consumption
- How to stay motivated.
- Provide feedback on our experience of the lifestyle and canteen programme.
- Be informed about the next steps: the maintenance text messages that you will receive for two weeks, blood measurements and the certificate of completion.

STRESS



- Stress is a natural part of living our life. Any change, good or bad, big or small, can cause stress.
- There are two types of stress: Acute stress and Chronic stress.
- An example of **Acute stress** is when you just learn about a deadline and need to complete your tasks within a shorter period. Acute stress has a higher peak of panic but is short lived.
- **Chronic stress**, on the other hand, is when you consistently experience a lower level of stress for a long period of time. For example, you might experience chronic stress if you are helping a family member who has a serious, long-term illness like cancer.
- When you are under stress, there is an increase in the level of a hormone called cortisol.
- Cortisol causes increases in blood glucose and blood pressure which can be especially harmful to people with diabetes or pre-diabetes.

Ways to prevent stress
Handout 1

[Handout 1 "Ways to Prevent stress"]

Ways To Prevent Stress

• Practicing saying "No"
  ○ Only say "Yes" when it is important to you.
• Share some of your responsibilities with others
• Set goals you can reach
  ○ Try it. See how it goes
• Plan ahead
	• Think about what situations are stressful
	  • Plan how to handle them
	• Keep things in perspective
	  ○ Think of all the good things in your life
	  ○ Remember why you joined the program

When You Can't Avoid Stress

• Catch yourself feeling stressed as early as you can • Take charge of your time schedules with the real world in mind • Get organised • Use problem solving: Describe the problem in detail Brainstorm your options Pick one option to try Create an action plan	• Reach out to people • Be physically active

Handout 2: Task completion at home: Action plan

What Are Your Major Sources of Stress?

____

____

1. Choose one source of stress from the list above.

2. Make a positive action plan to deal with this source of stress.

I will: ____

When? ____

I will do this first: ____

Challenges that might come up:	I will handle them by:
_________________________	_________________________
_________________________	_________________________

ACTIVITY

Now that we have learned about some stress management techniques, I am going to teach you a few breathing exercises that you can practice and use each time you feel stressed.

THE PROBLEM SOLVING PROCESS

We will now discuss:

- Negative thoughts
- Slips and your reactions to slips (a slip is when you lose control and do not follow your plans for eating healthy and being active)

The problem solving process (lets take a look at **Handout 3**)

- The first step is to describe the problem in detail.
- The second step is to brainstorm your options.
- Third, pick an option to try.
- Fourth, make a positive action plan.
- The fifth step of problem-solving is to try it and see how it goes.

Handout 4

Talk Back to Negative Thoughts

1. Catch yourself. Think, "I'm doing it to myself"
2. Imagine shouting, "STOP!" to yourself
   Picture a huge hand stop sign
3. Talk back with a positive thought

Examples of Negative Thoughts:

1. All-Or-Nothing

These thoughts divide the world into:

- Good or bad foods
- Seeing yourself as a success or failure
- Being on or off the program (and nothing in between)

Negative thought:

"I can never eat dessert again."

"Look at what I did. I ate that cake. I'll never succeed."

Talk back with a positive thought:

Work towards a Balance:

"I can eat that dessert in moderation and eat more fruits."

"One slip is not the end of the world. I can get back on track."

2. Excuses

These thoughts blame something or someone else for our problems. We don't mean to go off the program, but we "can't help it."

Negative thought:

"It's too hot to take a walk."

"I don't have the willpower."

Talk back with a positive thought:

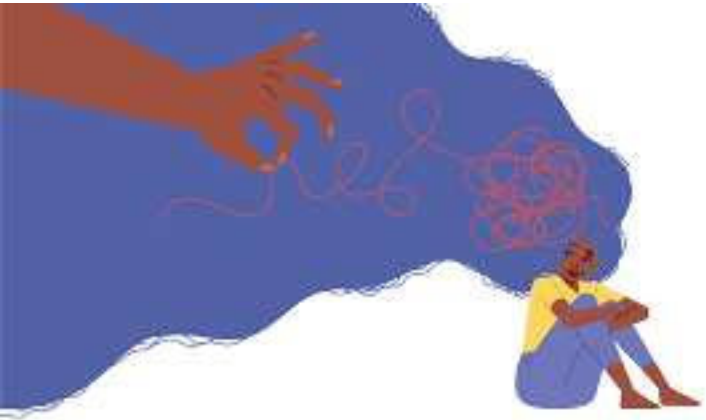
It's Worth a Try:

"I can try going for a walk and stop if it gets too hot or use sunglasses and hat for shade."

"It's hard to change old habits,

Handout 4: Talk Back Negative thoughts

Handout 4: Talk Back Negative thoughts



3. Should Have

These thoughts expect perfection and set-up for disappointment and can lead to anger and resentment.

Negative thought:

"I should have eaten less of that dessert."

"I have to write down everything I eat. I have to be perfect!"

Talk back with a positive thought:

It's My Choice:

"It was my choice. Next time I can decide not to eat so much or eat fruit instead."

"I'm writing down everything I eat because it helps me eat better. If I forget sometimes, it's okay."

4. Not-As-Good-As

We compare ourselves to someone else and blame ourselves for not being as good as others.

Negative thought:

"Dlamini lost a kilogram this week, and I lost nothing."

Talk back with a positive thought:

Everyone's Different:

"It's not a race. Dlamini and I can lose weight at different rates, and both succeed."

5. Give Up

After feeling defeated, we let other kinds of negative thoughts bother

Negative thought:

"This program is too hard. I might as well forget it."

"I'll never get it right."

Talk back with a positive thought:

One Step at a Time:

"I've learned something about what's hard for me."

"I'll try something different next time."

HARMFUL EFFECTS OF ALCOHOL AND TOBACCO

1. Alcohol contains a lot of calories, which makes it very difficult to lose weight.
2. Alcohol stimulates your appetite.
3. Alcohol impairs your judgment, causing you to make poor decisions regarding the foods you eat.
4. Heavy drinking and binge
5. Drinking increase your risk for cardiovascular disease.
6. Alcohol affects your blood sugar, which can make it harder to control diabetes.
7. Anti-diabetic medications may have an adverse reaction with alcohol.
8. Smokers are 30-40% more likely than non-smokers to develop type 2 diabetes.
9. Smoking cigarettes increases your risk for lung cancer by 25 times, cardiovascular disease by 2-4 times, and stroke by 2-4 times

Handout 6

Common Triggers

1) **Stress**
    - **Coping Mechanism for Stress:**
        - Take three deep breaths
        - Breathing exercises can help you direct your attention to the task at hand.
2) **A bad day**
    - **Coping Mechanism for a bad day:**
        - Request a 5–10-minute break where you can be alone.
        - Consider best possible options for addressing your spouse's or children's concerns.
        - Be open and honest with your family or close friends about your problems.
3) **Feeling Bored or Lonely**
    - **Coping Mechanism for Bored/Loneliness**
        - If your friends or relatives are not available to meet, go for a walk with neighbours
        - Consider picking up a new hobby rather than picking up a drink or cigarette.
4) **Celebration**
    - **Coping Mechanism**
        - Drink responsibly.
        - Savour the moment.

5) **Seeing other people drink**
    - **Coping Mechanism**
        - Be proactive.
        - Play a game or sport with your friends

Handout 7:

Ways to Resist the Temptation

a) Do Physical Activity

- Go for a walk
- Do yoga
- Run or play a sport
- Can address the problem more rationally
- Alcohol will only postpone the problem without ever solving it

b) Spend time with friends

- Go for a movie
- Play a sport
- Explore your city
- Go to the beach

c) Music or meditation

- Music will give you distance from reality
- Meditation
- You can continue to practice the meditation techniques we highlighted in the last session.

d) Talk to someone

- Family
- Friends
- Me
- Peer Support Group

WAYS TO STAY MOTIVATED

- Stay aware of the benefits you've achieved and hope to achieve.
- Recognise your successes.
- Keep visible signs of your progress so you can see how far you've come.
- Keep track of your weight, eating, and physical activity.
- Add variety to your routine.
- Remember that it is important to set new goals for yourself and develop ways to reward yourself when you meet each goal
- Create some friendly competition.
- Use others in your class to help you stay motivated.

ENVISION2030 transparency · honesty · integrity · respect · accountability
fairness · professionalism · commitment · compassion · excellence
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DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE
CREATIVE. DISTINCTIVE. IMPACTFUL.

PHYSICAL ACTIVITY

Next steps…….

- Now I would like to ask you if you can share your experience of the lifestyle programme and the canteen interventions. For the next two weeks you will receive 2 weeks of text message to support you in your journey to healthy eating and staying fit.
- Please make sure to keep track of the food and physical activity diary. We will collect it at the endline blood draw which will take place in the first week of December. At this blood draw, we will measure your weight, blood pressure, HbA1C and blood lipids.
- Early next year you will receive a certificate of completion.
- Let’s take a picture of the class against the banner.
- Thank you all!

Lesson 6: Stress Management, Alcohol and Smoking and Ways to Stay Motivated

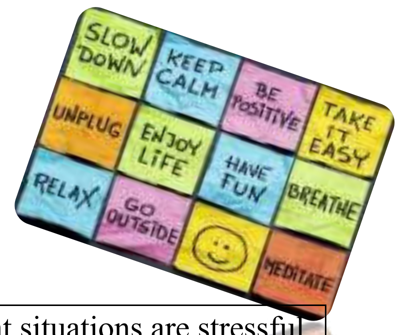
Objectives:

In this session, the participant will:

- Discuss how to prevent stress and cope with unavoidable stress.
- Discuss strategies to manage that stress.
- Classify the five steps to problem solving and illustrate prioritisation of issues and implementation of strategies to address them
- Discuss how to talk back to negative thoughts
- Discuss the health consequences of alcohol and tobacco consumption and ways to reduce intake by substituting for healthier alternatives
- Discuss triggers for alcohol and tobacco consumption and how to react differently to these triggers.
- Discuss ways to stay motivated
- Provide feedback on their experience of the lifestyle and canteen programme
- Be informed about the maintenance text messages they will receive for two weeks and about the certificate of completion that they will receive

[Handout 1 “Ways to Prevent stress”]

Handout 1



Ways To Prevent Stress

• Practicing saying “No”
  ○ Only say “Yes” when it is important to you.
• Share some of your responsibilities with others
• Set goals you can reach
  ○ Try it. See how it goes
• Plan ahead
	• Think about what situations are stressful
	  • Plan how to handle them
	• Keep things in perspective
	  ○ Think of all the good things in your life
	  ○ Remember why you joined the program

When You Can’t Avoid Stress

• Catch yourself feeling stressed as early as you can • Take charge of your time schedules with the real world in mind • Get organised • Use problem solving: Describe the problem in detail Brainstorm your options Pick one option to try Create an action plan	• Reach out to people • Be physically active

Handout 2 Task completion at home: Action plan

What Are Your Major Sources of Stress?

____

____

1. Choose one source of stress from the list above.
2. Make a positive action plan to deal with this source of stress.

I will: ____

When? ____

I will do this first: ______________________________________

Challenges that might come up:	I will handle them by:
____________________	____________________
____________________	____________________

Handout 3: Problem Solving

Many things can get in the way of being more active and eating healthy.

But problems **can** be solved.

The five steps to solving a problem:

1. **Describe the problem in detail**
   - Be specific
   - Look at what led up to the problem
   - Find the action (or behaviour) chain

   Try to see the steps (links) in the action chain. Look for:

   - Things that make you want to eat or be inactive
   - People who do not support you
   - Thoughts or feelings that get in your way

Example: Thandi's Action Chain

Didn't eat lunch

↓

Boss was critical

↓

Thandi felt stressed and anxious

↓

Came home tired, upset, and hungry

↓

Went right to the kitchen

Saw chocolate biscuits on counter

2. **Brainstorm your options**

Links	**Some of Thandi's options**
Didn't eat lunch	➢ Bring lunch to work
Boss was critical so Thandi felt stressed and anxious	➢ Talk with her boss about solving the problems at work ➢ Take a break ➢ Get support from a co-worker
Came home tired, upset, and hungry	➢ Go for a walk after work or listen to music to unwind
Went right to the kitchen	➢ Plan something to do the minute she gets home (like playing with the children or straightening a room in the house)
Saw biscuits on counter	➢ Don't buy biscuits ➢ Keep biscuits out of sight ➢ Keep fruit in sight

3. **Pick one option to try**

Weigh the pros and cons of each option

Choose one that is **very likely to work** and that **you can do.**

Try to break as many links as you can,

as early as you can.

4. **Make a positive action plan**

	Example for Thandi:
I will ...	➢ Pack a lunch
When? ...	➢ For Tuesday and Thursday next week
I will do this first ...	➢ Shop for the foods ➢ Pack lunch the night before
Roadblocks that might come up, and how I will handle them ...	➢ Might forget ➢ Choose a healthier food option at a nearby canteen
I will do this to make my success more likely….	• Ask a co-worker to join for lunch on Tuesday

5. **Try it. See how it goes.** 

Did it work? If not, what went wrong? Problem solve again

Problem solving is a *process.* Don't give up!

Handout 4

Talk Back to Negative Thoughts

1. Catch yourself. Think, "I'm doing it to myself"
2. Imagine shouting, "STOP!" to yourself
   Picture a huge hand stop sign
3. Talk back with a positive thought

Examples of Negative Thoughts:

1. All-Or-Nothing

These thoughts divide the world into:

- Good or bad foods
- Seeing yourself as a success or failure
- Being on or off the program (and nothing in between)

Negative thought:

"I can never eat dessert again."

"Look at what I did. I ate that cake. I'll never succeed."

Talk back with a positive thought:

Work towards a Balance:

"I can eat that dessert in moderation and eat more fruits."

"One slip is not the end of the world. I can get back on track."

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We don't mean to go off the program, but we "can't help it."

Negative thought:

"It's too hot to take a walk."

"I don't have the willpower."

Talk back with a positive thought:

It's Worth a Try:

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"It's hard to change old habits,

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5. Give Up

After feeling defeated, we let other kinds of negative thoughts bother

Negative thought:

"This program is too hard. I might as well forget it."

"I'll never get it right."

Talk back with a positive thought:

One Step at a Time:

"I've learned something about what's hard for me."

"I'll try something different next time."

Handout 5:

Harmful Effects of Alcohol and Tobacco

1. Alcohol contains a lot of calories, which makes it very difficult to lose weight.
2. Alcohol stimulates your appetite.
3. Alcohol impairs your judgment, causing you to make poor decisions regarding the foods you eat.
4. Heavy drinking and binge drinking increase your risk for cardiovascular disease.
5. Alcohol affects your blood sugar, which can make it harder to control diabetes.
6. Anti-diabetic medications may have an adverse reaction with alcohol.
7. Smokers are 30-40% more likely than non-smokers to develop type 2 diabetes.
8. Smoking cigarettes increases your risk for lung cancer by 25 times, cardiovascular disease by 2-4 times, and stroke by 2-4 times

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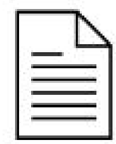
[Handout 6 "Common Triggers" ***]***



NEGATIVE TRIGGERS

1. Stress

Stress is a common trigger for both alcohol consumption and smoking. We have discussed the effects of both acute and chronic stress in week 2.

- **Coping Mechanism for Stress**
  - In stressful situations (whether it is in the work environment, home, or elsewhere), take a moment to take three deep breaths. Breathing exercises can help reduce your stress and allow you to focus and better direct your attention to a task such as a work-related project.

2. A bad day

Imagine that you are just finishing a long day at work and come home tired. Your spouse is nagging, your children are being difficult, and nothing is going right. In these instances, it may feel better to go out with your friends and consume alcohol.

- Coping Mechanism for a bad day:
  - Try to calmly vocalize your thoughts and request a 5-10-minute break where you can be alone.
  - During this break, be sure to consider best possible options for addressing your spouse's or children's concerns. This way, you are not overcome with their complaints and can think clearly on how to resolve their dilemmas.

    - Be open and honest with your family or close friends about your problems. This can help you release negativity instead of harbouring any feelings inside

3. Feeling Bored or Lonely

You may often find yourself feeling bored at home, especially if your friends are all busy on the weekends. This can lead to feelings of loneliness. In such instances, you may just resort to drinking while sitting at home and watching TV.

- Coping Mechanism for Boredom/Loneliness
    - If your friends or relatives are not available to meet, consider asking your neighbours if they have some spare time to go for a walk. Even if you are not too familiar with them, this may present a great opportunity for you to get to know them so you can build a friendship together.
    - Consider picking up a new hobby rather than picking up a drink or cigarette. For instance, you may want to join a cricket club or enrol in swimming or exercise classes. Your hobbies can also help you make new friends with similar interests as you!

POSITIVE TRIGGERS

4. Celebration

You just got a promotion. You grab a few friends and go out to the bar to celebrate. In cases like these, it is often difficult to abstain from alcohol. It is important, however, to drink responsibly as was mentioned earlier in the lesson. Drink less, celebrate more and focus more on savouring the moments of your success. This will create a better memory and help you prevent diabetes.

5. Seeing other people drink

In cases like these, it is better to be proactive. Drag your friends or family out and play a game or do another activity you all enjoy. Do not let it get to the point where everyone is drinking except you because this will tempt you even more to drink.

Handout 6

<u>Common Triggers</u>

1) Stress

- **Coping Mechanism for Stress:**
    - Take three deep breaths
    - Breathing exercises can help you direct your attention to the task at hand.

2) A bad day

- **Coping Mechanism for a bad day:**
    - Request a 5–10-minute break where you can be alone.
    - Consider best possible options for addressing your spouse's or children's concerns.
    - Be open and honest with your family or close friends about your problems.

3) Feeling Bored or Lonely

- **Coping Mechanism for Bored/Loneliness**
    - If your friends or relatives are not available to meet, go for a walk with neighbours
    - Consider picking up a new hobby rather than picking up a drink or cigarette.

4) Celebration

- **Coping Mechanism**
    - Drink responsibly.
    - Savour the moment.

5) Seeing other people drink

- **Coping Mechanism**
    - Be proactive.
    - Play a game or sport with your friends

Handout 7:

Ways to Resist the Temptation

a) Do Physical Activity

- Go for a walk
- Do yoga
- Run or play a sport
- Can address the problem more rationally
- Alcohol will only postpone the problem without ever solving it

b) Spend time with friends

- Go for a movie
- Play a sport
- Explore your city
- Go to the beach

c) Music or meditation

- Music will give you distance from reality
- Meditation
- You can continue to practice the meditation techniques we highlighted in the last session.

d) Talk to someone

- Family
- Friends
- Me
- Peer Support Group

Handout 8: Ways to Stay Motivated

1. Stay aware of the benefits you've achieved and hope to achieve

What did you hope to achieve when you first joined the lifestyle programme?

___

Have you reached these goals?

___

What would you like to achieve in the next six months?

___

2. Recognise your successes

What have you done in the program that you are most proud of?

___

___

3. Keep visible signs of your progress

- Post weight and activity graphs on your refrigerator door (or in places where you can see them easily)
- Mark your activity milestones on a map towards a particular goal
- Measure yourself (waist, belt size) once a month

4. Keep track of your weight, eating and activity

- Record your activity daily
- Record what you eat daily
- Record your weight every week

5. Add variety to your routine

What new activities have you tried? ___

What foods are you bored of eating? ___

How can you add variety to your meals and snacks?___

___

6. Set new goals for yourself

Develop ways to reward yourself when you meet each goal

Goals: Specific, short-term, just enough of a challenge

Rewards: Something you will do or buy if and only if you reach your goal

What are some non-food ways you can reward yourself for reaching a goal?

---

7. Create some friendly competition

Set up the kind of competition with a friend or family member in which you can both win. For example, see who can get the most minutes of exercise in a week and then go to a movie to celebrate the winner.

9. **Use other members in the lifestyle programme to help you stay motivated**

---

10. Closing 5 MIN

Now I would like to ask you if you can share your experience of the lifestyle programme and the canteen interventions.

For the next two weeks you will receive 2 weeks of text message to support you in your journey to healthy eating and staying fit.

Please make sure to keep track of the food and physical activity diary. We will collect it at the endline blood draw which will take place in the first week of December. At this blood draw, we will measure your weight, blood pressure, HbA1C and blood lipids.

Early next year you will receive a certificate of completion.

Physical Activity Routine 10 MIN

Thank you.

Lesson 6 - YOUR SUGGESTIONS ARE IMPORTANT

Thank you for your cooperation. We value your feedback and it will help us enhance the upcoming sessions.

Date: dd/mm/yyyy ________________ Time: hh:mm am/pm ____________________________

Site: ________________________________ Name____

After attending the session, please respond to the following questions, circle your answer:

1. Has the program helped you understand about the 2 different types of stress:
    - Yes
    - No
2. I now understand ways to help prevent and cope with stress:
    - Yes
    - No
3. I can try using the problem-solving steps to help me solve a problem:
    - Yes
    - No
4. Has the program equipped you with skills on how to talk back to negative thoughts?
    - Yes
    - No
5. Has the program helped you understand the harmful effects of alcohol and tobacco?
    - Yes
    - No
6. The program has helped me become aware of common triggers and coping mechanisms relating to alcohol and tobacco:
    - Yes
    - No
7. I have a good understanding of what I can do to resist temptation of alcohol and tobacco:
    - Yes
    - No
8. I feel motivated to manage my stress, alcohol, and tobacco intake:
    - Yes
    - No
9. How easy was the trainer's language to understand during today's session?
    - Trainer's language was not at all easy to understand
    - Trainer's language was a little easy to understand
    - Trainer's language was somewhat easy to understand
    - Trainer's language was very much easy to understand
    - Trainer's language was extremely easy to understand
10. For the following points, please rate your level of satisfaction:
    - Session arrangement- *Very unsatisfied, Unsatisfied, Neutral, Satisfied, Very Satisfied*
11. On a scale of 0 to 10, how easy or difficult was the program?

0=extremely easy *10= extremely difficult*

0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*

Thank you

APPENDIX U

Copy of Physical Activity Video Links

Link for lesson 1 exercise workout:

https://1drv.ms/v/s!Aj2guH6PFAJB3xjDbjD4lyMkZh-F?e=FJ8CkK

Link for lesson 2 exercise workout:

https://1drv.ms/v/s!Aj2guH6PFAJB3xn-CsOhF8hy8Br5?e=IJ6oN6

Link for lesson 3 exercise workout:

https://1drv.ms/v/s!Aj2guH6PFAJB3xqYpTCj6W0FgiIe?e=dXenk6

Link for lesson 4 workout:

https://1drv.ms/v/s!Aj2guH6PFAJB3xwFpkC9N1w8CYdb?e=HWk6Yv

Link for lesson 5 workout:

https://dut4lifeac-my.sharepoint.com/:v:/g/personal/evonnes_dut_ac_za/EYJuH_LdSblAlChtPGp8fyQBZojehYXxvlt6pTxZCecmjw?e=d52OJT

Link for lesson 6 workout:

https://dut4lifeac-my.sharepoint.com/:v:/g/personal/evonnes_dut_ac_za/Ebci2E37KglBinBrKGITu-QBtG0zBXhL3pJZHyubND8rdQ?e=GecJ6H

Appendix V - Photographic snapshot of the lifestyle interventions implemented at sites

Multi-site lifestyle classes

Multi-site lifestyle classes

Physical activity instructor and participants in action

Food and Physical Activity Diary

APPENDIX W

Food Diary

WORKSITE MULTICOMPONENT LIFESTYLE INTERVENTION STUDY (WMLIS)

LIVE HEALTHY GET FIT

Diabetes and Hypertension Prevention Programme

DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

RETAILABILITY

Unilever

NOTES

Full Name: ____

Department: ______________________________________

Worksite: ____

Session Number: ___________________________________

Date(s) of Session: ________________________________

Weight: ____

Goal Weight: ______________________________________

Physical Activity Goal: _____________________________

For any query contact

Email: evonnes@dut.ac.za Call: 0848101701

ashikan@dut.ac.za 0822009726

Day of the Week: ________________ Date: ______________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		

Day of the Week: _______________ Date: _____________

Physical Activity Diary

Time	Physical Activity Type	Duration

Daily Activity Goal: _______________________________________

Day of the Week: ________________ Date: ______________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		

Day of the Week: _______________ Date: _____________

Physical Activity Diary

Time	Physical Activity Type	Duration

Daily Activity Goal: _______________________________________

Day of the Week: ________________ Date: ______________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		

Day of the Week: _______________ Date: _____________

Physical Activity Diary

Time	Physical Activity Type	Duration

Daily Activity Goal: _______________________________________

Day of the Week: _______________ Date: _____________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		

Day of the Week: _______________ Date: _____________

Physical Activity Diary

Time	Physical Activity Type	Duration

Daily Activity Goal: _______________________________________

Day of the Week: ________________ Date: ______________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		

Day of the Week: _______________ Date: _____________

Physical Activity Diary

Time	Physical Activity Type	Duration

Daily Activity Goal: _______________________________________

Day of the Week: ________________ Date: ______________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		

Day of the Week: ________________ Date: ______________

Physical Activity Diary

Time	Physical Activity Type	Duration

Daily Activity Goal: ____

Day of the Week: ________________ Date: ______________

Diet Diary

Meal	Description	Amount
After waking up		
Breakfast		
Lunch		
Afternoon-Snack		
Dinner		
Before going to bed at night		

APPENDIX X

Copy of participant certificate for completion of lifestyle classes

DURBAN UNIVERSITY OF TECHNOLOGY

INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

Worksite Multicomponent Lifestyle Intervention Study (WMLIS)

CERTIFICATE OF PARTICIPATION

Awarded to:

Jade Pillay

(La Lucia)

For participating in the Diabetes and Hypertension Prevention Programme

24/10/2023

Dr Ashika Naicker

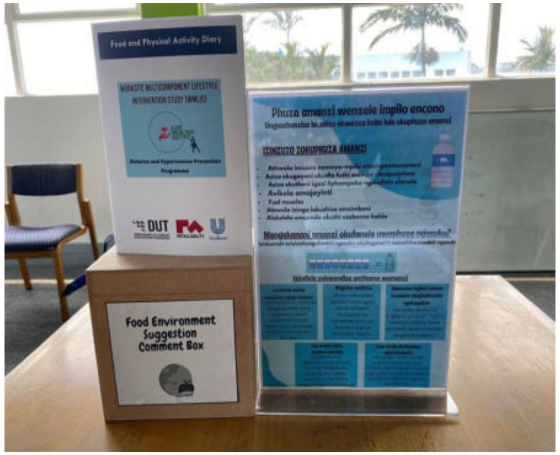
Ms Evonne Singh

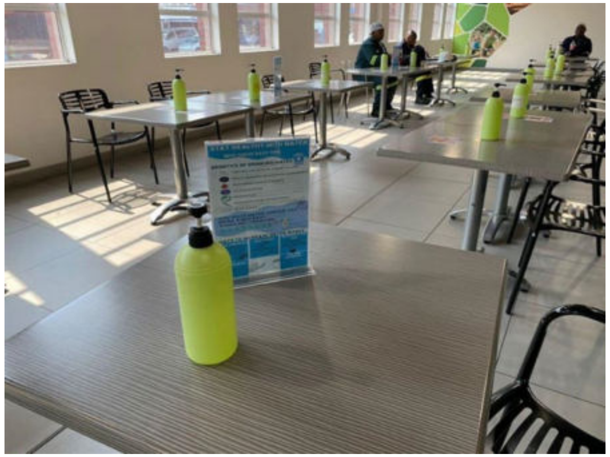
transparency • honesty • integrity • respect • accountability

fairness • professionalism • commitment • compassion • excellence

CREATIVE. DISTINCTIVE. IMPACTFUL.

APPENDIX Y - Photographic snapshot of the canteen interventions implemented at sites





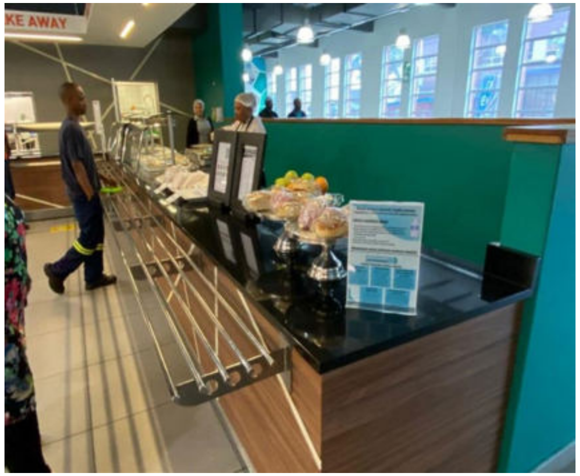


Table tents with health infographics (English and IsiZulu), food environment suggestion box, visible fruit

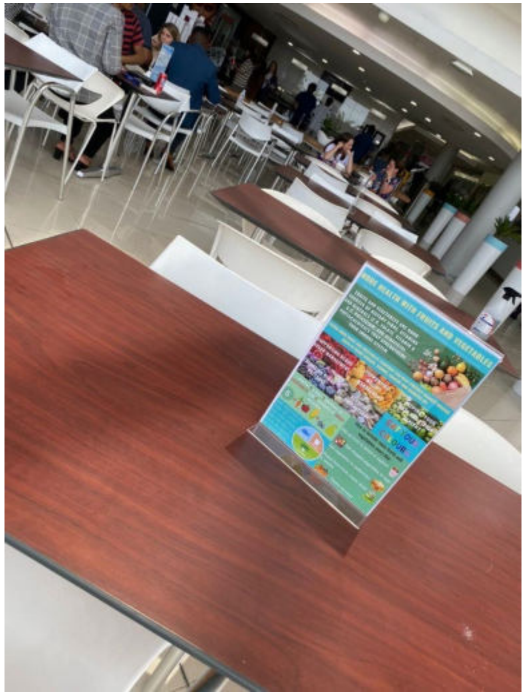
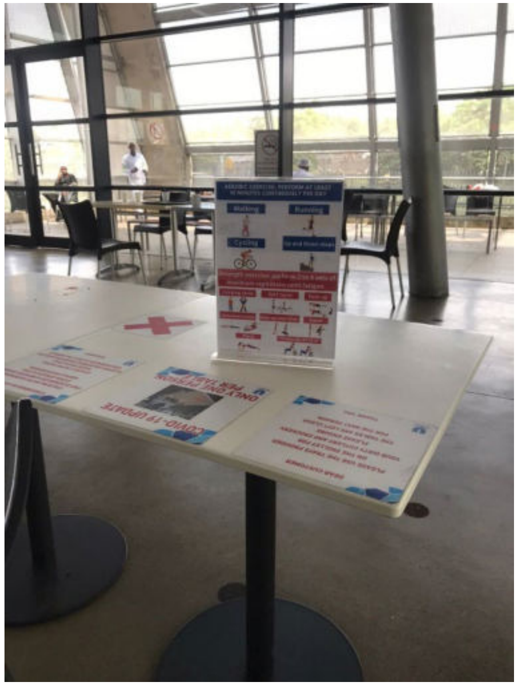
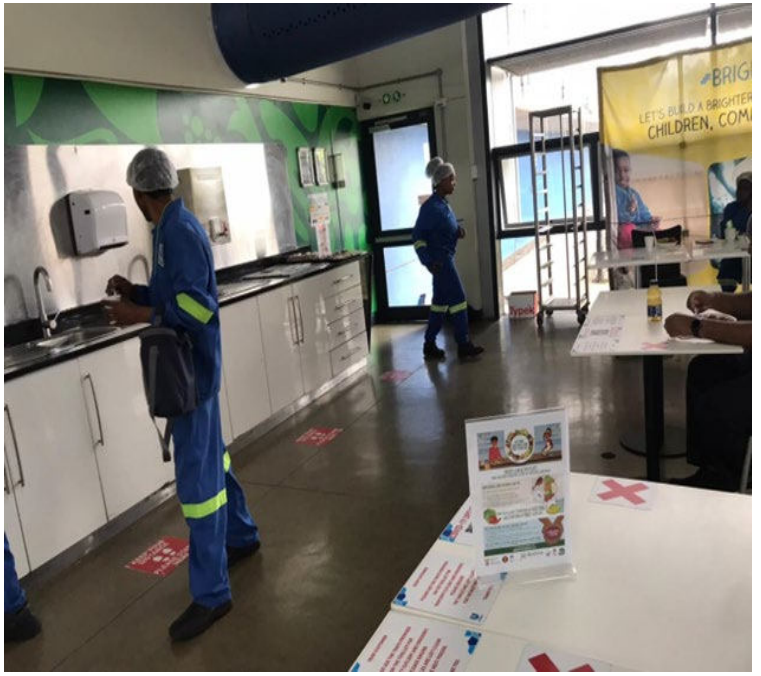
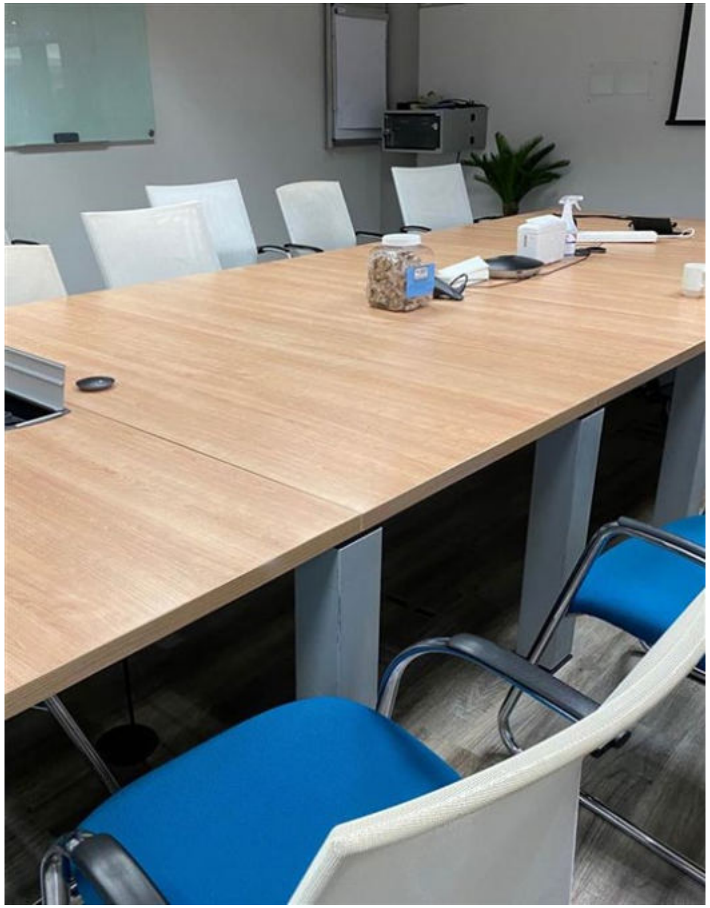
  

Table tents with health infographics for canteen environment

Seed bar at the canteens, with healthy sprinkle including oat bran, sunflower, chia, sesame, and lint seeds.
Supported with informative better-for-me, double-sided poster.

Canteen environment suggestion box and screening of on-site better-for-me video graphics



Healthy snack treats in boardrooms

Sensory evaluation - increasing vegetable consumption, salt meter; whole grains promotion with hot cooked oats service

Sensory evaluation – menu solutions; whole grains - hot cooked oats

APPENDIX Z

Copy Of Infographics Used During Interventions


Walking
Running
Cycling
Up and Down steps
Strength exercise: perform 2 to 4 sets of maximum repititions until fatigue.
Jumping Jacks
Split squat
Push-up
Abdominal Crunch
Step-up onto Chair
Squat
Plank
Triceps dip on Chair

THE FACTS ON FAT
HOW MUCH FAT DO YOU NEED?

Fat intake should provide 20-30% of our total energy intake.
If you are an adult woman who requires
a total energy intake of 8,400 kJ per day,
then 20% = 1680 kJ should be provided by fat intake.
Each gram of fat provides 37 kJ, so 1680/37 = 44 g of fat per day.

If we do this calculation for the higher intake of 30% of total energy,
then 30% of 8,400 kJ (2000 kcal) = 2,520 kJ (600 kcal) per day
which works out to 2,520/37 (600/9) = about 68 g of fat per day.
The adult woman would, therefore,
be able to eat between 44 and 68g of fat in total per day.

LOVE IT	LIMIT IT	LOSE IT
MONOUNSATURATED & POLYUNSATURATED FATS	**SATURATED FATS**	**HYDROGENATED OILS & TRANS FATS**
• Can lower bad cholesterol levels • Can lower risk of heart disease & stroke • Can provide essential fats that your body needs but can't produce itself.	• Can raise bad cholesterol levels • Can lower good cholesterol levels • Can increase risk of heart disease & stroke	• Can raise bad cholesterol levels • Can lower good cholesterol levels • Can increase risk of heart disease & stroke • Can increase risk of T2 diabetes
SOURCE	**SOURCE**	**SOURCE**
Plant-based liquid oils, nuts, seeds and fatty fish	Most saturated fats come from animal sources, including meat and dairy, and from tropical oils	Processed foods made with partially hydrogenated oils
EXAMPLES	**EXAMPLES**	**EXAMPLES**
Oils (such as canola, olive, peanut, safflower and sesame) Avocados Fatty Fish (such as tuna, herring, lake trout, mackerel, salmon and sardines) Nuts & Seeds (such as flaxseed, sunflower seeds and walnuts)	Beef, Pork & Chicken Fat Butter Cheese (such as whole milk cheeses) Tropical Oils (such as coconut, palm kernel and palm oils)	Partially Hydrogenated Oils Some Baked Goods Fried Foods Stick of Margarine

EAT SMART: REPLACE SATURATED FAT WITH UNSATURATED FAT AS PART OF HEALTHY LIVING.

EAT A DIET THAT:		
Includes GOOD FATS (Nuts, seeds, fatty fish, non-tropical oils)	Limits *saturated fats* to no more than **5-6%** of calories	Keeps ***trans fats*** as LOW as possible

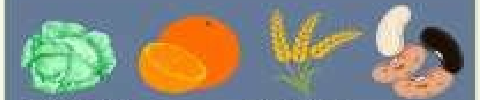
EAT THE RIGHT CARBS FOR GOOD HEALTH

Carbohydrates provide us with energy but there are good and bad carbs

KNOW YOUR CARBS

GOOD CARBS (COMPLEX CARBS)

Takes longer to digest and energy is released over a longer time.



Non-starch vegetables | Fruits | Whole grain breads | Legumes

Why are they good?

- High in fibre and nutrients
- Low glycemic index
- Keeps you full for longer

BAD CARBS (SIMPLE CARBS)

Digested quickly into our body. The energy is stored as glycogen in our cells and if not used, immediately gets converted into fat.

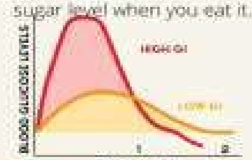
Cold drinks & sugar sweetened beverages | Sugary cereals | Sweets & chocolates | Cakes, pastries & biscuits

Why are they bad?

- Low in fibre and nutrients
- High glycemic index
- Elevates blood glucose levels

THE GLYCEMIC INDEX (GI)

Carbohydrates are all essentially sugars our body converts to glucose (blood sugar) which is stored for energy. The GI measures how much a particular food raises your blood sugar level when you eat it.



HIGH GI = BAD CARBS

High-GI foods are quickly digested and absorbed. This rapid fluctuation in blood sugar level has often been called sugar crash, which leaves you feeling tired and hungry faster.

LOW GI = GOOD CARBS

Low-GI foods are digested & absorbed slower which produces a gradual rise in blood sugar. They have benefits for weight control because they help control appetite & delay hunger.

TIPS FOR ADDING HEALTHY CARBOHYDRATES TO YOUR DIET

1.Start the day with whole grains.
Try a hot cereal, like oats or steel cut oats. A good rule of thumb: choose a cereal that has at least 4g of fibre and less than 8g of sugar per serving.

2. Use whole grain breads for lunch or snacks

3. Choose whole fruit instead of juice
An orange has 2 times as much fibre and half as much sugar as a glass of orange juice.

4. Pass on potatoes, and instead bring on the beans
Ditch the potatoes – which have been found to promote weight gain - choose legumes (beans, chickpeas) for an excellent source of slowly digested carbohydrates.

LIFE IS SWEETER WITH LESS SUGAR

DAILY ADDED SUGAR LIMIT

25 GRAMS
WOMEN

37 GRAMS
MEN

WAYS TO CUT DOWN SUGAR

1. Read food labels: A fat-free or low-fat product like yoghurt is often high in sugar. Check the label for "Sugar" listed under carbohydrates
2. Choose naturally sweet foods like fruits.
3. Add protein to your meals- your blood sugar levels will be more constant; you will feel fuller for longer.
4. Reduce sauces like tomato sauce and chutney (they contain sugar).
5. Start small-if you take sugar in your tea or coffee, reduce the amount of sugar over time until you can go without or very little

SUGAR CONTENT ON A FEW EVERYDAY FOOD ITEMS

CORN FLAKES
1 teaspoon per 40g

ORANGE JUICE
3 teaspoons per 100ml

DOUGHNUTS
4 teaspoons per 50g

CHOCOLATE
6 teaspoons per 50g

FIZZY DRINK
8 teaspoons per 330ml

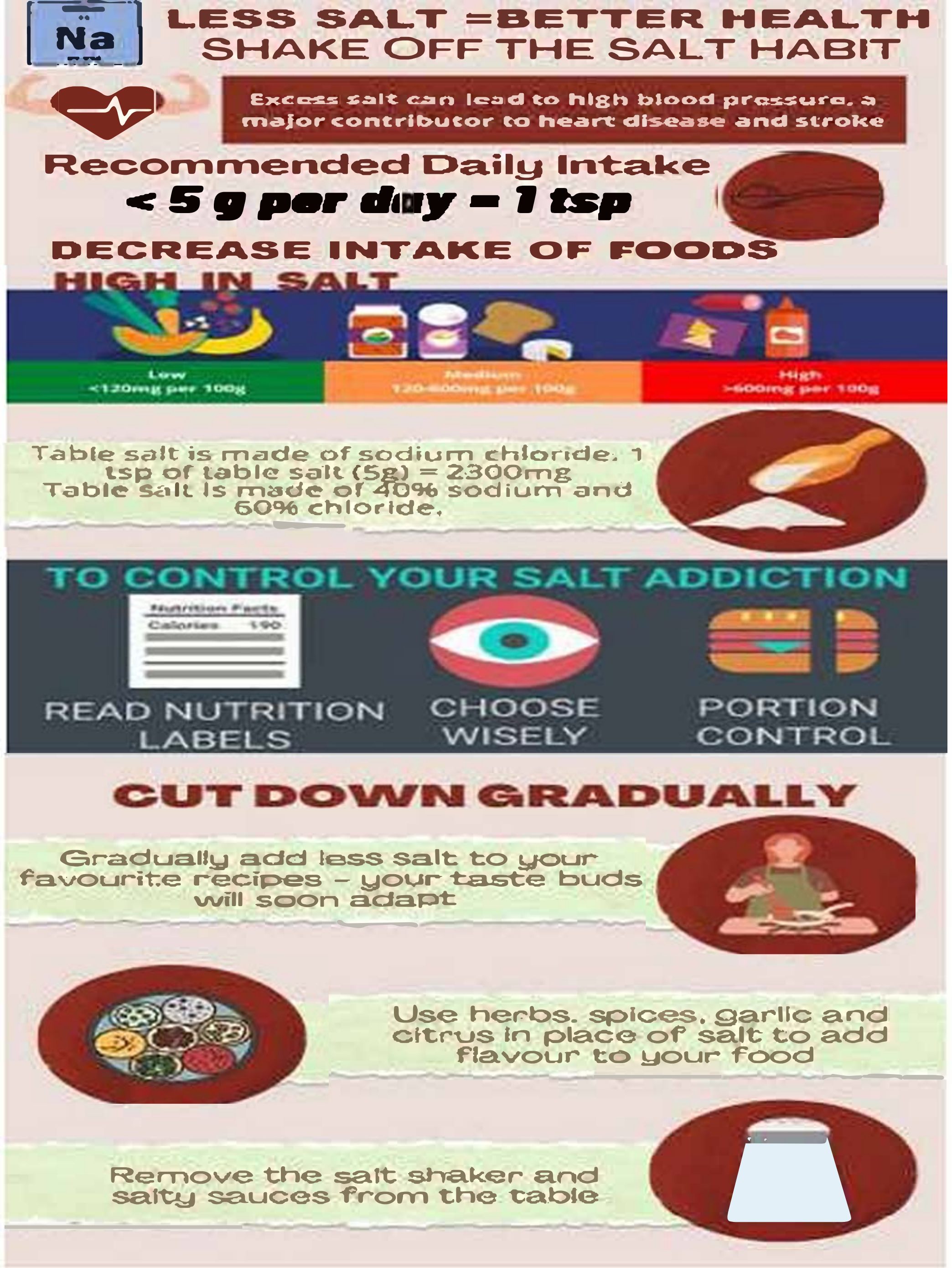
SWEETENED YOGHURT
2.5 teaspoons per 100g

TOMATO SAUCE
4 teaspoons per 100ml

1 SLICE OF TOAST WITH JAM
2.5 teaspoons

WHITE WINE
1 teaspoon per 330ml

STACKING UP THE SUGAR WITH BEVERAGES


Na
LESS SALT =BETTER HEALTH
SHAKE OFF THE SALT HABIT
Excess salt can lead to high blood pressure, a major contributor to heart disease and stroke
Recommended Daily Intake
< 5 g per day = 1 tsp
DECREASE INTAKE OF FOODS HIGH IN SALT
Low <120mg per 100g
Medium 120-600mg per 100g
High >600mg per 100g
Table salt is made of sodium chloride. 1 tsp of table salt (5g) = 2300mg
Table salt is made of 40% sodium and 60% chloride.
TO CONTROL YOUR SALT ADDICTION
Nutrition Facts
Calories 190
READ NUTRITION LABELS
CHOOSE WISELY
PORTION CONTROL
CUT DOWN GRADUALLY
Gradually add less salt to your favourite recipes – your taste buds will soon adapt
Use herbs, spices, garlic and citrus in place of salt to add flavour to your food
Remove the salt shaker and salty sauces from the table

APPENDIX AA

Turn-it-in Report

Full thesis

by Evonne Shanita Singh

Submission date: 14-Dec-2023 04:36PM (UTC+0200)
Submission ID: 2241387403
File name: ES_final_Singh_thesis_14_Decemberchngaes_after_to_mike.docx (2.26M)
Word count: 65121
Character count: 360421

Full thesis

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10%	9%	6%	3%
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