Dietary diversity and nutritional status of pregnant women attending an ante-natal clinic in KZN

By

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Declaration

This work has not previously been accepted in substance of any degree and is not being concurrently submitted in candidature for any other degree.

Signe [redacted]

Date: 21/08/18

This submission is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged giving explicit references. A comprehensive bibliography is appended.

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Date: 21/08/18

I hereby give consent for my work to be made available for photocopying and for interlibrary loan, and for the title and summary to be made available to outside organizations and future students.

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Lastly, to my husband Maritz, thank you for always believing in me and encouraging me to keep going through the difficult and frustrating times. I value your support and love more than you will ever know. This dissertation is dedicated to you.

Abstract

Aim:

This research aimed to establish the socio-demographic background, nutritional status, as well as food intake patterns of pregnant women in the first trimester of pregnancy attending an antenatal clinic in Cato Manor, Durban. This study formed part of the first phase of the MRC approved study "A multi-staged multi-disciplinary healthcare approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal", aimed at pregnant women and planned by the Faculty of Health Sciences at the Durban University of Technology.

The research was conducted in South Africa in the province of KwaZulu-Natal. This study was conducted in a primary health care clinic (PHC) in Cato Manor which falls under the auspices of the eThekwini municipality. The total sample (n=300) as predetermined by the MRC approved study included all pregnant women presenting at the PHC for their first antenatal visit over a designated period until the total sample size has been reached. These women were allocated into 3 groups: Group 1 compromised of the antenatal intervention group (n=100). A total of 139 pregnant women in the first trimester of pregnancy were eligible to be accepted to be a part of the study; however, due to a low return rate and incomplete questionnaires, a final sample of 100 women were included in the study and their data was used.

Methods:

A valid and relevant socio-demographic questionnaire was completed in a one-on-one interview situation wherein participants would be asked to tick relevant answers pertaining to the question at hand. Information regarding income, education level, religious influences and any other questions relating to the socio demographic background of the participants were included in the questionnaire.

A valid and reliable food frequency questionnaire was also completed in a one-on-one interview situation whereby participants would be asked to tick relevant answers pertaining to the question at hand, in order to determine the food variety and food diversity intake of the participants. Participants' dietary intake was determined through the completion of two x 24-hour recall questionnaires which were conducted in an interview situation. The two x 24-hour

recall questionnaires were completed pertaining to the participant's dietary intake during the week as well as to the participants' dietary intake on a weekend day.

Finally, participants' anthropometric measurements were obtained through the use of a scale and stadiometer in order to measure the weight and height, respectively, of each participant and calculate the BMI (body Mass Index) of each participant. All measurements were conducted twice and the average of the two figures was used in order to ensure accuracy.

Results:

The majority of the participants' role in the family was that of a daughter (72%) and they lived in a squatter camp (48%). In addition, 57% of participants shared a house with between two and five other people and the majority lived in a brick house (51%) with more than two rooms (63%). Most of the women were unemployed at the time of research (65%) and received a total monthly income of <R1500 a month (67%; n=43) with only one other person contributing to the monthly income (60%; n=59). Food insecurity was prevalent among some participants as 25% (n=24) reported sometimes not having enough money in the month to buy food and 40% of the participants spent <R500 a month on food. Furthermore, standard 10 (matric) was the highest level of education completed by most participants (48%) and Zulu was the most spoken language among the group (49%).

The majority of the participants had a normal BMI (40%) whereas 28% were considered overweight and 20% fell within obese class I. In addition, according to blood pressure measuring instruments, most participants had a normal systolic (82%) and diastolic (65%) blood pressure with a low prevalence of both low and high blood pressure.

The total range of individual food items consumed by an individual during the seven-day data collection period measured by the (FFQ) was between six and 62 foods. Fifty-two percent of participants consumed all nine food groups and a summary of the food variety within the food groups of the pregnant women was a mean of 31.02 (SD11.029) different foods within the nine food groups in a seven-day period which indicates a medium food variety score (FVS). Furthermore, the cereal group reported the highest individual mean FVS (±SD) of 6.60 (±3.000), followed by the vegetable group 4.56 (±2.217) and the meat group with a mean of 4.51 (±2.011).

The nutrient analysis indicated a deficient intake of all nutrients with the exception of phosphorous, vitamin A, niacin, vitamin B6 and vitamin K. The mean (±SD) for carbohydrates was 191.82g (SD±68.718) which indicated that all participants met the EAR of 135g per day; however, the energy contribution indicated that 95% of participants consumed <100 percent of the EER for energy.

Furthermore, the findings from the Top 20 food items measured by the 24-hour recall questionnaires indicated that pregnant women in the Cato Manor community consumed a largely carbohydrate-based diet as starchy food were the top three consumed. Protein-based foods, dairy, as well and fruit and vegetables had a very low consumption rate with the per capita intake of fruit and vegetables of 165.73g per day being significantly lower than the WHO goal of ≥400g, and the mean intake of 12.55g of dietary fibre was less than half of the recommended amount of 25g per day. However, the energy distribution of the macronutrients from the average of both 24-Hour Recalls indicated that the pregnant women were in the range of 15-30 percent of the total fat intake, 10-15 percent of the total protein intake and 55-75 percent of the total carbohydrate intake.

Table of contents

LIST OF ABBREVIATIONS	
AI	Adequate Intake
AMDR	Acceptable Macronutrient Distribution Ranges
BMI	Body Mass Index
DoH	Department of Health
DRI	Dietary Reference Intake
DUT	Durban University of Technology
EAR	Estimated Average Requirement
FAO	Food and Agriculture Organization
GDM	Gestational Diabetes Mellitus
g	Gram
IMMR	Institutional Maternal Mortality Ratio
KG	Kilogram
KZN	KwaZulu-Natal
LBW	Low Birth Weight
MBFI	Mother-Baby Friendly Initiative
MPI	Multi-dimensional poverty index
mg/day	Milligram per day
NCDs	Non-communicable Disease
µg	Microgram
PEM	Protein-energy Malnutrition
PRPP	Pregnancy-related pelvic pain
PTB	Pre-term Birth
RDA	Recommended Daily Allowance
SA	South Africa
SD	Standard Deviation
TT	Tetanus Toxoid

UKZN	University of KwaZulu-Natal
UL	Tolerable Upper Intake Level
UN	United Nations
UNICEF	United Nations Children's Fund
WHO	World Health Organization
%	Percent

LIST OF ANNEXURES	PAGE

Chapter 1- Introduction

1.1 Motivation for the study

This research aims to establish the socio-demographic background, nutritional status, as well as food intake patterns of pregnant women attending antenatal clinics in a rural community to inform the development of nutrition education material. This study will form part of the Medical Research Council (MRC) approved study "A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal" aimed at pregnant women planned by the Faculty of Health Sciences at the Durban University of Technology.

The research was conducted in South Africa in the province of KwaZulu-Natal. The sample was based on pregnant women attending the antenatal clinic of the Cato Manor community in KwaZulu-Natal and the sample size was estimated to be 100 as stipulated by the Faculty of Health Sciences. The researcher approached pregnant women attending the antenatal clinic in Cato Manor and data collection was conducted at the clinic. An information letter explaining the purpose of the study was issued to participants and written consent was obtained from each participant before the commencement of data collection. The community of Cato Manor was made up of predominantly males making up 51.31% of the population and females 48.69% (Census 2011: 1). Furthermore, according to the same census, the population of Cato Manor was split by race with the community being made up of mostly black residents (99.9%), followed by coloured (0.22%), white (0.15%), Asian (0.14%) and other or unidentified (0.10%). The area is also made up of by predominantly males aged between 30 and 39 years with most residents' earning a monthly total income of between R1001 and R1500.

As stated by Lingen (2012: 1), a woman's body goes through a number of physical, hormonal as well as physiological changes throughout the pregnancy process; therefore, it is crucial that a nutrient-rich diet is consumed in order to ensure the health of not only the baby but the mother as well. Moreover, during pregnancy, one's nutritional needs increase in order to support your health as well as the needs of the baby and as a result, a diet high in nutrients both from the macro- and micronutrient family should be consumed in order to meet specific

requirements relating to energy, protein, calcium, folic acid, iron, zinc, and iodine to name a few (Zerfu and Ayele 2013: 20 and Zeisel 2011: 532).
However, food insecurity is one of the leading causes of inadequate diets among pregnant women and result in diets lacking in essential nutrients needed to meet basic dietary needs. This in turn is associated with a decreased nutritional status as well as increased neonatal morbidity and mortality rates among women and babies respectively (Carmichael, Yang, Herring, Abrams and Shaw 2007: 2087).

As stated by WHO (2015, 1), the world faces a double burden of malnutrition that includes not only under-nutrition but overweight and obesity as well, particularly in developing countries. Pregnant women in particular are at greater risk of developing malnutrition due to hunger and inadequate dietary intake, putting not only themselves but also their infants at risk of death and impaired physical and mental development.

A woman that is undernourished at the time of conception is at risk of serious health issues for both herself and her baby as not only is it unlikely that her nutritional status will improve throughout the pregnancy, but her body will also experience added burden due to the developing baby. If the woman does not receive enough food, she will more than likely lose weight which can increase her risk of maternal mortality (Parrotte 2015:1). When a woman's body is not able to store adequate nutrients needed to support the growth of the foetus, the foetus's development may be impaired and this can lead to the delivery of a low birth weight baby which may result in severe developmental and cognitive deficiencies (Muller and Kwarinkel 2005: 279).

Furthermore, the rates of overweight and obesity worldwide are growing at a staggering rate and can be linked to the development of a number of chronic diseases. A woman's nutritional intake impacts both her and her baby's health throughout the pregnancy and without adequate care; she and her baby are vulnerable to illness (Parrotte 2015: 1).

1.2 Problem Statement

According to Zerfu and Ayele (2013: 20), thousands of women, particularly in developing countries suffer from a variety of complications throughout the pregnancy cycle which at times can result in maternal death. In addition, globally, more than half a million women die annually from complications pertaining to pregnancy and childbirth, with over 84% of maternal deaths occurring in Sub-Saharan Africa and other developing countries (Hogan, Foreman, Naghavi, Ahn, Wang, Makela, and Murray 2010: 1609).

As stated by Carmichael, Yang, Herring, Abrams and Shaw (2007: 2087), a healthy diet is a vital part of ensuring all nutritional needs are met throughout the pregnancy process, a healthy and safe pregnancy is experienced and the development and growth of the foetus is ensured; however, this can only take place if pregnant women are aware of what the nutritional requirements are during pregnancy and if they have adequate access to safe and nutritious foods throughout the pregnancy. Furthermore, Picciano (2003: 1997S) states that nutritional needs are increased during pregnancy in order to support foetal growth and development as well as prepare the body for various alterations in maternal tissues and metabolism that take place throughout the pregnancy.

One of the main nutritional needs that are increased during pregnancy is energy, as increased energy is required to ensure adequate growth of the foetus, placenta, as well as accompanying maternal tissues (Butte and King 2005: 1010). Increased energy is also required to supplement the increased metabolic demands of pregnancy, in addition to the energy needed to maintain adequate maternal weight, body composition and physical activity throughout the gestational period, as well as for sufficient energy stores to assist in proper lactation after delivery (Lingen 2012: 1). In addition, Brown (2010: 3) states that other important nutritional needs that must be met throughout pregnancy include an increase in protein, as the amino acids that make up protein are an essential component that is needed to ensure adequate brain growth of the foetus, particularly throughout the third trimester, as well as for ensuring cells of the foetus are properly developed.

A number of micronutrients need to be increased during pregnancy, such as folic acid which is needed before and during pregnancy in order to prevent neural birth defects such as spina bifida from occurring, and vitamin D which is required as a means of regulating the amount of calcium and phosphorous in the body in order to prevent soft bones and teeth from forming in the first few months of the foetus's life (Branum, Bailey and Singer 2013: 486). Vitamin C is required in to order protect and keep cells healthy, iron is needed to carry oxygen to the foetus as well as to prevent anaemia in the mother which can be detrimental to the foetus if not controlled and finally, an increase in zinc is required in order to prevent complications such as low birth weight in the baby as well as premature delivery and a complicated labour (Hermoso, Vollhardt, Bergmann and Koletzko 2011: 5).

Women living in developing countries are more often than not exposed to food insecurity and malnutrition, which are two of the leading causes of maternal and neonatal morbidity as well as other long-term effects that can affect the growth and development of the baby. As stated by Bistrian, Jensen, Heimburger and Roubenhoff (2009: 7), malnutrition can be defined as an imbalance of nutrients caused by either an excess intake of nutrients or a nutritional shortage and can manifest in two forms: over-nutrition and under-nutrition. Inadequate diet and/or an insufficient access to food is said to have a critical role in overall health status of the mother and foetus as both under- and over-nutrition can have a serious impact on the long-term health status and life expectancy of the mother and foetus. Prenatal malnutrition can have lasting effects on the children from affected pregnancies as both micro- and macronutrients play a vital role in the health outcome of the foetus and are a necessary part of ensuring the mother is protected and at optimal health throughout the pregnancy (Zeisel 2011: 533).

Finally, Darnton-Hill (2013: 1) suggests that nutrition education and counselling seek to improve nutrition practices before and during pregnancy in order to improve maternal nutrition and reduce the risk of poor health outcomes in both mothers and their children. Nutrition education and counselling should be an integral part of the pregnancy process and should be focused on the enhancement of the mother's quality of diet by educating women on which foods and what quantities need to be consumed in order to achieve an optimal dietary intake; this can also include counselling on the use of micronutrient supplements recommended during pregnancy, such as multiple micronutrient supplements containing iron and folic acid (Arrish, Yeatman and Williamson 2013: 2).

1.3 Prevalence of malnutrition among pregnant women

1.3.1 Globally

According to Abu-Saad and Fraser (2010: 5), malnutrition is an epidemic that not only affects developing countries but affects even the most developed countries worldwide. Nutrition plays a vital role in ensuring both maternal and child health; however, pregnant women with a poor maternal nutritional status are said to be more at risk of adverse birth outcomes such as low birth weight, maternal mortality as well as micronutrient deficiencies. In some countries worldwide, maternal mortality rates are still seen to be a problem as death rates have risen significantly since 1990, with 1200 maternal deaths being experienced in the United States of America as of 2013. Furthermore, Germany experienced 47 maternal deaths, Australia experienced 18 maternal deaths and the United Kingdom experienced 60 deaths as of 2013.

According to figure 1.1, the highest percentage of maternal deaths pertained to pre-existing conditions which accounted for 28% , severe bleeding accounted for 27% , pre-eclampsia accounted for 14% , infections accounted for 11% , obstructed labour accounted for 9% , abortion accounted for 8% and blood clots accounted for 3% (n=3). While these figures are not as high as most developing or third world countries, they are not to be ignored and must be addressed (WHO 2014: 1).

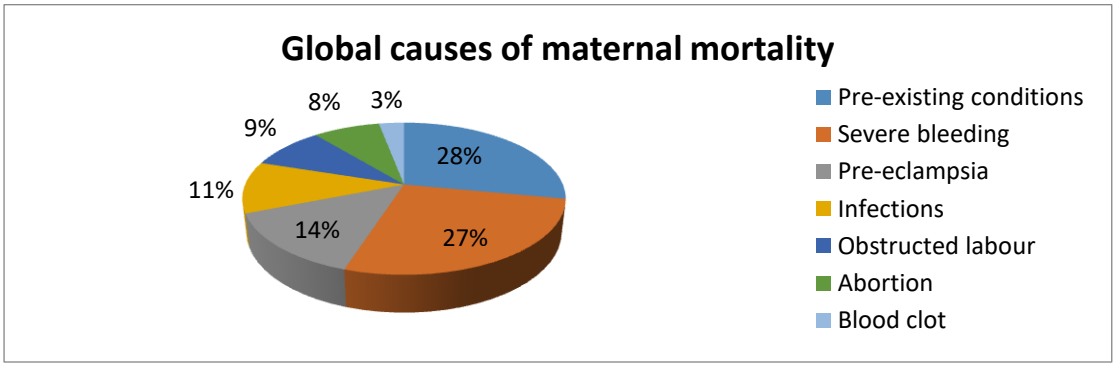


Fig 1.1: Percentage of maternal mortality causes globally, WHO (2014:1)

Another global issue affecting thousands of pregnant women globally is hunger and food insecurity. Hunger continues to take its largest toll in Southern Asia, which includes the countries of India, Pakistan and Bangladesh. The estimated 276 million chronically undernourished people in 2012–14 are only marginally lower than the number in 1990–1992. Eastern Asia (where China is by far the largest country) and South-Eastern Asia (including Indonesia, Philippines, Myanmar, Vietnam and others) have reduced under-nutrition

substantially. As a developing region Latin America has the most successful record in increasing food security. The vast majority of hungry people live in developing regions, which saw a 42 percent reduction in the prevalence of undernourished people between 1990–92 and 2012–14. As the most heavily populated region in the world, Asia is home to two out of three of the world's undernourished people.

According to Monangi, Brockway, House, Zhang and Muglia (2015: 574), preterm birth (PTB) can be defined as live birth before 37 weeks of completed gestation and presents one of the greatest global challenges to maternal, infant and child health. As stated by WHO (2014: 1), an estimated 15 million babies, or one in every ten babies, are born preterm annually with preterm complications being the cause of almost 1 million deaths in 2013. Of those babies that survive preterm birth, many suffer from a lifetime of disability, including learning, visual as well as hearing difficulties. In many low-income surroundings, half of preterm babies born at 32 weeks die due to a lack of accessible and adequate care such as warm and comfortable environments, breastfeeding support and basic infection care. While more than 60% of preterm births occur in Africa and South Asia, preterm birth is still a global problem with 12% of babies being born too early in low-income countries compared to 9% in higher-income countries.

According to WHO (2014:1) in table 1.1, the following number of babies were born preterm globally: 3 519 100 in India, 1 172 300 in China, 773 600 in Nigeria, 748 100 in Pakistan, 675 700 in Indonesia, 517 400 in the USA, 424 100 in Bangladesh, 348 900 in the Philippines, 341 400 in the DRC and finally, 279 300 in Brazil.

Table 1.1: Top ten countries with the highest number of preterm births

Country	**Number of preterm births**
India	3 519 100
China	1 172 300
Nigeria	773 600
Pakistan	748 100
Indonesia	675 700
The United States of America (USA)	517 400
Bangladesh	424 100
The Philippines	348 900
The Democratic Republic of the Congo (DRC)	341 400
Brazil	279 300

According to table 1.2, WHO (2014: 1) stated that as of 2014, the top country with the highest number of preterm births per 100 live births is Malawi with 18.1 preterm births per 100 live births. Comoros and Congo experienced 16.7 per 100, Zimbabwe 16.6 per 100, Equatorial Guinea 16.5 per 100, Mozambique 16.4 per 100, Gabon 16.3 per 100, Pakistan 15.8 per 100, Indonesia 15.5 per 100 and finally, Mauritania experienced 15.4 per 100 live births.

Table 1.2: Top ten countries with the highest number of preterm births per 100 live births

Country	**Number of preterm births per 100 live births**
Malawi	18.1 per 100
Comoros	16.7 per 100
Congo	16.7 per 100
Zimbabwe	16.6 per 100
Equatorial Guinea	16.5 per 100
Mozambique	16.4 per 100
Gabon	16.3 per 100
Pakistan	15.8 per 100
Indonesia	15.5 per 100
Mauritania	15.4 per 100

Out of 65 countries with reliable maternal-based data, 62 countries have seen a rise in preterm births over the last 20 years, possibly due to increased maternal ages, underlying health problems such as diabetes and hypertension and greater infertility treatment use. It has also been noted that a greater use of infertility treatments can lead to increased rates of multiple pregnancies and changes in obstetric practices as well as increased caesarean births before term (WHO 2014: 1). An appreciable difference has been noted in the survival of preterm babies with regard to their geographic location, as more than 90% of extremely preterm babies born into low-income countries die within the first few days of life, whereas less than 10% of preterm babies die in more developed countries.

As stated by WHO (2014: 1), 16% or 95 million children under the age of five years in less developed countries were underweight or had a low-weight-for-age according to the WHO child growth standards. It has also been noted that children living in rural areas are more likely to be underweight than those living in urban areas and childhood malnutrition is the underlying cause of death in 45% of all deaths among children under the age of five

years. These causes of death include but are not limited to restrictions on foetal growth, stunting, wasting as well as vitamin A and zinc deficiencies.

According to figure 1.2, Southern Asia has the highest prevalence of underweight in children with 28%, Western Africa accounted for 20%, Oceania and Eastern Africa represented 18%, South-East Asia represented 16%, Middle Africa represented 15% and Southern Africa accounted for 11% of underweight children globally.

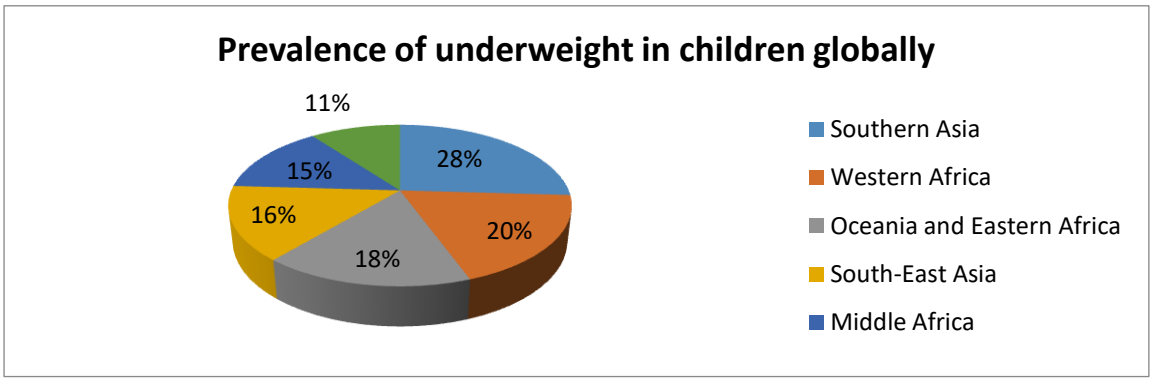


Figure 1.2 Prevalence of underweight in children globally

According to figure 1.3, the percentage of children suffering from underweight in Africa decreased from 23% in 1990 to 16% in 2014, the percentage of children with underweight in Asia decreased from 32% in 1990 to 18% in 2014, in Latin America from 8% in 1990 to 3% in 2014 and in the Caribbean, the percentage of children suffering from underweight decreased from 8% in 1990 to 3% in 2014 (WHO 2014: 1).

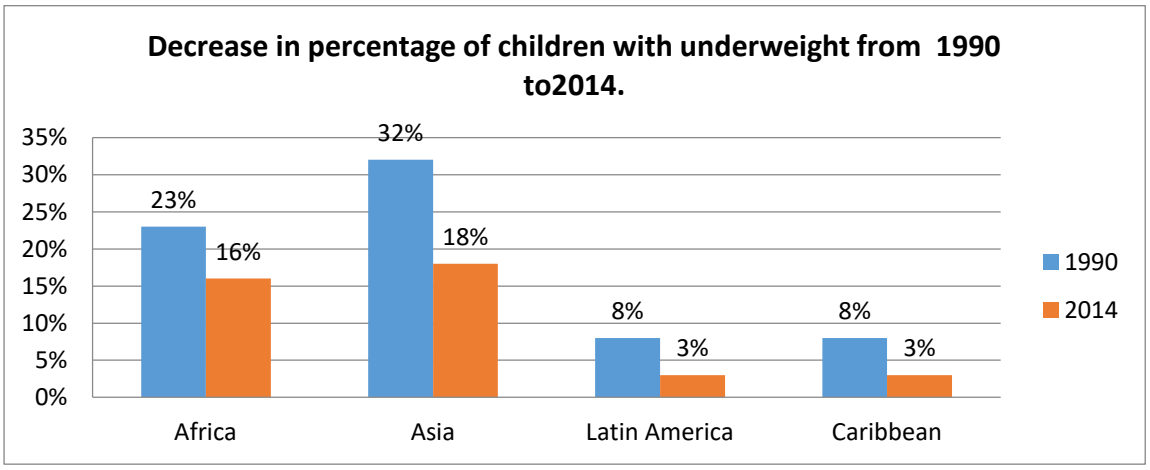


Figure 1.3 Decrease in percentage of children with underweight from 1990 to 2014

1.3.2 Africa

Many countries worldwide reflect a high number of maternal deaths which can largely be linked to a lack of access to basic health services with almost all maternal deaths occurring in developing countries, particularly in Sub-Saharan Africa and Southern Asia. As stated by Say, Chou, Gemmill, Tunçalp, Moller, Daniels and Alkema (2014: e323), the maternal mortality ratio in developing countries as of 2013 was 230 per 100 000 live births compared to the 16 per 100 000 live births recorded in developed countries. It is evident that there are large discrepancies between countries as evidenced by few countries having extremely high maternal mortality ratios of around 1000 per 100 000 live births and between women with high and low income and women living in rural and urban areas (WHO 2014:1).

Furthermore, figure 1.4 indicates that the main cause of maternal deaths in African countries is haemorrhaging which accounts for 37% of all maternal deaths, hypertensive disorders account for 19%, sepsis 15%, other direct causes 13%, abortion complications 11%, and embolisms 5%.

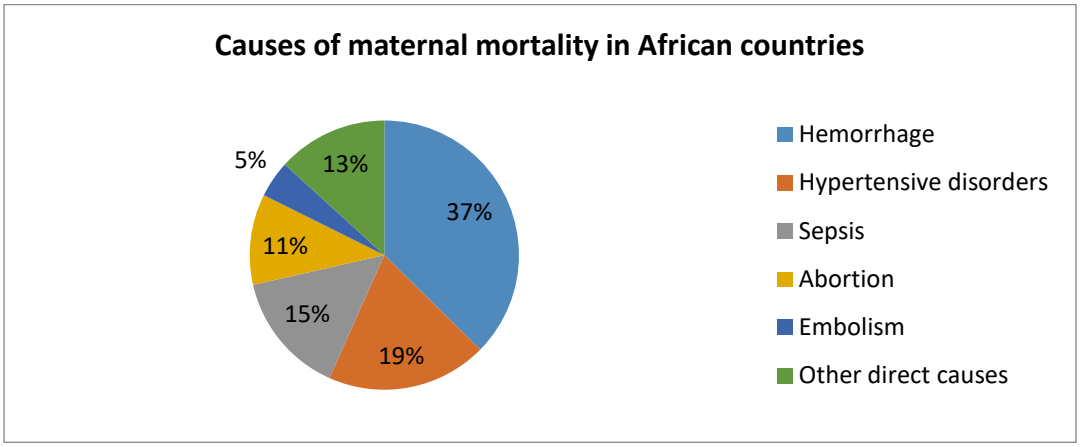


Fig 1.4 Causes of maternal mortality in African Countries, WHO (2014:1)

According to WHO (2013: 1), although maternal mortality rates still plague a number of African countries, there are a number of African countries whose maternal mortality rates have decreased between 2005 and 2013. Countries such as Zimbabwe have seen a decrease in maternal mortality from 3000 deaths in 2005 to 2100 deaths in 2013 and Namibia saw a decrease from 150 deaths in 2005 to 81 deaths in 2013.

Furthermore, WHO (2014:1) states that the risk of maternal mortality is said to be the highest among adolescent girls under the age of 15 with complications in pregnancy as well as childbirth being the leading causes of death among these girls, particularly in developing countries in Africa. Furthermore, women living in developing countries have far more pregnancies on average than women in developed countries, and their lifetime risk of death due to pregnancy is higher.

1.3.3 South Africa

According to WHO (2013: 1) and Maternal fact sheet (2014: 1), the number of maternal deaths in South Africa has decreased between 2005 and 2013 as 1800 maternal deaths were recorded in 2005 and 1500 maternal deaths were recorded in 2013 with the maternal mortality ratio being 310 per 100 000 live births.

As stated by Pattinson (2014: 1), South Africa saw a decrease in the institutional maternal mortality ratio (IMMR) from 176.22 deaths per 100 000 live births in 2008 to 154.06 deaths per 100 000 in 2010, representing a 12.6% decrease. In terms of causes of maternal mortality, non-pregnancy related infections such as HIV, tuberculosis and pneumonia accounted for 34.7% of maternal deaths in 2010, showing a decrease from the previously recorded 40.5% in 2008.

Maternal deaths due to obstetric haemorrhaging, due to bleeding during or after caesarean sections, represented 15.8% of deaths in 2004 and hypertension represented 14.8% of deaths in 2004, indicating a steady decrease from the 18% of deaths recorded in 2002. Maternal deaths relating to pre-existing medical and surgical conditions are said to have doubled between the periods 2002-2004 and 2011-2013 as they now account for 11.4% of all maternal deaths. There are also a number of contributory factors that are of high significance which have played a role in the increasing rates of maternal mortality, such as a lack of adequately trained doctors and nurses (WHO 2014: 1).

These factors have contributed to 24.4% of maternal deaths in South Africa in 2010 which represents a significant increase from the 13.5% recorded in 2008. These inadequacies contributed to high figures of maternal deaths, including anaesthesia, haemorrhaging, sepsis and hypertension which represented 47%, 27%, 24% and 19% of maternal deaths respectively.

According to table 1.3, it is evident that KwaZulu-Natal represents the highest number of maternal deaths in South Africa with 964 deaths recorded between 2011 and 2013. Gauteng follows closely behind with 849 deaths being recorded between 2011 and 2013 and Limpopo recording 750 maternal deaths between 2011 and 2013. The Northern Cape, however, recorded the lowest number of maternal deaths with just 110 deaths being recorded between 2011 and 2013.

Table 1.3: Number of maternal deaths in South Africa, per province from 2011-1013, Pattinson, 2014

Province: 2011-2013	Maternal deaths
KwaZulu-Natal	964
Gauteng	849
Limpopo	750
Eastern Cape	593
Mpumalanga	399
North West	292
Free State	281
Western Cape	214
Northern Cape	110

As stated by Basu and Basu (2012: 36), obesity and overweight are an epidemic in South Africa that affects all age groups of pregnant women, and in particular adolescent pregnant women; however, studies on obesity in pregnancy in South Africa are few and far between. Of the studies that have been carried out in South Africa, a common link between obesity and complications in pregnancy has been found. In a large retrospective study that was carried out in 2012, 28% of women who delivered were overweight or obese and were associated with a high body mass index (BMI), pregnancy-induced hypertension, gestational diabetes as well as an increase in caesarean sections. In another large retrospective study, caesarean sections increased to 106 among those women who were overweight and to 78 caesarean sections among those women who were obese. Finally, a pilot study was conducted at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) to determine the prevalence of obesity among adolescent pregnant women. From a total of 767 deliveries, 16 (30%) were of a

normal weight, 24 (44%) were overweight, 11 (20%) were obese, and three (6%) were considered morbidly obese adolescents. The results show both similarities and differences, when compared to other studies.

Table 1.4 Maternal research conducted in South Africa between 2005 and 2015

Author and reference	Study population	Measuring instruments	Summarized results
Zungu, L. and Manyisa, Z. 2009. Factors contributing to pregnancies among student nurses at a nursing college in Mpumalanga Province, South Africa. *Journal of Nursing and Midwifery* 11 (2) 2009: 61–74.	Seventy-seven female students of the targeted nursing college enrolled for the year 2006, completed questionnaires but only 75 of the returned questionnaires were usable.	A quantitative descriptive survey was done by using self-administered questionnaires. It comprised six sections requesting demographic information from respondents, focusing on sexual behaviour of respondents that contributed to their pregnancies, addressing the contraceptive methods used by respondents, identifying personal factors that contributed to respondents' pregnancies, addressing potential institutional factors that contributed to their pregnancies and identifying any other factors that contributed to their pregnancies.	According to the results, respondents were between the ages of 19-30 years and most were second year student nurses. Of the 75 respondents who experienced pregnancies prior to their training, 25.3% (n=19) indicated that they were disappointed, 13.3% (n=10) were shocked, 8.0% (n=6) were afraid, and 8.0% (n=6) were glad and 2.7% (n=2) did not know what their reactions were.

Table 1.4 Maternal research conducted in South Africa between 2005 and 2015 - continued

Mostert, D., Steyn, N., Temple, N. and Olwagen, R. 2005. *Dietary intake of pregnant women and their infants in a poor black South African community. Curationis* 28(4): 12-19.	46 women below 40 years old, in their 2nd trimester of pregnancy.	Their heights and weights were recorded, as well as their diets during pregnancy and during the first 6 months after delivery.	The subjects were living in severe poverty, none had running water and almost all did their cooking over an open fire. None of the subjects smoked and only one consumed alcohol. The diets were adequate in protein but were marginal in energy and in dietary fibre, and may have been deficient in numerous micronutrients, particularly calcium, iron, zinc, niacin, folate, and vitamins A, C, E, and B6. This was seen during pregnancy and lactation.
Marteleto, L., Lam, L., and Ranchhod, V. 2008. Sexual Behaviour, Pregnancy, and Schooling among Young People in Urban South Africa: *Journal of Family Planning*, 39(4): 351–368.	Data was used from Waves 1-4 of the Cape Area Panel Study (CAPS), a longitudinal survey of young people in metropolitan Cape Town.	The study analyses data from the Cape Area Panel Study (CAPS), a recently collected longitudinal survey of young adults and their families in metropolitan Cape Town.	Teen pregnancy is not entirely inconsistent with continued schooling, especially for African (black) women. Over 50% of African women who had a pregnancy at age 16 or 17 were enrolled in school the following year. We found that male and female students who performed better on a literacy and numeracy exam administered

			in 2002 were less likely to become sexually active and less likely to drop out of school by 2005.
Willan, S. 2013. A Review of Teenage Pregnancy in South Africa – Experiences of Schooling, and Knowledge and Access to Sexual & Reproductive Health Services. *A Review of Teenage Pregnancy in South Africa, Partners in Sexual Health*.	Literature review and qualitative in-depth interviews with a small number of teenage mothers.	The qualitative interviews that were used were not intended to provide a representative study of teenage mothers' experiences; the purpose was to speak to a few young mothers to understand some of the subjective experiences that they face in different settings, and to provide detailed in-depth understandings of these teenage mothers' experiences.	This review has shown that there are multiple drivers of South Africa's high levels of teenage pregnancy. Poverty, race-based inequalities and living in rural areas are additional factors that drive unplanned teenage pregnancies and need to be tackled.
Tomlinson, M., O'Connor, M., Le Roux, I., Stewart, J., Mbewu, N., Harwood, J.,	This research examined these overlapping risk factors among 1,145 pregnant Xhosa	A structured assessment questionnaire was developed for this study that included items that have been used among	The majority of women were married or living with a partner (56.77 %). Only 19.13 % were employed, with the majority of women

Rotheram-Borus, M. 2013. Multiple Risk Factors During Pregnancy in South Africa: *The Need for a Horizontal Approach to Perinatal Care*.	women living in 24 township neighbourhoods in Cape Town, South Africa.	similar populations in South Africa.	having a household income of less than $258 per month.
Gresh, A and Maharaj, P. 2014. Termination of pregnancy: Perspectives of female students in Durban, South Africa. *Supply on Population Issues in South Africa*, Vol. 28, No. 1.	Twenty interviews were conducted with female students under the age of 30 over a three-month period. In the sample, 11 women were black African, 6 white, and 3 Indian.	Qualitative methods were deemed most appropriate and interviews were conducted using open-ended questions to allow respondents to share their personal experiences. Interviews began by assessing the demographic profile and reproductive history of each participant. Questions covered topics such as: partner history, contraceptive use, pregnancy history, religious beliefs, and knowledge of abortion legislation and abortion methods.	One woman reported having experienced a miscarriage. There was only one woman who reported two previous abortions. All of the women who had previous pregnancies reported that they were unplanned and unexpected.
Amuna, P., Zotor, F., and Adewuya, T. 2012. *Impact of locally made food multimix on*	120 healthy pregnant women were recruited from four antenatal clinics in a randomised	Health screening, repeated 24-hour recall dietary assessment, and food frequency questionnaires were administered.	Locally produced complementary foods can contribute significantly to pregnancy outcomes.

maternal weight gain and outcome of pregnancy in Gauteng Province, South Africa.	controlled feeding intervention and assigned to intervention (*n*=60) or control (*n*=60) groups.		

1.4 Aim and objectives of the study

1.4.1 Aim

The aim of the study is to determine the food consumption patterns, dietary diversity and nutritional status of pregnant women as part of the screening process in order to plan interventions to address the deficiencies and incorrect food intake patterns identified. This will form part of the first stage of the MRC approved study "A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal" aimed at pregnant women and planned by the Faculty of Health Sciences at the Durban University of Technology.

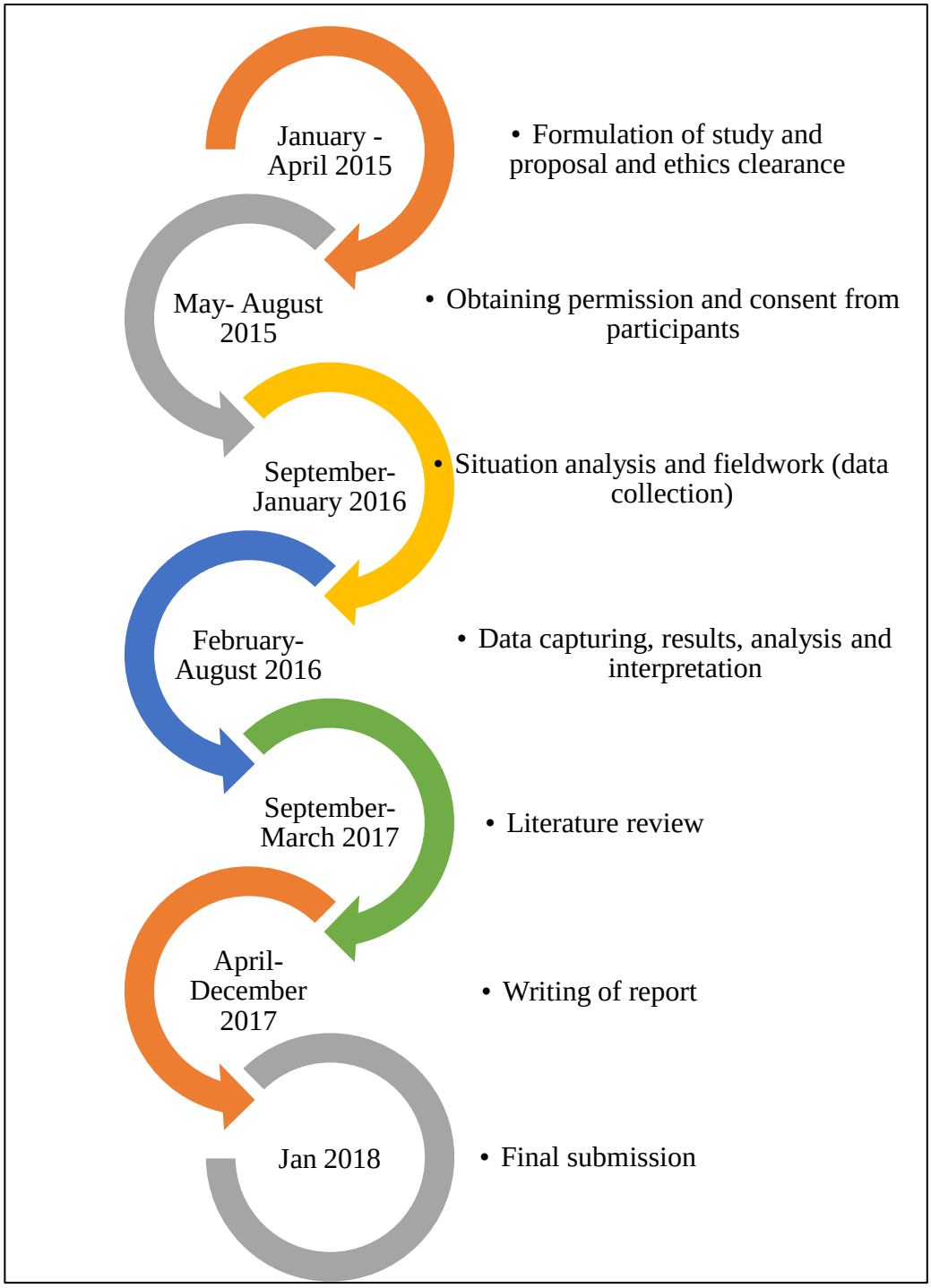
1.4.2 Specific Objectives

- To determine the socio-demographic profile of the households by means of a socio-demographic questionnaire
- To determine the participants' dietary intake by completing 2 x 24 hour-recall questionnaires
- To determine the food variety intake of participants by completing a Food Frequency Questionnaire (FFQ)
- To determine the BMI of each pregnant woman by weighing and measuring the height of each woman in the first trimester
- To determine the blood pressure of each pregnant women by taking the diastolic and systolic blood pressure measurement by use of a sphygmomanometer,

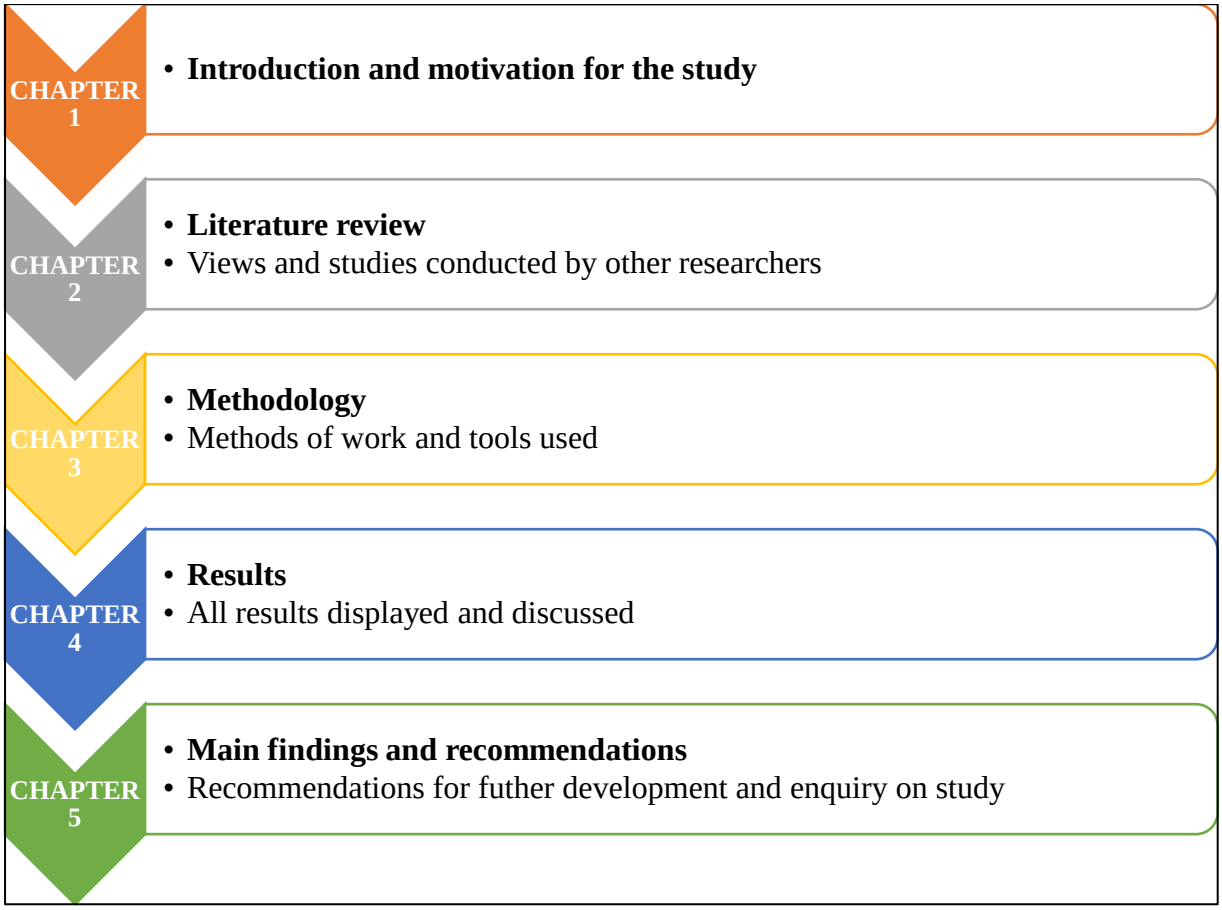
1.5 Conceptual framework of the study

Framework Outline of the study

Masters of Applied Science: Consumer Science: Food and Nutrition: Dietary diversity and nutritional status of pregnant women attending an antenatal clinic in KZN.



1.6 Structure and outline of the report



1.7 Conclusion

This study serves to determine the dietary diversity and nutritional status of pregnant women as part of the screening process in order to plan interventions to address deficiencies and incorrect food intake patterns identified. This in turn will provide adequate information needed to plan interventions in the hope of decreasing the prevalence of maternal morbidity and mortality rates in a selected district in KwaZulu-Natal. The following chapter will offer an in-depth look into malnutrition, the causes of malnutrition, the nutritional needs of pregnant women and factors that affect their food intake as well as strategies implemented to address the issues of malnutrition. The following chapter will provide an in-depth insight into the dietary needs of pregnant women as well as problems that could potentially affect not only the nutritional status of the mother but the foetus as well.

Chapter 2 – Literature Review

2.1 Introduction

This chapter presents an in-depth definition of malnutrition, its causes, the nutritional needs of pregnant women as well as factors that affect food intake and strategies implemented to address the issues of malnutrition.

2.2 Malnutrition

As stated by World Food Programme (2014: 1), malnutrition can be defined as an inadequate, disproportionate or imbalanced consumption of nutrients which can result in the inability of the body to perform and maintain necessary processes such as growth and recovery from illness or disease. Malnutrition consists of two main aspects, under-nutrition and over-nutrition, and is an increasingly recognized problem that is associated with both morbidity and mortality among pregnant women worldwide (Rojer, Kruizenga, Trappenburg, Reijnierse, Sipilä, Narici, and De van der Schueren 2015: 758).

2.2.1 Over-nutrition

Over-nutrition can be defined as an imbalance of energy consumption and expenditure and can lead to various health problems such as overweight and obesity as well as lifestyle diseases such as coronary heart disease, hypertension, diabetes and respiratory disease (Saunders and Smith 2010: 624).

- Overweight

According to World Health Organization (2014: 1), overweight can be defined as a condition whereby an individual can weigh more than what is considered normal or healthy for their age, height and sex and can be diagnosed through a body mass index (BMI) calculation; if an individual has a BMI of between 25 and 29.9 kg/m2 they are overweight. Furthermore, pregnant women have a separate set of BMI indicators due to their inevitable weight gain throughout the pregnancy; however, it is important to note that maternal anthropometry differs across population groups. Women belonging to ethnic groups characterized by a small body size have been reported to gain less weight on average during pregnancy than larger women. In less-developed Asian countries, including Vietnam, women generally have a lower BMI and/or a smaller gestational weight gain than in developed countries whereas in

the United States of America, for example, two percent of pregnant women have a BMI < 18.5 kg/m2 and more than 50% have a BMI > 25.13 kg/m2.

In addition, Athukorala, Rumbold, Willson and Crowther (2010: 56) state that there are several risk factors associated with being overweight such as high blood pressure and in some cases, depression caused predominantly by an energy imbalance as well as by overeating, lack of or no exercise, lifestyle and genetics (Obese vs. overweight 2014: 1). More importantly, mothers who are overweight during pregnancy and childbirth, as measured by increasing maternal body mass index (BMI), are known to be at risk of significant antenatal and neonatal complications which can include recurring miscarriages, pregnancy induced hypertension (PIH), preeclampsia, gestational diabetes mellitus (GDM) and blood clots (Siega-Riz, and Laraia 2006: 153). Overweight women are also more likely to require inducing and caesareans, and infants of overweight mothers are often "big bodied" and require prolonged hospital admissions (Athukorala, Rumbold, Willson, and Crowther 2010: 56).

However, although pregnant women are at risk of being overweight throughout their pregnancy, it is vital that pregnant women gain sufficient weight to monitor adequate nutrition of both the mother and baby (Turley and Thompson 2014: 352). While maternal weight gain is reliant on the weight and height of the mother at the time of conception, recommended weight gain indicators have been developed to ensure proper nutrition and health of the mother as well as adequate development of the foetus (Boyle 2014: 356).

Table 2.1: Recommended weight gain for pregnant women

	Pre-pregnancy body weight	**Pregnancy body weight**	**Recommended weight gain**
Underweight	(BMI < 18.5 kg/m2)	(BMI < 19.8 kg/m2)	12-18 kg
Normal weight	(BMI 18.6- 24.9 kg/m2)	(BMI 19.9- 25.9 kg/m2)	11-16 kg
Overweight	(BMI 25-29.9 kg/m2)	(BMI 26-29 kg/m2)	7-11 kg
Obese	(BMI > 30 kg/m2)	(BMI > 29 kg/m2)	5-9 kg

(WHO 2016:1)

- Obesity

As stated by WHO (2014: 1), obesity, on the other hand, is a more extreme version of overweight and can be defined as a chronic disorder characterised by an accumulation of more fat than the body needs. Moreover, Obese vs. overweight (2014: 1) states that obesity is mainly caused by an excess intake of kilojoules and lack of physical activity and now represents one of the major health care issues of the 21st century as it's prevalence has increased hugely in both the developed and developing world in the last couple of decades. Individuals diagnosed with obesity are more likely to suffer from health-related problems such as heart disease resulting in heart attacks and/or strokes as well as hypertension (high blood pressure), diabetes and mortality (Saunders and Smith 2010: 624).

As stated by Johansson, Villamor, Altman, Bonamy, Granath, and Cnattingius (2014: 349), the high occurrence of maternal overweight and obesity may have implications for infant health, as infants born to obese mothers are at higher risk of poor health and death and are more susceptible to poor development. Additionally, obese women are especially at risk of developing medically-related complications such as gestational hypertension, gestational diabetes and postpartum infections as well as complications during labour and delivery (Whitney and Rolfes 2013: 480).

Obesity has also been seen to double the risk for neural tube defects and it has been revealed that undiagnosed diabetes may be the explanation as to why obese women have a greater risk of giving birth to infants with heart defects and other abnormalities (Whitney and Rolfes 2013: 480). Furthermore, numerous studies over the last 50 years worldwide have confirmed that mothers who are obese during pregnancy put their children at a higher risk of developing not only obesity but also other lifestyle diseases such as diabetes, cardiovascular disease and some cancers later in life (Abu-Saad and Fraser 2010: 25).

2.2.2 Under-nutrition

As stated by Miese-Looy, Rollings-Scattergood and Yeung (2008: 74), nutrition plays a vital role in the nutritional status of both the expectant mother as well as the foetus as both under- and over-nutrition can seriously impact on the long-term health and life expectancy of both parties. It has also been noted that a nutrient imbalance throughout the pregnancy can have serious long-term adverse effects, regardless of whether the total kilojoules intake is adequate to meet the high demands of pregnancy (Abu-Saad and Fraser 2010: 25).

In countries where consuming a diet of high quality and variety is not attainable, the risk of children developing physical, immune and cognitive defects is increased hugely. This particularly pertains to the first 1000 days of life, meaning from pregnancy up to 24 months in age, as nutritional setbacks are irreversible particularly with regard to growth and cognitive ability (Fanzo 2012: 37). Furthermore, this particularly poses a setback for many African countries as large numbers of pregnant women suffer from inadequate health care facilities and often do not practise appropriate feeding and care practices.

It is alarmingly evident that poor nutrition in pregnancy has been related to adverse birth outcomes; however, the relationship between maternal nutrition and birth outcomes is extremely complex and is often influenced by not one but several biologic, socioeconomic and demographic factors. Still, it is important to try and understand the relationship between maternal nutrition and birth outcomes as understanding this has the potential to form the basis of nutritional intervention development (Miese-Looy, Rollings-Scattergood and Yeung 2008: 74).

- Micronutrient deficiencies in pregnant women

A phenomenon that has increased in many African and many other developing countries is that of “hidden hunger”; a result of under-nutrition but with hunger being less visible. In this instance, a person may have access to adequate energy resources but lack sufficient micronutrients in the form of vitamins and minerals, resulting in severe consequences on the health, productivity and mental impairment of not only the mother but the foetus in later years as well (Fanzo 2012: 37).

The results of recent studies have estimated that a total of 2 billion people worldwide including pregnant women suffer from one or more micronutrient deficiencies, including deficiencies in Vitamin A, C, E, B6, B12 as well as iron, zinc, folate and riboflavin (Zerfu and Ayele 2013: 1).

Furthermore, Hamdy, Abdel-Aleem and El-Shazly (2013: 2) state that during pregnancy, the requirements for vitamin A are increased to an intake of 800 μg due to its vital role in ensuring the proper development of the foetus's heart, lungs, kidneys, eyes and bones, and the circulatory, respiratory, and central nervous system. However, WHO states that women in

African countries do not consume adequate amounts of vitamin A and therefore, 7.8% of African women suffer from night blindness and 15.3% from low serum retinol concentrations. Furthermore, another consequence of a vitamin A deficiency in pregnant women includes a high prevalence of developing anaemia, as currently 41.8% of pregnant women globally and 57.1% of pregnant women in Africa alone suffer from this condition (El-Khashab, Hamdy, Maher, Fouad and Abbas 2013: 199). This poses a high risk to women suffering from anaemia, a well-known result of a vitamin A deficiency, as maternal anaemia is said to increase the prevalence of maternal mortality as well as premature and stillbirth as well as other adverse foetal outcomes.

Fanzo (2012: 17) also states that pregnant women suffering from a severe iron deficiency, or anaemia, contribute to the deaths of approximately 50 000 women a year in pregnancy and childbirth and can contribute to a decrease in the overall workforce productivity and development of countries, resulting in losses of up to two percent of gross domestic product (GDP) in countries that are affected the worst. Additionally, it is important to note that a vitamin A deficiency does not only affect the sight and health of the pregnant women but can also have severe consequences regarding maternal mortality and can increase infant mortality within the first year of life (Boyle 2014:1; WHO 2016:1).

Another common micronutrient deficiency experienced by pregnant women is a folate deficiency, which has contributed to one in every ten deaths caused by heart disease in adults as well as 200 000 severe birth defects annually (Fanzo 2012: 18). Expectant mothers who do not consume enough folate throughout their pregnancy put the foetus at extreme risk of being born with birth defects such as neural tube defects ─ a result of the foetus's spinal cord and brain not being adequately developed (Greenberg, Bell, Guan, and Yu 2011: 52). South Africa, however, has taken measures to reduce these risks and statistics by introducing the fortification of flour programme which was launched in 2003. This programme was designed to ensure that flour or maize meal, which is a common staple of many South African pregnant women, would be fortified with eight micronutrients including iron, zinc, vitamin A and, more importantly, folic acid. Since the commencement of this programme, South Africa has seen a dramatic decline in birth defects with reductions in spina bifida by 42% and anencephaly by 11% (Zimmerman 2011: 55).

Moreover, the prevalence of numerous micronutrient deficiencies in children across Africa can underestimate the magnitude of the burden of hidden hunger due to the various diseases already associated with poor nutrition (Fanzo 2012: 3).

2.3 Nutritional needs of pregnant women

As stated by Hanson, Bardsley, De-Regil, Moore, Oken, Poston, McAuliffe, Maleta, Purandare, and Yajnik (2015: S215), nutritional status during adolescence, preconception as well as pregnancy presents major public health issues that not only affect the health of women but also that of their children. The need for most nutrients is said to increase during pregnancy due to the high nutritional demands of not only the mother, who herself goes through a growth period while carrying the child and preparing for lactation, but for the growing foetus as well (Brown 2011: 4). In several societies, particularly in developing countries, women and adolescent girls are inadequately nourished, with regard to both the macro- and micro-nutrient contents of their diets. Therefore, it is essential that good health and nutrition practices are maintained before conception for the mother to meet the nutrient demands of pregnancy and lactation as this is vital to the healthy development of the embryo, foetus, infant and child (Hanson *et al* 2015: S216).

Good nutrition practices as well as an adequate diet that provides all the essential macro- and micro-nutrients in the correct amounts ensures optimal health for women throughout the pregnancy as well as when the foetus is born. Furthermore, it has been said that making a significant improvement to the nutrition of women before and during pregnancy can contribute to the reduction of the global non-communicable disease (NCD) burden as well as having a positive effect on the long-term risk of NCDs in the future generation (Hanson *et al* 2015: S216). Additionally, ensuring pregnant women consume nutrient-rich diets can assist in reducing the number of deaths caused by NCDs which is expected to increase by 15% in Sub-Saharan Africa over the next decade (WHO 2016: 1).

2.3.1 Energy

It is vitally important for pregnant women to consume sufficient nutrients throughout their pregnancy to ensure adequate growth and development of the foetus is achieved and maintained. Sufficient energy intake is essential to support their increasing nutrient needs as well as the needs of the growing foetus; however, the energy intake of a pregnant woman is dependent on whether a woman is undernourished, of normal weight, overweight or obese at

the time of conception. In addition, women who are underweight need to consume an additional 630 kilojoules in the first trimester, and an additional 840 and 1255 kilojoules in the second and third trimesters respectively. Women of normal weight should also increase their energy intake in the second and third trimesters by 1200 and 2000 kilojoules respectively, whereas an obese woman should only consume an additional 1800 and 1400 kilojoules in her second and third trimesters respectively (Brown 2011: 5; Brown 2014: 7).

2.3.2 Macronutrients

i) Carbohydrates and fibre

The energy requirements of a woman during pregnancy increase substantially to support the growth and growing energy requirements of the foetus, and can be easily met provided sufficient and the correct forms of carbohydrates are consumed daily (Brown 2011: 3). The rapid growth of the foetus requires that plentiful amounts of energy in the form of glucose are available to the foetus since carbohydrates are needed particularly for the development of the brain and central nervous system as well as for red blood cell functioning (Fisk 2014: 1).

Foods that are rich in fibre are essential in the diet of pregnant women as it is needed to promote gastrointestinal health and regularity and aid in the prevention of obesity, type-2 diabetes and atherosclerosis as well as some cancers. Allowing for at least half of one's carbohydrate intake to consist of whole grains ensures that blood sugar levels remain constant, which, in turn, decreases the prevalence of mood swings as well as prevents the risk of the baby developing obesity later in life (Fisk 2014:1 and Brown 2011:8). Furthermore, although the foetus itself does not depend on any adequate supply of fibre for proper development, it is a vital component of the prenatal diet as well as ensuring the complete comfort of the pregnant mother through the pregnancy in ensuring the digestive system functions optimally.

ii) Protein

The healthy and vital development of the foetus during pregnancy is largely dependent on adequate protein development due to the critical role it plays in the formation of muscle, antibodies, collagen and enzymes (Brown 2011: 3). In addition, protein is not only essential for the healthy growth and development of the foetus but also for the growth of foetal-supporting tissues such as the placenta and to support the growth of blood volume expansion, the uterus and breasts (Stephens, Payne Ball, Pencharz and Elango 2015: 73). However,

Blumfield and Collins (2014: 994) state that women who consume too much protein throughout their pregnancy put greater strain on their kidneys as well as increase their saturated fat intake through the consumption of certain animal fats. It is important to note that women choosing to follow a vegan diet during pregnancy increase their risk of developing a protein deficiency before and during the pregnancy. Therefore, consumption of all essential amino acids through plant-based sources as well as following careful planning and monitoring during pregnancy is critical in ensuring adequate foetal growth and development (Brown 2011: 3). Several vitamins and minerals are vital in ensuring the health of the mother and foetus is optimal and need to be consumed in recommended amounts daily.

2.3.3 Micronutrients

The WHO defines micronutrients as essential elements presented in minuscule amounts that enable the body to produce necessary enzymes and hormones as well as additional substances required for adequate growth and development. Although micronutrients are only needed in very small quantities, they are essential for the normal physiological function, growth and development of the unborn foetus. However, several micronutrients are not always consumed in the recommended amounts by pregnant women, therefore leading to nutrient deficiencies and having a negative impact on the health of the mother throughout the pregnancy as well as the new-born baby (WHO 2016: 1).

i) Vitamins

Vitamins are vital nutrients required in small amounts that contribute to the normal metabolism, growth and physical wellbeing of expectant mothers and the foetus. According to Brown (2011: 30), several vitamins are required for various functions throughout a woman's pregnancy, namely vitamin D, vitamin C and folic acid which can be obtained through several different food sources as well as through supplementation.

- **Folate**

In previous years, globally, folate deficiencies among pregnant women were highly prevalent, particularly in developing countries such as South Africa (Metz 2013: 978). However, due to several advancements that have been made in the role of supplementation and fortification, the number of women with folate deficiencies has decreased greatly among pregnant women. Spina bifida is the most common defect found in babies because of an insufficient folate consumption during pregnancy and affects between 0.77 and 6.1/1000 live births in South

Africa alone (Fieggen and Stewart 2014: 218). However, although the instance rates of this defect has decreased over the years, due to the crucial role folate plays in not only tissue growth but also the growth of the placenta and uterus during pregnancy, numerous efforts are still being made to increase the promotion of folate supplementation and introduce fortified foods into the diets of pregnant women globally (Fekete *et al* 2012: 75).

- **B vitamins**

Although all B-vitamins are required in varying amounts throughout pregnancy, vitamin B-6 and B-12 are said to both play a particularly important role in the advancement and normal functioning of the central nervous system in the developing foetus as well as to prevent preeclampsia and preterm births states WHO (2017: 1). Currently, a deficiency in vitamin B-12 throughout pregnancy is still a sizeable problem globally and particularly in lower income areas including those in West and Sub-Saharan Africa (Gernard, Schulze, Stewart, West and Christian 2016: 4). However, although pregnant women in developing countries are more prone to developing vitamin B deficiency and the complications associated with it, consuming a supplement in sufficient amounts has been shown to improve the vitamin B status of mothers as well as prevent the prevalence of adverse birth outcomes in the foetus (Duggan *et al* 2014: 758).

- **Vitamin A**

According to Thorne-Lyman and Fawzi (2012: 1), vitamin A deficiency (VA) is still extremely prevalent in many developing countries including South Africa and has numerous adverse health outcomes on the foetus once born and which continue well into the child's life. In addition, WHO (2017: 1) states that an estimated 250 million children of preschool age suffer from a vitamin A deficiency in Sub-Saharan Africa, with this high statistic being mainly due to children being born in vitamin A deficient areas and to mothers who were vitamin A deficient throughout the pregnancy period. However, in September 2008, South Africa launched its first ever Vitamin A Supplementation (VAS) campaign to target the public health problem of vitamin A deficiencies among children under five years old as well as pregnant and post-partum mothers (Department of Health 2012: 5). However, Farber (2017: 1) states that although the VAS campaign has been rolled out nationally with almost 57% of children between the ages of one and five years old receiving supplementation, the distribution of supplementation services is not consistent throughout each province, as only

40% have received such services in some districts while in other districts the percentage is as high as 90%.

- **Vitamin C**

One of the essential proteins required for the normal growth of the foetus throughout pregnancy is collagen as it assists in developing connective tissue and the structure of the baby's body and organs (Mistry and Williams 2011: 2). This protein requires the presence of vitamin C in the diet to assist with the production of collagen required by the foetus. In addition to supporting the growth of the foetus during pregnancy, vitamin C also boasts other benefits as it ensures the cells of the baby are kept healthy and is a useful antioxidant for the mother as a way of building the immune system.

- **Vitamin D**

As stated by Brown (2014: 29), Vitamin D plays a central role in the absorption and utilization of calcium, and a sufficient vitamin D intake during pregnancy is vitally important as it supports the growth of the foetus as well as contributing to gene programming. This can potentially influence the development of chronic diseases such as rheumatoid arthritis and cancer later in life. An adequate intake of vitamin D is said to be essential for the health of both the mother and foetus during pregnancy as well as in the prevention of adverse outcomes such as preterm birth of the foetus and preeclampsia in the mother (Kaushal and Mahon 2013: 76) and can be met primarily through receiving adequate amounts of sunlight every day. However, even with the free and readily available sunlight in South Africa, Green, Robin *et al* (2015: 604) states that vitamin D deficiency among pregnant women has been notably evident across South Africa with 19% of pregnant women being classified vitamin D deficient in 2015.

Other vitamins that are important during the pregnancy life cycle include pantothenic acid, biotin and choline as well as vitamin E and K which are further explained below.

Table 2.2 Water soluble vitamin requirements for pregnant women

UNIT OF MEASURE	NUTRIENT	REQUIREMENT (PREGNANT WOMEN) (MG/µG) P/DAY	MAJOR FUNCTION IN THE BODY	FOOD SOURCE
EAR	Vitamin B1 (Thiamine)	1.2mg	• Helps the body convert food (carbohydrates) into fuel (glucose). • Helps the body metabolize fats and protein. • Necessary for healthy skin, hair, eyes, and liver • Helps the nervous system function properly. • Is necessary for optimal brain function.	• Asparagus • Lettuce • Mushrooms Spinach • Sunflower seeds • Tuna • Green peas • Tomatoes • Eggplant • Brussel sprouts
EAR	Vitamin B2 (Riboflavin)	1.2mg	• Maintains the mucous membranes that are located throughout the digestive tract. • Necessary for proper formation of red blood cells • Helps the body produce antibodies • Benefits skin, hair, finger nails, toenails and the connective tissue	• Mushrooms • Spinach • Lettuce • Asparagus • Broccoli • Turnips • Chicken eggs • Yogurt • Cow's milk
EAR	Vitamin B3 (Nicotinic Acid)	14mg	• Cell respiration • Helps in the release of energy and metabolism of carbohydrates, fats, and proteins. • Proper circulation and healthy skin • Functioning of the nervous system • Normal secretion of bile and stomach fluids • It is used in the synthesis of sex hormones, treating schizophrenia and other mental	• Meat • Poultry • Fish • Wholegrain and enriched cereal grains

			illnesses.	
AI	Pantothenic Acid	6mg	• Metabolism of carbohydrates, proteins and fats • Supply of energy from foods	• Mushrooms • Cauliflower • Broccoli • Sunflower seeds • Tomato • Strawberries • Yogurt • Eggs • Sweet corn
AI	Biotin	30µg	• Used in energy and amino acid metabolism, fat synthesis, fat breakdown • Helps the body use blood sugar.	• Tomatoes • Lettuce • Carrots • Chicken eggs • Onions • Cabbage • Cucumber • Cauliflower • Goat's milk/ cow's milk
AI	Choline	450mg	• Assists in the development of the brain and spinal cord of the foetus. • May protect foetus against neural tube defects.	• Beef liver • Chicken • Brussel sprouts • Broccoli • Skim milk

AI – Adequate Intake, EAR – Estimated Average Requirement

WHO (2014: 1) and NICUS (2003: 1)

Table 2.3 Fat soluble vitamin requirements for pregnant women

UNIT OF MEASURE	NUTRIENT	REQUIREMENT (PREGNANT WOMEN) (MG), (µG) P/DAY	MAJOR FUNCTION IN THE BODY	FOOD SOURCE
EAR	Vitamin E (µg)	12mg	• Serves as an antioxidant • Protects vitamins A and C, red blood cells and essential fatty acids from free radicals. • Maintains a healthy reproductive system and nerves. • Promotes healthy skin.	• Vegetable oils • Margarines • Fruits and Vegetables • Grains • Nuts • Seeds • Fortified cereals

AI	Vitamin K (µg)	90µg	• Used by the body for blood clotting • Makes bone and kidney tissues. • Essential for healthy bones.	• Green vegetables • Cauliflower • Cabbage • Broccoli • Soybean • Olive oil

AI – Adequate Intake, EAR – Estimated Average Requirement

WHO (2014: 1) and NICUS (2003: 1)

ii) Minerals

Minerals are inorganic compounds that originate in the earth and cannot be manufactured by living systems. They are divided into two main groups, namely macro minerals, also known as bulk minerals, as well as micro minerals known as trace elements. Minerals are vitally important in maintaining the structure of bones and teeth as well as in controlling many of the body's processes. According to Brown (2011: 30), there are several important minerals required for various functions throughout a woman's pregnancy, namely calcium, iron and zinc which can be obtained through several different food sources as well as through supplementation.

- **Calcium**

As stated by Whitney, Rolfes and Pinna (2015: 450), the absorption and retention of calcium has been said to increase dramatically during pregnancy to help the mother meet the calcium needs of the foetus. The uptake of calcium by the foetus is particularly high during the third trimester when the foetus's bones mineralize and during the third trimester of pregnancy, when more than 300 milligrams of calcium is transferred to the foetus as the foetal bones begin to calcify (Brown 2014: 29 and Whitney, Rolfes and Pinna 2015: 450). Moreover, Brown (2014: 29) states that it is vitally important that an adequate amount of calcium is consumed throughout the pregnancy to help conserve the bones of the mother while still meeting the needs of the foetus, as a lack may result in a loss of bone density in the mother.

To meet the DRI calcium needs, pregnant women must ensure adequate amounts of calcium as well as protein are consumed daily through her diet by means of milk or milk alternatives. However, many of these foods are not always practical to consume on a regular basis particularly in developing countries such as South Africa due to limited food availability and

increased food costs, hence the consumption of a dietary supplement may be sufficient (Turley and Thompson 2014: 358).

- **Iron**

According to Turley and Thompson (2014: 358), the DRI for iron during pregnancy increases substantially from 18 to 27 milligrams per day due to its role in generating many new red blood cells to support the growth and development of the foetus and placenta. Therefore, pregnant women need sufficient iron to support their increased blood volume as well as to provide for placental and foetal needs (Rolfes, Pinna and Whitney, 2015: 449). As stated by Brown (2014: 29) and Rolfes, Pinna and Whitney (2015: 449), a woman ideally should enter pregnancy with adequate iron stores and maintain sufficient iron throughout the pregnancy, as an iron deficiency develops when a woman enters pregnancy with existing low iron stores and fails to consume enough iron throughout her three trimesters. Furthermore, very few women are fortunate enough to have adequate iron stores at the start of the pregnancy; therefore, women with existing iron-deficiency anaemia are likely to give birth to low birth weight infants (Rolfes, Pinna and Whitney 2015: 449). In addition, expectant teenage mothers are more likely to be at risk of developing iron deficiencies due to increased iron requirements during adolescent years that are not always met due to not consuming a variety of iron-rich foods due to cost and lack of availability (Rolfes, Pinna and Whitney 2015: 449).

Furthermore, 30 milligrams of supplemental iron per day is recommended for the 2nd and 3rd trimesters and women who do not take supplemental iron are more likely to develop iron deficiencies as well as deliver small infants who may be at risk of developing iron deficiency in their first year of life (Brown 2014: 29).

Table 2.4: RDAs for Iron for women of child-bearing age

Age	Non-pregnant women	Pregnant women	Lactating women
14-18 years	15mg	27mg	10mg
19-50 years	18mg	27mg	9mg

WHO (2014: 1) and NICUS (2003: 1)

- **Magnesium**

As magnesium and calcium work together, it is vitally important that both minerals are consumed in adequate amounts to ensure the health of both the mother and foetus during pregnancy as well as for the important role it plays in muscle relaxation and the production of energy in lactating women (Brown 2011: 31). While most women of child bearing age receive sufficient amounts of calcium, many women in lower-income countries lack magnesium which can largely be attributed to an unavailability of magnesium-rich food sources. However, Darnton-Hill and Mkparu (2015: 1745) suggest that while magnesium deficiencies may occur, consuming a supplement is not always necessary as there is very little research that shows any real benefits of consuming a magnesium supplement regularly.

Other minerals that are important during the pregnancy life cycle include phosphorous, zinc, fluoride, iodine, selenium and chromium.

Table 2.5: Mineral requirements for pregnant women

Unit of measure	NUTRIENT	REQUIREMENT (Pregnant women) (mg), (µg) p/day	MAJOR FUNCTION IN THE BODY	FOOD SOURCE
EAR	Phosphorous	580mg	• Plays an important role in energy metabolism. • Assists in the development of strong bones in the foetus.	• Red meat • Poultry • Fish • Dairy products • Cereal grains
EAR	Magnesium	290mg	• Energy utilization • Muscle contraction • Nerve function • Assists in lowering blood pressure. • Assists in the development of strong bones and teeth in the foetus.	• Whole wheat bread • Low fat dairy products • Lean meats • Beans
EAR	Zinc	9.5mg	• Immune function • Protein synthesis	• Lean meats • Low fat dairy

			• Plays a vital role in the construction of the foetus's cells and DNA.	• Products • Beans • Peanut butter • Grain products
AI	Fluoride	3.1mg	• Assists in the development of strong teeth in the foetus.	• Fruit and vegetables grown where fluoridated pesticides are used
EAR	Iodine	160µg	• Needed to make thyroid hormones • Maintains normal metabolism in all cells of the body. • May assist in reducing the risk of learning difficulties. • Reduces the risk of motor skills and hearing difficulties in the foetus.	• Iodinated salt • Seafood
EAR	Selenium	49µg	• Mineral antioxidant in human nutrition • Plays a role in reducing muscular oxidative stress. • May assist in the prevention of miscarriage and early labour.	• Meat • Fish • Seafood • Whole grain foods • Nuts
AI	Chromium	30µg	• Assists cells in utilizing glucose. • Assists in the prevention of	• Whole grain breads • Cereals • Meat

			gestational diabetes in pregnant women.	

AI – Adequate Intake, EAR – Estimated Average Requirement

WHO (2014: 1) and NICUS (2003: 1)

iii) Water

According to Wright, Hoffman and Savitz (2010: 1), water is the most abundant nutrient in the body and is vital for the transportation of essential nutrients including vitamins, minerals and hormones to the blood cells and ultimately the foetus. Consuming adequate amounts of water throughout the pregnancy ensures that the developmental needs of the foetus are being met as well as assisting in preserving amniotic fluid and ensuring the proper kidney functioning of the foetus. Water plays an essential role in the prevention of pregnancy fatigue, a problem experienced by many pregnant women globally (Brown 2011: 30). By drinking adequate amounts of water daily, pregnant women can ensure dehydration does not occur, and furthermore, prevent exhaustion and chronic fatigue as well as headaches and dizziness. Additionally, by removing excess sodium from the body, water minimizes oedema, more commonly known as swelling, in the ankles and feet and has been said to assist in alleviating morning sickness, heartburn as well as indigestion (Anderson, Rooks and Barroso 2016: 113). In addition, expectant mothers should consume at least ten glasses of water per day, except for those women who do light fitness exercise as they are expected to drink an additional glass of water for each hour of exercise completed.

2.4 Causes of malnutrition in pregnant women

2.4 1 Inadequate dietary intake

It is no secret that throughout the pregnancy, nutrient requirements increase to meet the needs of the foetus as well as support maternal tissues linked to pregnancy as stated by (Durrani and Rani, 2011: 177). However, many pregnant women in developing countries do not consume diets that are nutritionally adequate and therefore fail to meet the necessary nutrient requirements needed throughout the pregnancy. This in turn not only puts themselves but also the foetus at greater risk of developing malnutrition, further leading to complications in both the foetus and the mother. Inadequate nourishment and dietary intake throughout the pregnancy can significantly contribute to the prevalence of a low birth weight of the foetus as well as adding to the risk of infant mortality and morbidity (Merchant 2014: 165).

2.4.2 Illness and health issues

A woman's nutritional status at the time of conception plays a significant role in the health condition of not only herself but of the foetus as well. Without adequate care in the months leading up to delivery as well as in the critical first few months of the baby's life, both the mother and child are highly susceptible to illness and death (Parrotte 2015: 1). Women in developing countries without adequate basic prenatal care are more susceptible to illness due to poor living conditions. This in turn increases the incidence of poor dietary intake due to poor appetite and poor cooking and eating conditions, ultimately leading to the increased prevalence of malnutrition among pregnant women (Sappenfield, Jamieson and Kourtis 2013: 2).

Furthermore, there are other specific problems a woman experiences throughout the pregnancy which can also contribute to the prevalence of malnourishment as well as impacting on the health and wellbeing of the foetus (Brown 2014: 30).

- Pre-existing diabetes

  According to Rolfes, Pinna and Whitney (2015: 454), women already suffering from diabetes at the time of conception not only suffer from higher rates of infertility but those that do conceive suffer from preterm birth as well as increase the risk of the foetus suffering from both mental and physical complications later on in life.
- Gestational diabetes (GDM)

  Another common health complication women experience during pregnancy is gestational diabetes which is brought on by the onset of pregnancy in women who have not previously suffered with diabetes. In addition, Turley and Thompson (2014: 360) state that although gestational diabetes does normally go away once the foetus is born, in some instances the mother may develop type-2 diabetes later in life. Furthermore, in a study conducted in Johannesburg, South Africa, of 554 patients who completed a two-day glucose test for GDM, 45.8% had at least one risk factor for GDM. Furthermore, in a study conducted by Nhlapo (2015: 30) on the descriptive profile of GDM patients at the Tygerberg Academic hospital in the Western Cape, 57% of participants with GDM had a previous family history of diabetes and 55%

were forced to deliver the foetus via caesarean section due to complications associated with GDM.

- Gestational hypertension and pre-eclampsia

  Women suffering from chronic hypertension at the time of conception have a greater risk of developing gestational hypertension throughout the pregnancy and it also increases the risk of the mother developing type-2 diabetes (Rolfes, Pinna and Whitney 2015: 455). Furthermore, women suffering from gestational diabetes are also more likely to develop a more severe maternal complication known as pre-eclampsia. As Makhanya, Moodley and Govender (2016: 13) state, pre-eclampsia is still one of the biggest causes of maternal mortality in South Africa and in a study conducted on its prevalence in 19 maternity clinics in KwaZulu-Natal, 27% of women had uncontrolled blood pressure levels and several women suffered from mild to moderate pre-eclampsia.

2.4.3 Education and ignorance

As stated by Fallah, Pourabbas, Delpisheh, Veisani and Shadnoush (2013: 175), education and basic nutritional knowledge play a role in the nutritional status and dietary behaviour of pregnant women. In developing countries especially, pregnant women who have low education levels are more likely to follow false beliefs and behaviours when it comes to good dietary practices thus making dietary changes difficult to implement and incorrect nutritional practices difficult to break. The WHO (2016: 1) suggests that adequate nutrition education as well as counselling is becoming a popular and sought-after strategy as a means of improving the nutritional status of pregnant women. This strategy aims at not only promoting a healthy diet through the increase in consumption of diverse foods but also the promotion of sufficient weight gain through appropriate and adequate energy and protein intake. Furthermore, evidence suggests that adequate nutrition education plays a role in ensuring optimal gestational weight gain, an increased birth weight of the foetus as well as lowering the risk of preterm delivery.

2.4.4 Pica and hormonal changes

An unusual contributing factor to malnutrition which has seen rapid growth in prevalence among both children and pregnant women is pica, whereby patients develop unexplainable cravings for substances that hold no nutritional value and can, in turn, cause serious health risks (Khan and Tisman 2010: 86). Among the unusual substances consumed by women

during pregnancy, the most commonly consumed are ice and clay as in a recent study done by Khoushabi *et al* (2014: 1) on substances consumed by pregnant women, ice was consumed by 53.7% of participants and clay consumed by 23.3%. In addition, Khan and Tisman (2010: 86) conclude that consuming such substances during pregnancy can greatly contribute to noteworthy health risks including mercury poisoning, obstructions in the intestine, tooth pain as well as several gastrointestinal problems. However, this condition does not only affect the women during pregnancy with the complications as listed above, but can also contribute to adverse pregnancy outcomes and contribute towards the development of learning disabilities and even brain damage in children in some cases. Furthermore, the increase in hormonal changes in the mother can also contribute to the growing desire to consume more or less of specific food types including the unusual items listed above (Khoushabi *et al* 2014: 649).

2.5 Factors affecting food intake

As stated by Kearney (2010: 2793), one of the leading causes of inadequate food intake among the world's population and particularly those living in developing countries is the decrease in food availability due to increased demand and rising food prices. This in turn has seen a large increase in the prevalence of hunger, especially among vulnerable groups including children, pregnant and lactating women and those living in developing countries. Hence, the prevalence of malnutrition has multiplied over recent years as a direct result of a lack of dietary intake and/or disease, making vulnerable groups more susceptible to disease and ultimately, death. This cycle of increased nutrient requirements during illness and an inability to meet these needs due to a lack of food availability is not one that is easily broken and continues to plague both pregnant women and children across the globe (FAO 2012: 8).

2.5.1 Insufficient health services and unhealthy environment

The environment in which a pregnant woman lives plays a major role in the quality of food consumed as well as the overall health of the mother and foetus. Pregnant women who are exposed to harsh and unsafe environments during pregnancy have an increased risk of poor overall health as well as adverse birth outcomes (WHO 2017: 1). As stated by Santiago, Park and Huffman (2013: 91), pregnant women who are exposed to environmental toxins before and during pregnancy due to poor living conditions or inadequate waste removal, face increased exposure to dangerous toxins which, in turn, greatly affects the neurological and biological development of the foetus. Furthermore, illness during pregnancy leads to

malabsorption of nutrients consumed through foods and supplements as well as decreasing the desire to eat, and further weakening the immune system of the mother.

2.5.2 Cultural beliefs and traditions

While access to adequate, safe and nutritious food is a basic human right, many low and middle-income countries are still plagued by inadequate food consumption due to poverty as well as unsuitable food distribution (Zerfu, Umetaand and Baye 2016: 22). This in turn has a major impact on the nutritional status of the residents of these countries, and on vulnerable groups including pregnant women. In addition to food shortages and insufficient food intake, various forms of food taboos and cultural beliefs have been said to have an impact on the dietary consumption patterns of people living in African countries and can negatively affect the health status of vulnerable groups including pregnant women and subsequently, the unborn foetus (Ugwa 2016: 1).

In African countries especially, some foods with high nutritional benefits are sometimes avoided due to specific beliefs or superstitions pertaining to the effect such foods may have on the pregnant mother and child once born. Some of these practices include excluding eggs and milk from the diet of pregnant women and girls in Nigeria as stated by Ugwa (2016: 1) and in some South African communities, pregnant women are encouraged to eat soil and clay in order to provide the foetus with good skin and ensure a smooth delivery at birth (Tanoh-Dick 2015: 1). Furthermore, Ogana (2014: 41) states that women residing in Durban, KZN have moved away from traditional African diets in recent years and have adopted a more Western way of eating. This in turn has increased the consumption of saturated fats and foods high in cholesterol which has increased the prevalence of obesity in pregnant women in KZN.

2.5.3 Poverty and food insecurity

One of the obvious outcomes of malnutrition in pregnancy can be seen in the health and nutritional status of the foetus after birth (Vorster 2010: 2). The researcher also states that there is a vital link between poverty and malnutrition and furthermore, it has been demonstrated that low birth-weight babies have a higher risk of developing stunting as children as well as non-communicable diseases such as obesity and diabetes mellitus later in life. Pregnant women living in poverty-stricken areas or areas with low food availability are naturally more prone to consuming an inadequate diet due to increased nutrient demands that

cannot be met, time restraints on preparing adequate and wholesome food as well as insufficient income needed to purchase nutrient-rich foods (Ivers and Cullen 2011: 1740S).

Furthermore, the prevalence of food insecurity globally has been a known crisis for many years and continues to plague many developing countries (Devereux and Waidler 2017: 1), as 795 million people were classified as undernourished as of 2016. Of this number, 153 million Sub-Saharan Africans were said to suffer from food insecurity, including those living in South Africa. As stated by Chan (2014: 1910), food security is defined by a society of people who always have sufficient food to live an active and healthy life. This broad definition of the term includes various aspects such as an availability of food that is not only safe but nutritious, as well as the ability to acquire good quality food in a manner that is socially acceptable. On the contrary, food insecurity is hugely prevalent in many developing countries as communities are unable to access safe, good quality food on a regular basis due to inadequate resources, poverty and natural causes and has a further impact on the inhabitants, and vulnerable groups such as children, the elderly and pregnant women.

As stated by Tsai, Tomlinson, Comulada and Rotheram-Borus (2016: 70), food insecurity has had a negative impact on pregnant women in developing countries including South Africa as it has contributed to the prevalence of cardio-metabolic diseases including diabetes and hypertension. These adverse conditions not only contribute to the poor health status of expectant mothers, including gestational diabetes, but also contribute to the prevalence of poor birth outcomes of the foetus such as low birth weight and birth defects. Furthermore, Grundlingh, Herselman, and Iversen (2013: 552) and FAO (2016: 2) state that South Africa still has one of the highest food insecure rates in the world, particularly among vulnerable and disadvantaged groups as seen by national surveys conducted up to 2016.

2.5.4 Displacement

As stated by Owoaje, Uchendu, Ajayi, and Cadmus (2016: 161), over 40 million people globally and 12 million people in Africa alone were displaced as of 2015 due to emergencies such as war, conflict, natural disasters, floods and famine. Among those displaced both globally and in Africa, many include vulnerable groups including pregnant women, making such groups more susceptible to disease, illness and malnutrition due to their vulnerability.

Micronutrient deficiencies and under nutrition is highly prevalent among people living in emergency-related environments due to basic food and health facilities not being readily available. Furthermore, those suffering with poor nutrition and non-communicable diseases before the time of displacement are at an even higher risk of developing illness and infections due to weakened immune systems aggravated by poor and inadequate food intake (WHO 2017: 1)

Among those most susceptible to malnutrition in these environments are children and the elderly as well as pregnant and breastfeeding women. As pregnant women have increased nutrient needs, they are most susceptible to the harsh consequences of deficiencies and subsequently increase the risk of the foetus under developing while in the womb which can in turn contribute to irreversible and poor physical and mental development later in life (Owoaje, Uchendu, Ajayi, and Cadmus, 2016: 161). Unfortunately, this has become increasingly prevalent in African countries including South Africa as women, particularly those living in informal settlements, are often forced to move from their homes due to natural disasters such as fires and flash floods destroying their dwellings. In other instances, some women may need to flee due to the non-availability of food in certain areas that are suffering from drought. In addition, pregnant women face various challenges relating not only to their health but the health of the foetus as well, and while breastfeeding can be life-saving to the child once it is born, inadequate and uncomfortable environments increase the difficulty for women to solely breastfeed (Time 2016: 53 and WHO 2017: 1).

2.5.5 Vegetarianism

According to Piccoli *et al* (2015: 623), although vegetarianism in pregnancy has negative connotations due to the belief that vegan or vegetarian mothers may not consume adequate foods to supply the foetus with the nutrients it needs or would normally obtain from meat and dairy products, there is no real research that suggests following a vegetarian diet throughout pregnancy is not appropriate, provided it is followed strictly and the mother consults with a professional to guide her food intake. The consumption of specific foods would naturally be excluded in such a diet; however, the loss of associated nutrients would therefore need to be compensated by consuming alternative food choices as well as be complemented with various food groups in order to prevent micronutrient deficiencies that could potentially harm the growth and development of the foetus (Snow 2017: 297). Furthermore, according to Rose-Innes (2015: 1), the trend of pregnant women to follow a vegetarian or vegan diet in South

Africa is becoming increasingly popular in both high- and low-income communities due to health, financial and personal preference reasons. However, Piccoli *et al* (2015: 623) states that in a systemic review of vegetarianism in pregnancy, mothers who followed a vegetarian diet reported having low birth-weight babies who are more susceptible to developing deficiencies in both iron and vitamin B12.

2.5.6 Urbanization and eating away from home

As previously discussed, there are several factors that contribute towards the development of malnutrition in pregnant women. However, one factor that is often overlooked yet remains a burden to many women is the reliance on friends, family and neighbours for the provision of food to meet basic daily requirements (Todd, Mancino and Lin 2010: 4). As many South Africans still do not always have sufficient funds to purchase food, many are forced to eat away from their homes, either at community centres if available or with friends and family. Furthermore, this in turn contributes to the poor health status of pregnant women due to their inability to be able to control what is consumed daily. In addition, diets are nutritionally poor and insufficient quantities of food are consumed, resulting in weakened immune systems, putting not only themselves but the foetus in danger as well (Holmes and Roberts 2009: 3). In addition, due to today's fast-paced lifestyle and the prevalence of more working women in today's society, the consumption of more fast foods and ready-to-eat meals has increased over the last decade; however, little is really known about how the intake of such meals affects the overall quality of the diets of pregnant women in the first trimester (Fowles, Timmerman, Bryant and Kim 2011: 630).

2.5.7 Common problems associated with pregnancy

Throughout pregnancy, women experience multiple discomforts and problems that although they may not cause malnutrition directly, can contribute to a lack of desire to eat certain foods and consume adequate food variety needed to meet nutrient needs (Brown 2011: 15).

- Acid reflux is a common, yet uncomfortable problem many women face throughout pregnancy, as hormonal changes together with the pressure placed on the stomach by the baby causes a burning sensation in the lower oesophagus. While acid reflux is very treatable with over-the-counter antacids, in some cases, a prescribed medication may be offered if the problem prevents the women from eating regularly throughout the pregnancy due to discomfort (Brown 2014: 13).

- Nausea and vomiting, more commonly known as “morning sickness”, is a very common problem pregnant woman experience and affects one’s ability and desire to eat sufficiently. NVP or “nausea and vomiting of pregnancy” occurs predominantly in the 4th and 7th week of pregnancy and is one of the earliest symptoms experienced by women; however, NVP does typically end at around the 20th week of pregnancy and can be treated with general nausea and vomiting medication (Brown 2014: 15).

- Pregnancy-related pelvic pain (PRPP) has been reported in up to 71% of pregnant women globally and can be identified by sharp shooting pains in the pelvic area as well as lower back pain and discomfort when performing daily activities such as walking, walking up and down stairs and getting up from sitting (Howell 2012: 102). Furthermore, in a study conducted on 50 pregnant women in Tygerberg, Western Cape, 72% experienced pain in the lower back with severities of pain ranging from mild to severe (Kluge, Hall, Louw, Theron and Grové 2011: 187). However, Kluge *et al* (2011: 187) and Belogolovsky, Katzman, Christopherson, Rivera and Allen (2015: 53) suggest that pregnant women suffering with PRPP and mobility problems can benefit from a specific 10-week exercise that is supervised, functional and aimed at core strengthening.

2.6 Economic impact of malnutrition

2.6.1 Impact of malnutrition on the global economy

Although malnutrition directly affects individuals both physically and mentally, malnutrition also has a much larger impact on the economy of a country and has created major implications on the economy, globally (FAO 2017: 1). The perpetual cycle of poverty and economic stagnation is one that is not easily broken due to the impact malnutrition has on adults and vulnerable groups, namely pregnant women and children, putting further pressure on an individual’s ability to obtain a good education and access employment that can contribute to the economy. As it stands, globally malnutrition currently costs up to 3.5 trillion dollars to the economy and under-nutrition and micronutrient deficiencies cost up to 2.1 trillion dollars with maternal and child malnutrition being the largest nutrition-related health burden (FAO 2017: 1).

2.6.2 Impact of malnutrition on South Africa's economy

Despite the prevalence of food security improving over recent years in South Africa, several anthropometric measurements suggest the nutritional status of many vulnerable people has only marginally improved since the early 90s (Devereux and Waidler, 2017: 1). Many South Africans still suffer from malnutrition with children being the most affected part of the population as the onset of malnutrition begins not only once the child is born but from the time the mother falls pregnant and throughout the pregnancy. As stated by StatsSA (2017: 1) 55%, or 10 million, of children in South Africa still belong to households that live under the poverty line of less than R800 a month with Limpopo and the Eastern Cape being the most poverty-stricken provinces in the country.

In addition, children living in such conditions are often not exposed to adequate education due to lack of funds and are more susceptible to disease and illness because of insufficient food intake, putting further strain on local health systems as well as further reducing employment rates and opportunities to contribute to the country's economy (UNICEF 2013: 1). Children who are born to mothers who are malnourished throughout the pregnancy, are more likely to be born with similar deficiencies and are more susceptible to infections and illness, therefore increasing the time needed to recover and stabilize in hospital, and are more likely to develop long-term health problems that would require further treatment later on in life (CTA policy brief 2011: 1).

In addition, Omarjee (2017: 1) states that according to the Discovery Vitality OBE city index for 2017, the prevalence of overweight and obesity in South Africa costs the country a whopping R700 billion per year through direct and indirect costs. In addition, people with unhealthy body weights are directly related to increased healthcare costs and incur an increased R4400 per person per year cost to the country. Furthermore, UNICEF (2013: 1) states that the effect of malnutrition in the form of underweight is just as significant as the mortality and morbidity related to hunger and severe underweight results in a direct loss in productivity and human resources for the economy.

2.7 Strategies to address malnutrition in pregnant women

2.7.1 Promotion of breast feeding

Several programmes have been implemented across South Africa either in primary healthcare facilities, communities or hospitals, to promote the importance of breastfeeding exclusively, particularly when living in poverty-stricken environments with limited or no access to sufficient food sources (Swart, Sanders and McLachlan 2008: 130). As breastfeeding is considered the best form of feeding for a baby for the first six months of life, due to its ability to provide all the necessary nutrients needed by the new-born, the Baby Friendly Hospital Initiative was established in South Africa in 1991 and was later renamed the Mother-Baby-Friendly-Initiative (MBFI), which name is still being used and promoted today. With this initiative in place and by ensuring that all public health facilities and hospitals are suitable for and accepting of breast feeding, infant mortality has been prevented in more than 820 000 babies annually as well as death by breast cancer in over 20 000 mothers (DuPlessis, Peer, English and Honikman 2016: 110). However, DuPlessis *et al* (2016: 111) further states that even with the MBFI in place nationwide, exclusive breast feeding for up to six months in the baby's life is often not followed through by mothers, and complementary foods are said to be introduced between two and three months of age, resulting in children becoming predisposed to poor health outcomes both as infants and through to adulthood. Furthermore, several human milk bank facilities have been set up around South Africa in an effort to provide pre-term and sick babies with donated milk and in some cases to mothers who are not able to provide milk or grandmothers who are forced to look after new-borns (Department of Health 2018: 1). The process is extensive in which donors are first screened and, if accepted, donate milk that is then collected, processed and distributed to healthcare facilities across the country to recipients in need (Goodfellow, Reimers, Israel-Ballard and Coutaoudis 2016: 83). This in turn provides vulnerable babies with the nutrients needed to ensure growth and development as well as decrease the prevalence of malnutrition in infants and young children (Department of Health 2018: 1).

2.7.2 Food fortification

It is no secret that the first 1000 days of a child's life are particularly vital in all spheres as the intake of micronutrients has a major impact on the growth and future health of not only the child, but possibly generations to come. Furthermore, Jacobs (2017: 1) suggests that any malnutrition-related damage done during the first critical few years of a child's life can also

have implications for a country's economic burden due to productivity loss and increased costs of healthcare.

Of all the interventions developed to fight malnutrition in pregnancy the most effective one to date has been the fortification of staple foods across South Africa due to its effect in the reduction of the folate deficiencies among pregnant women states Metz (2013: 978). In addition, fortified foods that are regularly consumed by women before and throughout pregnancy ensure the body maintains sufficient nutrients stores and advantages not only themselves during pregnancy and breastfeeding but also the growth and development of the foetus and child in later years (Jacobs 2017: 1). According to food advisory consumer service (2017: 1), in 2003 South Africa launched its first fortification of maize-based foods including maize meal and maize flour with several micronutrients including vitamin A, thiamine, riboflavin, folate, niacin, zinc and iron, as these foods were identified as the most widely consumed across the country. This has given the majority of pregnant women in South Africa the opportunity to consume staple foods rich in micronutrient sources and ensure the recommended daily requirements for vital nutrients are consumed.

In addition, complementary feeding has become increasingly necessary for children's nutritional adequacy when the mother's breast milk is no longer sufficient to meet the nutrient needs of the growing infant, therefore, certain liquids and foods are introduced into the diet (WHO 2018: 1). Furthermore, the introduction of complementary foods is common within the period of 6 months to 24 months of infant life; however, such practices can continue past two years of age. In addition, 6% of deaths among children can be avoided with sufficient complementary feeding and introducing four or more complementary food groups at least twice a day can help prevent several micronutrient deficiencies as well as reduce stunting by up to 20% when supplemented with breastfeeding (Mokori, Schonfeldt and Hendricks 2016: 7)

2.7.3 Nutrition education

As stated by WHO (2017: 1), nutrition education is a widely used and popular approach used globally and particularly in developing countries such as South Africa to improve the nutritional status of women during pregnancy. Such an approach focuses primarily on promoting the benefit of following a healthy diet and ensuring a wide variety of diverse foods are consumed as well as promoting sufficient weight gain and the consumption of

micronutrient supplements and fortified foods throughout the pregnancy. One of the leading causes of maternal and foetal mortality in South Africa as of 2005 was malnutrition, hence, several interventions were developed by the Department of Health to promote micronutrient supplements and fortified foods in healthcare facilities as a means to manage and prevent malnutrition in pregnant women and children (Department of Health 2013: 16). As previously stated, according to the Department of Health (2012: 3), the Mother-Baby Friendly Initiative (MBFI) was developed and implemented in the 1990s to assist in the promotion and support of breastfeeding in South Africa and, in turn, to assist in minimizing the prevalence of childhood malnutrition. Furthermore, the MBFI consists of four main guidelines which include

- To inform healthcare facilities on the MBFI designation process and steps to be followed to be assessed and designated as Mother-Baby Friendly
- To ensure healthcare facilities are given sufficient support to ensure appropriate and sustainable implementation before designation takes place
- To provide healthcare facilities with guidance on how to sustain mother and baby friendly practises
- To ensure facilities understand their roles and responsibilities before and after designation
- To define and describe how provincial MBFI assessors must support healthcare facilities to attain and sustain MBFI practices.

Another initiative launched by the Department of Health was the Infant and Young Child Feeding Policy in 2007 which aimed to promote growth and development as well as improve the health outcomes of children in South Africa (Department of Health 2013: 11). This approach also aimed at promoting exclusively breastfeeding among women in order to lower the infant and child mortality and morbidity rate, providing healthcare facilities with adequate and scientific-based information on maternal health and infant and child feeding as well as allowing healthcare facilities to provide adequate support to pregnant women (Department of Health 2013: 12).

In addition, Taylor and Galanis (2010: 750) also state that nutrition education related specifically to food safety is also vitally important in ensuring pregnant women are aware of what foods can be harmful not only to themselves but to the foetus as well throughout the

pregnancy. Despite the fact that all consumers need to be aware of where their food comes from as well as how it is prepared and stored, pregnant women in particular need to ensure that no raw food is consumed throughout the pregnancy or lactating period including eggs and any fish products as well as unpasteurized milk or dairy products as the risk of developing food borne illnesses that could harm the foetus is greatly increased when consuming such foods (FDA 2017: 1).

Furthermore, the Nutrition Society of South Africa together with the Department of Health and other various stakeholders developed the South African food based dietary guidelines which were first launched in 2003 as a means of providing South Africans five years and older with a set of guidelines to improve daily dietary patterns and intakes as well as the overall nutritional status of consumers (FAO 2018: 1). While there are no guidelines specifically aimed at pregnant women, Vorster, Badham and Venter (2013: S4) suggest that further testing needs to be conducted to include guidelines aimed at targeted groups including pregnant and lactating women, adolescent boys and girls as well as infants and young children.

2.7.4 Government grants

As poverty and malnutrition are two major issues that continue to plague hundreds of pregnant women in South Africa, support from government is critical in ensuring the health of the mother during pregnancy and subsequently that the health of the foetus is not put at risk. One initiative developed by the South African government several years back was the implementation of the child grant system, whereby caregivers looking after children under the age of 18 were entitled to a monthly stipend of R380 a month to cover living costs (Department of Social Development 2014: 9). However, the same support has not yet been offered to the very women that carry these children and is an issue that needs to be addressed and further developed. Furthermore, Sidimba (2017: 1), suggests that several researchers in South Africa state that the absence of a pregnancy grant in SA is long overdue and believe that the sooner the support is provided to the mother, the more ideal nutrient transfer via the placenta will be, further benefiting both the child and mother.

Furthermore, although in recent years it was previously reported that many teenage girls were falling pregnant intentionally in order to obtain child grants from the government as a means of acquiring a steady amount of income monthly (Fuku 2015: 1), the Department of Health

(2017: 12) has stated that this statement is inaccurate and has been proven false as the number of teenage pregnancies has not increased over the last few years which indicates that pregnancy is not being used to obtain any form of government grant. Moreover, the percentage of teenage pregnancies recorded in South Africa has decreased from 35% to 28% in the 19-year-old age group alone.

2.7.5 Food supplementation

According to Haider and Bhutta (2015: 3), pregnant women are now being advised to consume nutritional supplements to reduce the prevalence of malnutrition and micronutrient deficiencies from occurring to protect the health of both the mother and foetus. In addition, while vitamin supplements do not replace a healthy diet, they do ensure the mother receives sufficient nutrient amounts needed to guarantee the adequate growth of the foetus as well as ensure the foetus develops both physiologically and neurologically.

In addition, the Department of Health (2015: 37) states that upon the first antenatal visit, women are provided with supplementation to assist the pregnancy including ferrous sulphate in order to prevent anaemia, calcium to prevent pre-eclampsia, folic acid as well as tetanus toxoid (TT) immunization to prevent tetanus in neonates. However, in a study conducted on the assessment of the implementation of supplementation among pregnant women in Cape Town conducted by Grundlingh, Herselman, and Iversen (2013: 552), of the 70 women who qualified to receive the supplementation, only 40 understood why the supplementation was needed in the first place, despite various reasons being cited including helping in the development of the baby (5%) and helping/protecting and building the baby (65%). Furthermore, although some respondents admitted that the information that was received regarding supplementation was sometimes confusing (13%) and not always helpful, the majority indicated that the information was very helpful and constructive (81%).

2.7.6 Ante Natal Clinics

In 2017 the Department of Health launched an updated set of guidelines aimed at pregnant women in South Africa in an effort to ensure girls and women who suspect they are pregnant are fully aware of the procedures to follow to ensure a safe and healthy pregnancy is experienced and no complications to the mother or foetus occur (Department of Health 2017: 20).

The guidelines include:

- Visit the nearest health care facility as soon as you miss your first period.
- Get tested for HIV as soon as you know that you are pregnant.
- Ensure support from your partner during pregnancy and while caring for the baby.
- Always use condoms correctly and consistently when having sex even during pregnancy to prevent sexually transmitted infections, including HIV.
- Eat healthy meals and exercise regularly while pregnant.
- Rest adequately while pregnant.
- Don't drink any alcohol, smoke or take any illicit drugs to prevent foetal abnormalities.
- Stop self-medication or taking any medication not prescribed by the health care provider.
- Wear loose clothes and low heel shoes during pregnancy.
- Take folic acid, iron or calcium supplements while pregnant.
- Don't eat soil during pregnancy.
- Check the wellbeing of your unborn baby by counting movements, baby kicks, etc.
- Visit the nearest health care facility when not feeling well.
- Report any abnormalities including vaginal bleeding during pregnancy.
- Take and adhere to prescribed medication.
- Take and adhere to antiretroviral (ARV) treatment of HIV positive in order to stay healthy and to prevent infecting the baby with HIV.

According to StatsSa (2015: 13) the latest statistics regarding antenatal care coverage for pregnant women (first visit) nationally in 2014 was 92.9%, which was a significant increase from 86.2% in the previous year and 84.9% in 2012. In KwaZulu-Natal alone, the ante natal care (ANC) coverage in 2012 was a low 63.9%; however, the coverage rose to 82% in 2013 and 91.3% in 2014. In addition, the Department of Health (2015: 33) states that a pregnant women across the country in all provinces should be provided with adequate ante natal care through the provision of proper antenatal preparation in order to ensure healthy and positive pregnancy outcomes. Such preparation at ANC clinics includes screening women for possible problems related to the pregnancy, assessing any prevalent risks, treating existing problems experienced by the woman during the pregnancy period and providing essential medication, as well as providing both psychological and physical support and information for childhood

and parenting. Furthermore, Patience, Sibiya and Gwele (2016: 1) state that through a cross-sectional quantitative analysis across 12 primary healthcare clinics in KwaZulu Natal, the majority of processes and guidelines of proper antenatal practices were evident in obtained records; however, in several instances such processes were not recorded or records were missing.

2.8 Conclusion

The literature in this chapter provided an in-depth look into several variables as well as nutritional factors that influence the pregnancy process and overall health of both the mother and foetus. The foundation of understanding the literature provided, created the basis for the objectives and goals of the research as well as providing valuable insight into measures needed to be taken to improve the overall nutritional status and eating habits of pregnant women in South Africa.

Chapter 3- Research Design and Methodology

3.1 Introduction

The purpose of this chapter is to provide a description of the research design and methodology, as well as the data analysis used in this study. A description of both the participants and the sampling procedures is provided and a brief overview of the measures used to collect the data is included to obtain the following objectives:

- To determine the socio-demographic profile of the households by means of a socio-demographic questionnaire;
- To determine the participants' dietary intake by completing 2 x 24-hour recall questionnaires;
- To determine the food variety intake of the participants by requesting them to complete a Food Frequency Questionnaire (FFQ);
- To determine the BMI of each pregnant woman by weighing and measuring them;
- To measure blood pressure as an indication of risk to the pregnancy from high blood pressure

This study made use of a quantitative, descriptive research design and was nested within a larger birth cohort study to evaluate and improve antenatal care access and clinic attendance at primary health care level in KZN. The participants comprised of a convenience sample selection of pregnant women who participated in the MRC-funded maternal study attending the antenatal clinic of the Cato Manor community health care centre in KZN titled "A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal". A total of 100 women who presented for their first antenatal care visit were included in the study.

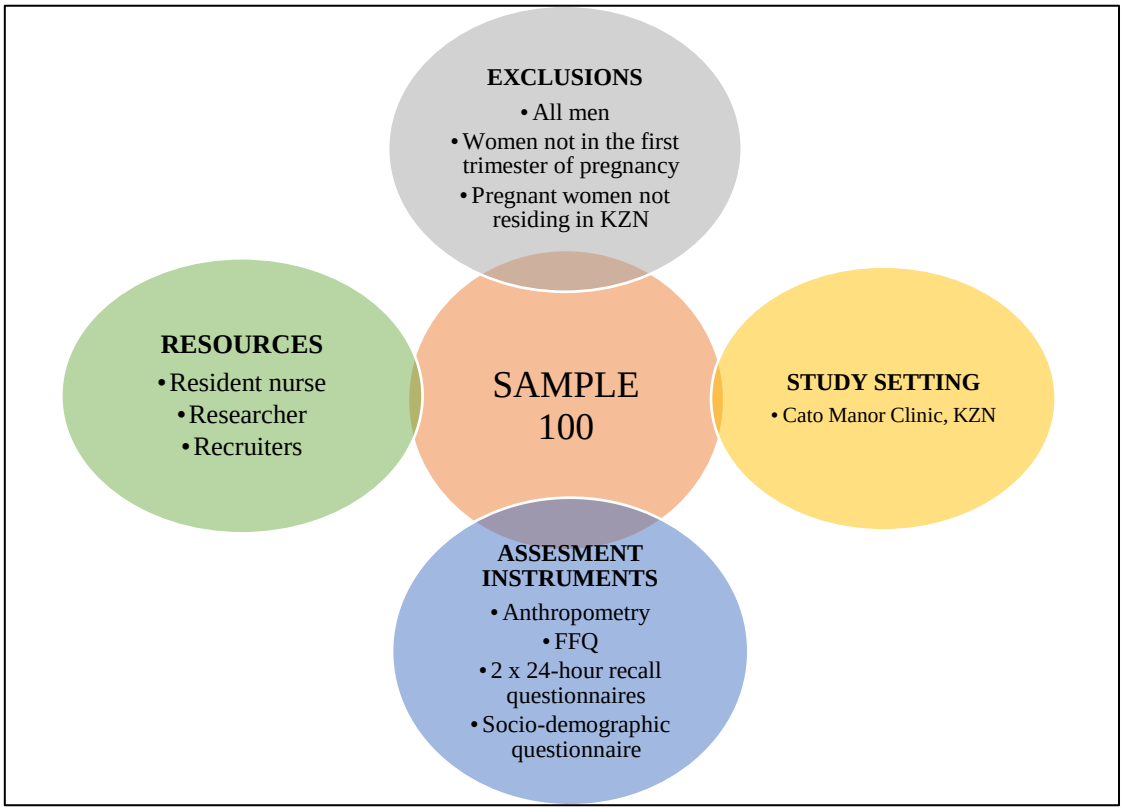
3.1.1 Topic

The study proposed to determine the dietary diversity and nutritional status of 100 pregnant women attending Cato Manor community health care centre in Durban, KZN. According to WHO (2017: 1), malnutrition is still considered a crisis across Africa and more specifically in South Africa and therefore affects the nutritional status and dietary intakes of many young

women including those who are pregnant, resulting in complications during pregnancy as well as an increase in the number of low birth weight babies born (WHO 2017: 1). According to Fanzo (2012: 37), many South Africans still experience hidden hunger as a result of under nutrition and lack of sufficient food availability. In addition, many pregnant women experience the phenomenon whereby the individual may consume adequate energy resources but may be lacking in several macro- and micronutrients and therefore, experience mild to severe health problems which directly affect the health of the foetus.

The needs of most nutrients required by pregnant women increase during pregnancy due to the high nutritional demands of not only the mother but of the growing foetus as well (Brown 2011: 4). In several communities in South Africa, many women of child-bearing age are inadequately nourished, with regards to both the macro- and micro nutrient contents of their diets. Therefore, it is essential that good health and nutrition practices are maintained before conception for the mother to meet the nutrient demands of pregnancy and lactation as this is vital to the healthy development of the embryo, foetus, infant and child (Hanson et.al 2015: S216).

3.1.2 Study variables



3.1.3 Sampling and recruitment

The sample for this maternal study was based on pregnant women attending the antenatal clinic of the Cato Manor Community Health Care Centre in KwaZulu-Natal. A total of 139 pregnant women in the first trimester of pregnancy were eligible to be accepted to be a part of the study; however, due to a low return rate and incomplete questionnaires, a final sample of 100 women were included in the study and their data was used. The data collected in this project will be stored in the Department of Consumer Science Food and Nutrition at the Durban University of Technology in a locked cupboard for 5 years, after which it will be disposed of by shredding.

Participants were informed of the study by recruitment personnel and through advertisements placed in the clinic and surrounding areas. Participants who attended their first ante natal visit were informed by the recruiter on all details pertaining to the study and were asked whether they would like to partake in the study. Participation was voluntary and no coercion was used to recruit participants.

Inclusion criteria of the participants:

- Pregnant women attending Cato Manor clinic for their first ante natal visit
- Participants in the first trimester of pregnancy
- Participants who were residents in KwaZulu-Natal

Exclusion criteria of the participants:

- Women who were not pregnant
- All men were excluded from the study
- Pregnant women who did not live in KwaZulu-Natal
- Pregnant women not attending their first antenatal visit at a Primary Health Care Clinic (PHC)
- Women in the second and third trimester of their pregnancy

The above criteria were excluded from the study as this study formed part of the MRC approved study “A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal”. This ensured that only

pregnant women in the first trimester of pregnancy attending the Cato Manor Community Health Care Centre were included in the study. All pregnant women who attended the clinic for their first antenatal visit before 24 weeks were recruited to form the first group of participants in the first trimester.

3.2 Research design

The final sample obtained for this study was made up of 100 pregnant women who attended Cato Manor Community Health Care Centre in KwaZulu-Natal, South Africa and who were in the first trimester of pregnancy. As stated by the Department of Health (2015: 1), the Cato Manor Community Health Care Centre is located at Umkhumbane (Mayville) and forms part of the EThekwini district operated by the Provincial and eThekwini Municipality situated in KwaZulu-Natal. All pregnant women who attended the clinic for their first antenatal visit before 24 weeks were recruited. The women were allocated into 3 groups as outlined by the MRC. The first 100 women were allocated into the antenatal intervention group (Group 1); the second 100 to the nutritional education intervention (Group 2) whilst the last 100 women presenting compromised the control group. The control group received standard antenatal care as provided by the PHC clinic and recruitment continued until the sample of 300 is reached as stipulated by the MRC for the MRC-approved study "A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal". This community of Cato Manor is known for its rich cultural and political heritage and is populated by predominantly males aged between 30 and 39 years; however, it is a densely-populated community burdened by high unemployment rates and low socio-economic conditions (Department of Health 2017: 1). The community is made up of predominantly black African inhabitants together with a small number of local Indians. A small percentage of Cato Manor residents have lived in the community their whole lives while most residents have lived in the same household for 11 to 15 years. The majority of residents own their property; however, most residents' total monthly income falls between R1001 and R1500. The majority of Cato Manor residents have obtained secondary education while 24% of the residents have only obtained primary school education as their highest level of education (Department of Cooperative Governance and Traditional Affairs 2011: 1).

Figure 3.1: Cato Manor Community Health Care Centre

Upon arrival at the Cato Manor Community Health Care Centre, participants were escorted to a waiting area outside the maternal health department while participants waited to see the nurses for a full check-up. During this time, the recruiter informed the women on all details pertaining to the study, including the objectives of the study, as well as what would be expected of the participants in terms of completing questionnaires and having weight, height and blood pressure recorded. The recruiter ensured that no tactics or promises would be used to coerce the women to participate in the study including monetary payment of any kind. If the participants agreed to participate in the study, the participants were provided with an information letter and consent form in either English or Zulu (annexure C and D respectively) which again informed the participants of all the details of the study and which they were required to sign to provide and confirm their consent.

After consent was obtained, the participants entered the maternal health centre and registered required information such as name and age with the nursing sisters for the purpose of follow-up visits. Participants were provided with a participant number at this stage; thereafter, participants would enter individually into the treatment room to have urine and blood samples (not included in this part of the study) taken. Here, the nursing sister recorded the participant's blood pressure readings and the researcher recorded the weight and height of each participant which was recorded in a medical record review.

Figure 3.2: Demonstration of anthropometric measurements

Once the participant's blood pressure, weight and height were recorded, the participant was escorted back to the waiting area to see the nursing sister for a full physical exam. Here, the researcher administered, either in English or Zulu, valid and reliable socio-demographic (annexure E and F), food frequency (annexure G and H) and 24-hour recall (annexure I and J) questionnaires to the participants to utilize the time while participants waited to see the nurse. The researcher was on standby to answer any of the participants' questions or to assist them to answer the questions where required.


Figure 3.3: Participants being assisted to complete the various questionnaires

Once the participants had consulted with the nursing sister and completed all the questionnaires, they were then free to go home provided there were no complications with any of the tests carried out by the nurses. After all the assessments were completed the participants were given a nutrition education talk by the resident nutritionist and nursing sisters on necessary general information needed to better understand the pregnancy process and what to expect. If any participants' results came back indicating complications, such as having a high or low BMI or high or low blood pressure, they were then referred to the resident nutritionist who would provide them with relevant information needed to manage the problem. On leaving, participants were provided with a gift pack containing sponsored items such as hair conditioner, hand cream and deodorant as well as a small lunch pack and juice.


Figure 3.4: Example of the sponsored gift pack received by participants


Figure 3.5: Example of complimentary food and drink pack given to participants

3.3 Responsibilities of the Field Workers

The researcher was appropriately trained and was based at the Cato Manor community health centre throughout the duration of the data collection process and assisted with the administration and completion of questionnaires as well as with obtaining anthropometric measurements from the participants. The researcher could assist participants in answering the questionnaires in either English or Zulu and was trained on how to correctly complete a socio-demographic questionnaire, a food frequency questionnaire as well as the 24-hour recall questionnaire as well as how to correctly record participant's anthropometric measurements and blood pressure readings to ensure accuracy.

Figure 3.6: A nursing sister explaining results to a participant

3.4 Ethical consideration

This study was for non-therapeutic purposes and was a descriptive study. Approval from the institutional research ethics committee IREC 10/15 (see annexure A) of the Durban University of Technology was obtained as well as permission from the Department of Health (see annexure B) for the study by the research group as this study was one part of a MRC approved study "A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal". Meetings were held

with the management of the selected antenatal clinic in Cato Manor to acquire permission to commence the research. The meetings were held with the head nurse of the maternal section of the clinic together with the researcher and other members of the research team. The purpose of the meetings was to explain the purpose of the study and the details of how and when data collection would begin. After a certain amount of time, the research team received written permission from the Cato Manor clinic to commence the research and the data collection process began shortly thereafter.

Thereafter, all participants meeting the inclusion criteria at the selected clinic were approached until the quota of 100 participants had been reached and the purpose of the research was explained. The study was explained to all the participants and written consent was obtained from each participant before any aspects of the study commenced. Participants were assured that all findings from the study would be kept confidential as each participant would be assigned a numbered code to ensure the anonymity of each participant. Participants were also assured that should any participant wish to leave the study, they were free to do so without any penalty being imposed. Questionnaires were then completed in one-on-one interviews and weight and height measurements together with blood pressure measurements were taken in a private room by the researcher and the resident nurse. Finally, participants were also made to understand that there was to be no financial gain for participating in the study.

3.5 Measuring instruments

3.5.1 Research design

The descriptive study formed part of a Masters of Applied Science qualification and consisted of quantitative data which was obtained using questionnaires administered during one-on-one interviews followed by anthropometric measurements and blood pressure readings.

3.5.2 Measuring instruments

The process of data collection consisted of six main steps and can be seen below.

Table: 3.1: Process of data collection

STEP 1	Greeting of participants by fieldworker (researcher)
STEP 2	All questionnaires are administered to the participant in the preferred language (English or Zulu)
STEP 3	Participants complete socio-demographic and food frequency questionnaires individually. Assistance is provided if needed.
STEP 4	Researcher sits with participant in an interview process to complete 2 x 24-hour recall questionnaires.
STEP 5	Once questionnaires are completed the fieldworker checks all questions are answered and moves participant on to next stage.
STEP 6	Participants then have both weight and height measurements as well as blood pressure readings recorded.

3.6 Data gathering techniques

A variety of valid and reliable questionnaires related to the participant's dietary habits and socio-demographic background were used as the measuring instruments for this study. The questionnaires were all validated at the Durban University of Technology as well as at the community of Mkhizwane, KwaZulu-Natal before being administered to the participants.

Prior to this the researcher conducted a focus group with ten women from the community of Mkhizwane together with members of the research team; the purpose of the focus group was to identify whether the questionnaires were translated correctly and able to be understood. The researcher then went through each question of the questionnaire with the focus group members and was provided with feedback on how understandable the questions were and where they weren't, the questions were amended.

The questionnaires were then administered in an interview-style method and were completed with the aid of the researcher.

3.6.1 Socio-demographic questionnaire

A validated and reliable socio-demographic questionnaire was used as an assessment tool and was completed in an interview situation. This questionnaire is used to collect information pertaining to the social status of individuals or groups of people and includes questions used to understand and recognize potential impacts on the food consumption patterns, food security and nutritional status of participants and is thus important in measuring the social well-being of the participants. The questionnaire also consists of questions pertaining to various demographic factors such as age, gender, occupation, level of education and income level to measure the impact of these variables and determine the level of poverty in the community (Napier 2006).

3.6.2 Anthropometric measurements

Anthropometry is one of the most common forms of health assessment used when determining the overall health of an individual or group of people and allows for the analysis of health trends and concerns pertaining to a specific demographic and community. Using anthropometry allows a researcher to identify cases of both under- and over-nutrition and allows for interventions to be put in place to combat adverse nutrition related outcomes (Gibson 2005). Some of the most commonly used anthropometric measurements in epidemiological studies include weight, height, hip and waist circumference measurements as well as skin fold thickness to determine outcomes such as fat percentage and BMI (Ververs, Antierens, Sackl, Staderini and Captier 2013: 2); however, in this study, only BMI and blood pressure measurements were used as these were the most relevant statistics to use to measure the nutritional status of the pregnant women.

i) Body Mass Index

Body mass index is regarded as a straightforward and simple guide to classify underweight, overweight as well as obesity in adults through weight-for-height measurement and is predominantly used to assess the nutritional status of individuals as well as groups. Several cut-off points relating to BMI are also used to determine whether an individual is at high-risk

of developing various lifestyle diseases such as obesity, high blood pressure and type-2 diabetes (Nuttall 2015: 118). BMI is calculated using a weight over height squared metric formula and is than compared to cut-off points to identify cases of both under- and over nutrition.

- Height and length

Measuring the height, or length, of an individual is useful in the determination of the nutritional status of adults and should be measured correctly to obtain the most accurate estimate of the BMI (1995: 47). In addition, a Seca stadiometer was used to obtain the height of the women. Each woman that consented to participate was taken into a private room and asked to remove her shoes as well as any hats/headdresses that may impact on the measurement. The participant was then asked to stand straight with her back against the stadiometer, looking straight ahead. Her height was then recorded and the woman was asked to step away from the stadiometer; the process was repeated to obtain a second measurement and the two measurements could not differ by more than 2 cm. The average of the two heights was then used as the final recording.

- Weight

Measuring an individual's weight provides an overall evaluation of fat as well as muscle store and was obtained using a MDW calibrated, electronic scale. The weight measurement procedure was in line with the WHO (1995: 47) recommendations. The participant was taken to a private room and was asked to remove shoes and any heavy clothing such as jackets as well as any jewellery so as not to influence the weight recorded. The electronic scale was switched on and the nurse waited for the 0.00 indicator to appear before allowing participants to step onto the scale. The participant was then asked to step on the scale and the participant's weight was recorded. The participant was then asked to step off the scale which allowed the scale to recalibrate. The participant was then asked to step back onto the scale and a second weight recording was measured and the difference between the two weights couldn't be more than 2g. The average of the two recordings was then used to ensure accuracy of the measurements taken.

ii) Blood pressure

The participant was taken to a private room and if necessary she was asked to roll up her sleeve to above her elbow. An instrument called a Beurer sphygmomanometer was used to measure both the diastolic and systolic blood pressure of each participant. The cuff of the sphygmomanometer was placed around the upper arm with the cuff's lower edge placed 3cm from the elbow pit. The cuff was then rapidly inflated to 180mmHg after which the air from the cuff was released at a moderate rate (3mm per second). A stethoscope was then used to listen against the diaphragm until the first knocking sound was heard which measured the systolic pressure, and then the diastolic pressure (which is measured when the knocking sound is no longer heard). The pressure was recorded in both arms and the difference was recorded by a qualified nurse to ensure accuracy.

3.6.3 Dietary-related questionnaires

i) Food frequency questionnaire

A food frequency questionnaire (FFQ) was selected to determine the food variety (FV) and food group diversity (FGD) of the participants in respect of food consumed over a period of seven days (Marais and Glasuer 2014: 22). The food frequency questionnaire was adapted by the researcher in the community of Mkhizwane, KwaZulu-Natal in a focus group situation with ten pregnant women who were not part of the study prior to the commencement of the research project. This was done to add or remove any foods not commonly consumed by the community and to have a valid questionnaire which would reflect actual food consumed in this community. Participants sat with the researcher to complete the questionnaire and were asked to tick or mark with an "x", which foods the participants consumed in the last seven days from all nine food groups.

The FFQ allowed participants to select which foods had been consumed within the last seven days by choosing from a large variety of food options from various food groups. These food groups included meat, eggs, dairy products, cereals, roots and tubers, legumes and nuts, vitamin A rich fruit and vegetables, other fruits, juices, and other vegetables and fats and oils as identified by the FAO (Marais and Glasuer 2014: 22). A study by Oldewage-Theron and

Kruger, (2008: 115) proved that dietary diversity indicators, namely the Food Group Diversity Score (FGDS) and Food Variety Score (FVS) were measured by a FFQ.

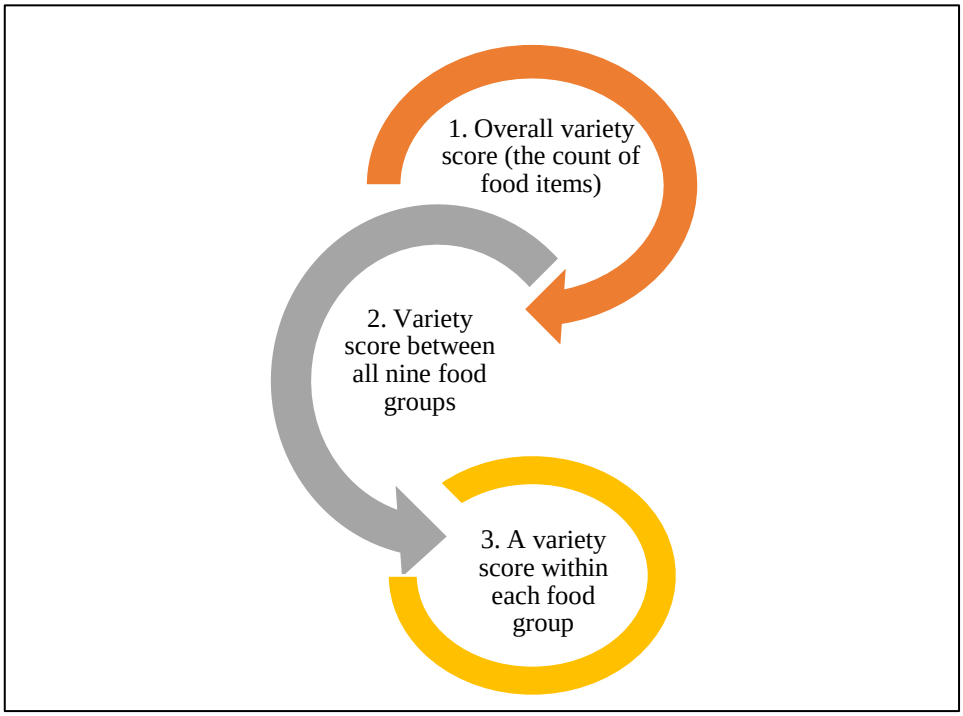


Figure 3.7: Calculation process of the dietary diversity score

The FVS was also presented in table form to indicate the number of foods consumed by the participants over a period of seven days and to provide a comparison between the food groups. Data was presented in terms of frequencies and percentages for the various categories.

ii) 24-Hour recall

According to Rankin (2008: 4), a 24-hour recall questionnaire is a structured interview-based questionnaire designed to identify specific and detailed information about various foods and drinks consumed by the participant over 24 hours. This is intended to recognize common meal patterns and food intakes of participants and consists of several open-ended questions to allow for as much information as possible about the foods and drinks consumed to be recorded. The researcher conducted the interviews and used various food models, illustrations and pictures to aid in portion size estimates and to obtain as much specific information as

possible from the participants. The questionnaire was also recorded twice, once relating to food intake on a weekday and once again relating to food intake on a weekend day to ensure validity as well as to identify any differences in meals consumed during the week and on weekends. The 24-hour recall questionnaire is advantageous due to its applicability to various populations and ethnic groups as well as being a non-invasive dietary tool; however, it is largely dependent on the participant's memory which can prove to be unreliable and inconsistent (Oldewage-Theron *et al* 2005: 13).

3.7 Data Analysis and Statistics

All data and necessary information was obtained from 139 women in the first trimester of pregnancy as part of an MRC funded study "A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal" and was based largely on the number of women that came for their first ante natal visit and who were eligible to take part in the study. Once all the questionnaires and assessments were checked, only 100 data sets were found to be complete and were included in this study. Incomplete data sets were largely due to participants not completing questionnaires thoroughly or not returning for further visits after the first ante natal visit.

The researcher administered the study and assisted the participants in completing all the relevant questionnaires including the socio-demographic, food frequency and 24-hour recall questionnaires as well as recording the participant's weight and height; however, the participant's blood pressure was recorded by the resident nurse. The completed socio-demographic, food frequency and 24-hour recall questionnaires and anthropometric measurements were captured on an Excel® spread sheet by the researcher and analysed for descriptive statistics using the Statistical Package for the Social Sciences (SPSS) version 17, 0 with the help of a statistician. The correlations were directed by a statistician using the ANOVA statistical test. The ANOVA tests the significance designed to determine whether a significant difference exists among multiple means in a sample. The Pearson's correlation coefficient puts into quantitative terms the association implied by scatter plots of the two variables. A value $r = 0$ implies no association whatsoever, whereas the values $r = 1$ and $r = -1$ imply perfect positive and negative associations, respectively. However, statistical significance testing, the p-value, is the probability of obtaining a test statistic at least as

extreme as the one that was actually observed, assuming that the null hypothesis is true. However, the null hypothesis is rejected when the p-value is less than 0.05 or 0.01. When the null hypothesis is rejected, the result is said to be statistically significant.

3.7.1 Anthropometry

3.7.1.1 Body mass index

The average height and weight were captured on an Excel® spread sheet and the body mass index (BMI) was calculated as the weight (kg) divided by the height squared (m^2). The BMI scores were calculated using both an individual's weight and height measurements and the result clearly indicated whether an individual was identified as suffering with either under- or over-nutrition. The data captured was analysed on the SPSS for windows version program with the assistance of a statistician.

The formula can be calculated as follows:
Metric Formula: BMI= Weight (kg) ÷ Height (m^2)
English formula: BMI = Weight (lb.) ÷ (Height (in) x Height (in) x703
E.g. BMI = 70kg/ (1.75m) ^{2} = 70/ 30, 0625 =22.9 (WHO, 2004)

As seen in table 3.1, pregnant women with a BMI of below 18.5 are said to be considered underweight, pregnant women with a BMI of between 18.5 and 24.9 are considered to be within the normal range, whereas women with a BMI of 25-29.9 are considered overweight. A BMI of above 30 indicates obesity which can increase the risk of the foetus being obese in adulthood as well as being more susceptible to developing lifestyle diseases related to obesity.

Table 3.2: BMI cut-off points for pregnant women

CATEGORY	BMI
Underweight	<18.5
Normal weight	18.5-24.9
Overweight	25-29.9
Obese- class I	30-34.9
Obese- class II	35-39.9

Ota, Haruna, Suzuki, Anh, Tho, Tam, Thiem, Anh, Isozaki, Shibuya and Ariyoshi, 2011: 127.

3.7.1.2 Blood pressure

According to table 4.7, the American Heart Association (2014: 3) and the Heart and Stroke Foundation (2016: 1) indicates that pregnant women that have a systolic and diastolic blood pressure of below 140 and 90 mm Hg respectively are considered to have a normal blood pressure. Pregnant women with a systolic and diastolic blood pressure of between 140/90 mm HG and 149/99 mm Hg are considered to have mildly high blood pressure, pregnant women with a systolic and diastolic blood pressure of between 150/100 mm Hg and 159/109 mm Hg are considered to suffer from moderately high blood pressure, and finally, pregnant women with a systolic and diastolic blood pressure of 160/110 mm Hg or above are said to suffer from severe high blood pressure (American Heart Association 2014: 3)

Table 3.3: Blood pressure cut-off points for pregnant women

Classification	SBP/DBP
Low blood pressure	<90/60 mmHg
Normal blood pressure	<120/80 mmHg to 129/84 mm Hg
High-normal blood pressure	130/85 to 139/89 mmHg
Mildly high blood pressure	140/90 mmHg to 159/99 mmHg
Moderately high blood pressure	160/100 mmHg to 179/109 mmHg
Severe high blood pressure (pre-eclampsia)	> 180/110 mmHg

American Heart Association (2014: 3) and Heart and Stroke Foundation (2016: 1).

3.7.1.3 Recommended Dietary Intake (DRIs)

As stated by the Nutrition Information Centre University of Stellenbosch (NICUS 2003), the approach used by the Food and Nutrition Board of the Institute of Medicine of the United States to convey the DRIs represents a paradigm shift that is essential in reducing the prevalence of nutrient deficiencies that occur today. The DRIs play an important role in promoting health in adding to one's quality of life as well as to provide essential guidelines aimed at specific groups and individuals to reduce the risk of developing chronic disease. Furthermore, per NICUS (2003: 1), the DRI framework includes several factors that contribute to its objectives, namely:

• To communicate recommendations to meet a diverse range of uses

• The role of nutrients in reducing the risk of chronic disease

• The inclusion and assessment of other components of food

• The use and the rationale for functional end points

• The assessment of estimates of upper safe levels of nutrient intake.

The DRIs are grouped into four nutrient-based reference values, each of which refer to the average daily nutrient intake and it is therefore the average mean intake over time that is the nutritionally important reference value. The four nutrient-based reference values that form part of the DRIs are as follows:

- ❖ Estimated Average Requirement (EAR) is the average daily dietary intake level estimated to meet the nutrient requirements of half of all healthy individuals in a life-stage and gender group. The EAR is a dietary intake value and it includes an adjustment for an assumed bio-availability of the respective nutrient and is used as the basis in setting the RDA. Furthermore, if sufficient scientific evidence is not available to establish an EAR, no RDA is set.
- ❖ Recommended Dietary Allowance (RDA) is the average daily dietary intake level sufficient to meet the nutrient requirements of nearly all healthy individuals in that gender group, at the given life-stage. Additionally, it is important to note that the

RDA applies to individuals and not to groups and is the goal for dietary intake by the individual.

- Adequate Intake (AI) is used in a case where the scientific evidence is inadequate to set an EAR. Therefore, in such cases the AI reference is used instead of the RDA. The AI is based on experimentally resultant intake levels or approximations of observed mean nutrient intake by a group of healthy people who have normal circulating nutrient blood concentrations, growth or other functional indicators of health. An AI is an indication that substantially more research is required to have an EAR established and to have an RDA calculated.
- Tolerable Upper Intake Level (UL) is the maximum level of daily nutrient intake likely to pose no risk of adverse health effects for almost all individuals in the general population (NICUS 2003).

During pregnancy, there are several different nutrients, both macro- and micronutrients, that play a vital part in ensuring the health of the mother and her baby. However, Brown (2011: 3) suggests that certain macro- and micronutrients have an even more important function in pregnancy and should be looked at more closely to ensure adequate amounts are consumed daily to ensure optimal maternal and child health. Important macronutrient requirements that need to be met by the mother include carbohydrates together with fibre, energy and protein.

3.7.2 Health assessment

i) Food frequency questionnaire

The questionnaire was edited and translated into Zulu and was later captured by the researcher on an Excel® 2010 spreadsheet and then analysed using the SPSS for windows version 20.0 software program with the assistance of a statistician.

These scores were calculated for a reference period of seven days for this study and were used together to reflect dietary diversity (DD) in different ways. The nine nutritious food groups recommended by the FAO were used for the classification of broad food intakes. A ‘low variety’ was indicated when less than 30 foods were consumed in a period of 7 days, compared to a ‘medium variety’ with 30-60 foods, while a ‘high variety’ indicated more than

60 foods consumed in the same period. All the dietary diversity scores (FVS and FGDS) were calculated from the seven-day FFQ (n=100). Descriptive statistics, including frequencies, means and standard deviations, were determined. Tables were drawn up to represent the FGDS indicating the number of food groups consumed by the participants. Various graphs displaying Nutrient Adequacy Requirements as well as Food Group Diversity Scores were included to display in a graphic form the nutrients that did not meet 100% requirement as well as to show how varied the diets of the participants were.

ii) 24-hour recall questionnaire

During the data capturing process, the data obtained from participants was captured and analysed by a trained research assistant using the MRC Food Finder® version 3.0-software which is based on the South African Food Composition tables. This program was developed to present a theoretical analysis of the nutrient content found in consumed food items. The means of two consecutive days was used for the analysis of the nutrient intake, top-20 foods, fruit and vegetable intake as well as the Acceptable Macronutrient Distribution Range. (AMDRs). The (AMDRs) was also used to correlate the DRIs for women in the first trimester of pregnancy relating to energy, carbohydrates and fat. Finally, the association of the nutrient intake relating to vitamins and minerals and nutritional status was compared to the DRIs (NICUS 2003; 2007) for the age group between 19 and 30 years for pregnant women.

iii) Socio-demographic questionnaire

All the data completed on the socio-demographic questionnaire was sorted and checked for completeness and accuracy by the researcher and n=100 were useable. Descriptive statistics including frequencies, means, standard deviations and confidence intervals were determined. Tables were then drawn up with percentages of the different variables included in the questionnaire. Data were presented in terms of frequencies and percentages for the various categories. The socio-demographic data was then used to calculate the Multi-Dimensional Poverty Index (MPI).

Furthermore, descriptive statistics (frequencies, means, standard deviations and confidence intervals), where applicable, were determined with the assistance of a statistician. The variables in line with the objectives of the study and statistical methods are described in Table 3.4

Table 3.4: Overview of measuring instruments used per objective and tools used for analysis

OBJECTIVE	VARIABLE(s)	QUESTIONNAIRE USED	STATISTICAL ANALYSIS
To determine the demographic characteristics of the household	Age, gender, socio-economic status, income and household composition	Socio-demographic questionnaire	Descriptive statistics, SPSS version 20.0
To determine the dietary intake of the pregnant women	Dietary intake for 24 hours at a time (24 Hour-Recall) x 2 days	2 x 24 Hour recall questionnaires	Food Finder software (MRC 1991), mean, minimum, maximum and standard deviation compared to DRIs.
To determine the food variety intake of the pregnant women	Food variety over 7 days	Food frequency questionnaire	Descriptive statistics, SPSS version 20.0, t-test for significance between groups.
To determine the anthropometric status of the pregnant women	Weight, height and age	Electronic scale and stadiometer	SPSS Version 20.0 (Mean weight, height, BMI and blood pressure)

The calculation of the total MPI for pregnant women attending an antenatal clinic and residing in Cato Manor was based on the Alkire and Santos (2010) cross-dimensional cut-off points of indicators and weighting. In addition, deprivation is considered as follows:

Table 3.5: Deprivation indicators

Indicator	**Deprived if:**
Education	• No member of the household has completed five years of schooling • Any child of school age is not attending school (grade one to grade seven)
Health	• Any child has died in the family • Any adult is considered underweight by having a BMI of below 18.5

Standard of living	• The household has no access to electricity. • The household has no access to clean drinking water. • The floor of the household is made from sand, dung or dirt. • The household has no access to adequate sanitation facilities. • The household's cooking fuels are charcoal, wood or dung. • The household does not own more than one radio, television, bicycle or motorbike, or refrigerator and does not own a car.

These indicators were then given percentages according to the socio-demographic results and multiplied by the relative weights between dimensions; also refer to table 3.4. Weights were based on the criteria that a household had to be deprived in at least the equivalent of 30% of the weighted indicators (3 indicators) in order to be considered multi-dimensionally poor. This amounts to six asset indicators or two health or education indicators. Furthermore, a household is considered to be multi-dimensionally poor if the weighted indicators in terms of which they are deprived amount to 30%.

Table 3.6: Indicators calculation

Weight of Health	= 3.33 divided by 2 indicators	= 1.6 for each indicator = 1/6 (of 10 indicators)
Weight of Education	= 3.33 divided by 2 indicators	= 1.6 for each indicator = 1/6 (of 10 indicators)
Weight of Standard of living	= 3.33 divided by 2 indicators	= 0.55 for each indicator = 1/18 (of 10 indicators)
In the case of Assets indicator	= 1/18 for 6 cut-offs (variables)	= 1/18 divided by 6 = 0.009 = 1/108 (of 10 indicators)

Therefore, the calculation for each indicator was as follows:

Table 3.7 MPI Calculation

MPI measure	**Results of middle-income pregnant women in the Cato Manor area**	**Weight**	**MPI Score**
Health			
Child mortality	% households that indicated that a child had died in the past	x 1/6	
Nutrition	% respondents presented with being in the underweight classification of BMI	x 1/6	
Education			
Years of schooling	% none	x 1/6	
Child enrolment	% children of school-going age not attending school	x 1/6	
Standard of living			
Electricity	% have no access	x 1/18	
Drinking water	% have no access	x 1/18	
Sanitation	% have no access	x 1/18	
Flooring	% of households that had dung, sand, mud as floor	x 1/18	
Cooking fuel	% households that used wood or charcoal to prepare food	x 1/18	
Assets	**% Owning <2**		
Radio Television Telephone/ mobile phone Bicycle or motorbike Refrigerator	% % % % %	x 1/108 x 1/108 x 1/108 x 1/108 x 1/108	
Assets	**% not owning a vehicle**		

Table 3.7 MPI Calculation - continued

Car	%	x 1/108	
TOTAL			

The sum total of the calculations (%) was then used to compare deprivation against the 30% cut-off point. The calculations were also used to determine the percentage contribution of each dimension to multi-dimensional poverty.

3.8 Statistical significance and correlations

To determine the statistical significance of the results, a statistician used Statistics version 12 with Independent t-tests. The independent t-test is an inferential test designed to establish whether the null hypothesis should be accepted or rejected. Correlations were also conducted using the program ANOVA statistical test which is designed to determine whether a statistical significance occurs among various sample means. When testing the statistical significance of a sample, the p-value must reflect less than 0.05 otherwise it can be concluded that there is no statistical significance between two samples. There were some correlations of statistical significance found in this study.

3.9 Conclusion

This chapter has presented an overview of the study as a methodological approach to identify the nutritional status and dietary intake patterns of pregnant women in the first trimester of pregnancy. All principles and procedures as well as the ethics involved in the study were described. The results obtained from the questionnaires and procedures identified in this chapter are explained in chapter 4 using graphs and tables.

Chapter 4- Results and discussion

4.1 Introduction

Chapter 4 presents the study results as revealed through socio-demographic, food frequency and 24-hour recall questionnaires as well as by obtaining anthropometric measurements as measured in pregnant women in the first trimester of pregnancy. These results are presented per the study objectives namely:

- To determine the socio-demographic profile of the households by means of a socio-demographic questionnaire;
- To determine the participants' dietary intake by completing 2 x 24-hour recall questionnaires;
- To determine food variety intake of participants by completing a Food Frequency Questionnaire (FFQ);
- To determine the BMI of each pregnant woman by weighing and measuring the height of each woman at each trimester; and
- To determine the systolic and diastolic blood pressure of each pregnant woman by use of a sphygmomanometer.

All the results in this chapter will be represented by means of graphs and tables and will be interpreted, evaluated and discussed.

4.2 Socio-demographic data

4.2.1 Introduction

A socio-demographic questionnaire was used to understand and recognize potential impacts of the socio-demographic profile of the community as well as on the food consumption patterns, food security and the nutritional status of the participants. The socio-demographic results present the study population characterized in percentages per sample size, accommodation, family composition, work status, income, education, language and assets. The data was subsequently represented using tables and graphs. All graphs and tables are

totalled to 100% as the sample size was 100 and therefore only the percentages will be displayed in the tables and graphs unless otherwise indicated.

4.2.2 Accommodation and family composition

The role in the family that was claimed by the participants was varied as according to table 4.1, many participants (72%) took on the role of daughter in the family, 19% were mothers, 6% were grandmothers and 3% described themselves as the girlfriend in the family. With regard to the type of area the participants lived in, most participants (47%) lived in a squatter camp, 38% lived in a township, whereas only 11% lived in a town or city. In addition, although many participants lived in unfavourable living conditions, the majority (79%) indicated that there were other people living in the house, hence potentially impacting the nutritional status and dietary intake of the participants due to there being more mouths to feed.

Table 4.1: Role in the family and type of living area (n=100)

Variables	
Role in the family	**Percentage**
Mother	19.0
Grandmother	6.0
Daughter	72.0
Other (participant)	3.0
Total	100.0
Type of living area	**Percentage**
Town/city	11.0
Farm	1.0
Squatter camp	48.0
Rural village	1.0
Hostel	1.0
Township	38.0
Total	100.0
Other people living in the house?	**Percentage**
Yes	79.0
No	21.0
Total	100.0

Figure 4.1 indicates that 31% had one other person living in the household, 57% of the households had two to five people, 10% had six to eight people and 2% had nine or more people living in the household.

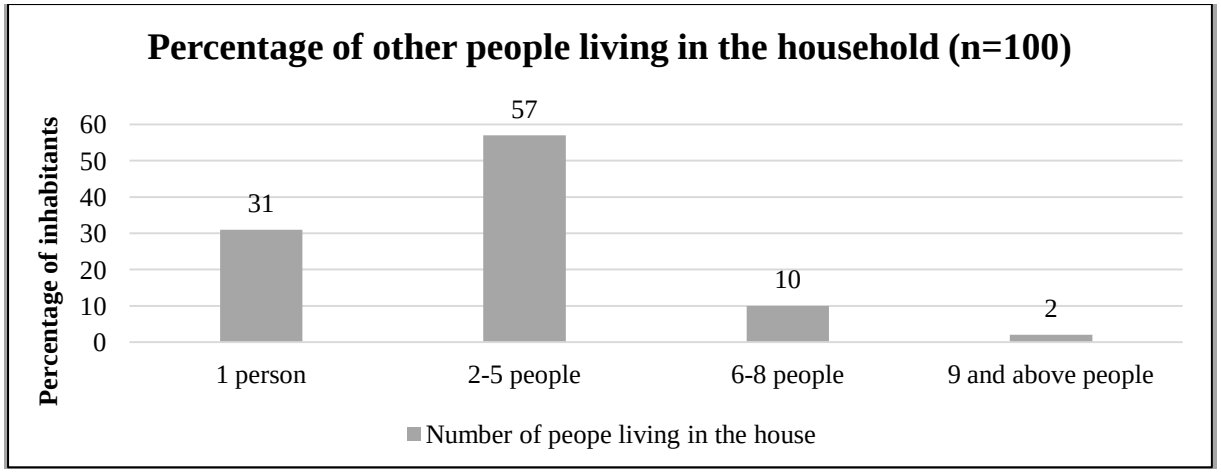


Figure 4.1: Number of people living in the household (n=100)

According to the results of table 4.2, the majority of participants (54%) had lived in the current house for over five years, 20% for less than one year, 23% between one and five years and 3% were unsure of the number of years they had lived in the house. In addition, most participants (51%) lived in a house made of brick, despite residing in squatter camps as previously mentioned, whereas the remainder of participants lived in houses made out of either tin (21%), wood (16%), grass (10%) or clay (2%). Furthermore, the majority of the participants (63%) lived in a house with fewer than two rooms with no other houses or shacks on the same property, while other participants had between three and four rooms in the house (24%) or more than four rooms (12%).

Table 4.2: Number of years living in current house, type of house and number of rooms in house

Variables	
Number of years living in current house	**Percentage (n=100)**
<1 year	18.8
1-5 years	24.0
>5 years	54.2
DK	3.0
Total	100.0
Type of house	**Percentage (n=100)**
Brick	51.0
Clay	2.0
Grass	10.0
Wood	16.0
Tin	21.0
Total	100.0
Number of rooms in the house	**Percentage (n=100)**

Table 4.2: Number of years living in current house, type of house and number of rooms in house - continued

<2	**63.0**
3-4	24.0
>4	12.0
Total	100.0
Other houses/shacks in backyard?	**Percentage (n=100)**
Yes	28.0
No	72.0
Total	100.0

With reference to table 4.3, 40% of the participants lived in a rented house or flat, 12% lived in an owned house or flat, 19% lived in a squatter home, and 19% lived with relatives whereas other participants were considered either homeless (3%) or lived in hostel accommodation (1%) or on an employee's property (1%).

Table 4.3: Living status

Variables	**Percentage (n=100)**
Homeless	3.0
Living with relatives	19.0
Living with friends	2.0
Hostel accommodation	1.0
Squatter home	19.0
Rented home/ flat	40.0
Own house/ flat	12.0
Employees property	1.0
Total	100.0

With regard to municipal facilities, many participants still lived in poor conditions with lack of sufficient access to water or adequate sewerage facilities. In table 4.4, it is evident that the majority of respondents (51%) were required to access water from an outside tap, whereas 39% used a tap inside the house. In addition, 9% of the participants were subjected to fetching water daily from elsewhere such as dams or streams and 1% was required to use a borehole. Such conditions are not favourable to the health of either the mother or the foetus, as access to clean and safe water should be a human right and not a luxury (Wilkinson, 2014: 1). Furthermore, 3% of participants had no access to any sewerage/toilet facility, 1% of participants were required to use a bucket, 26% of participants used a pit latrine as the main toilet facility, while the majority (70%) had access to a flush toilet, or formal sewerage

system and. Additionally, although the majority of participants (85%) had access to adequate sewerage waste removal facilities, 15% had no such facility, making disease and illness an increased risk to the pregnant women. In addition, 59.2% of the participants lived on tarred roads whereas 42.3% of the participants lived on gravel roads.

Table 4.4: Access to municipal facilities

Variables	
Water	**Percentage (n=100)**
Tap in house	39.0
Tap outside the yard	51.0
Borehole	1.0
Fetch water from elsewhere	9.0
Total	100.0
Toilet	**Percentage (n=100)**
None	3.0
Pit latrine	26.0
Flush/Sewerage	70.0
Bucket system	1.0
Total	100.0
Waste removal	**Percentage (n=100)**
Yes	85.0
No	15.0
Total	100.0
Tarred road	**Percentage (n=98)**
Yes	59.2 (n=58)
Gravel road	**Percentage (n=95)**
Yes	43.2 (n=41)
Electricity	**Percentage (n=99)**
Yes	91.9 (n=91)

According to table 4.5, 57.1% (n=56) of participants had cement as the main type of floor in the house, 12.2% (n=12) had tiles, 25.5% (n=25) had carpet, 3.1% (n=3) had sand or mud and 2% (n=2) had dung as the main type of floor in the house With regard to problems with the house, 30% (n=12) of participants experienced problems with the house being too small, while other participants listed problems with the house including damp (39.2%; n=16), leaking (23.3%; n=12) as well as other problems such as paint chipping (2.3%; n=1),overcrowding (2.3%; n=1) and muddiness (2.3%; n=1).

Table 4.5: Type of floor in house and problems experienced with housing

Variables	
Type of floor in house	**Percentage (n=98)**
Cement	57.1 (n=56)
Tiles	12.2 (n=12)
Carpet	25.5 (n=25)
Sand/mud	3.1 (n=3)
Dung	2.0 (n=2)
Total	100.0
Problems with housing	**Percentage (n=43)**
Too small	30.0 (n=12)
Damp areas	39.2 (n=16)
Leaking	23.3 (n=12)
Painting	2.3 (n=1)
Overcrowding	2.3 (n=1)
Muddy	2.3 (n=1)
Total	100.0

In line with figure 4.2, the majority of participants (54%) reported problems with pests in the house including mice or rats as well as cockroaches (39%), ants (23%), mosquitoes (41%), frogs (9%), snakes (4%) and fleas and bed bugs (2%).

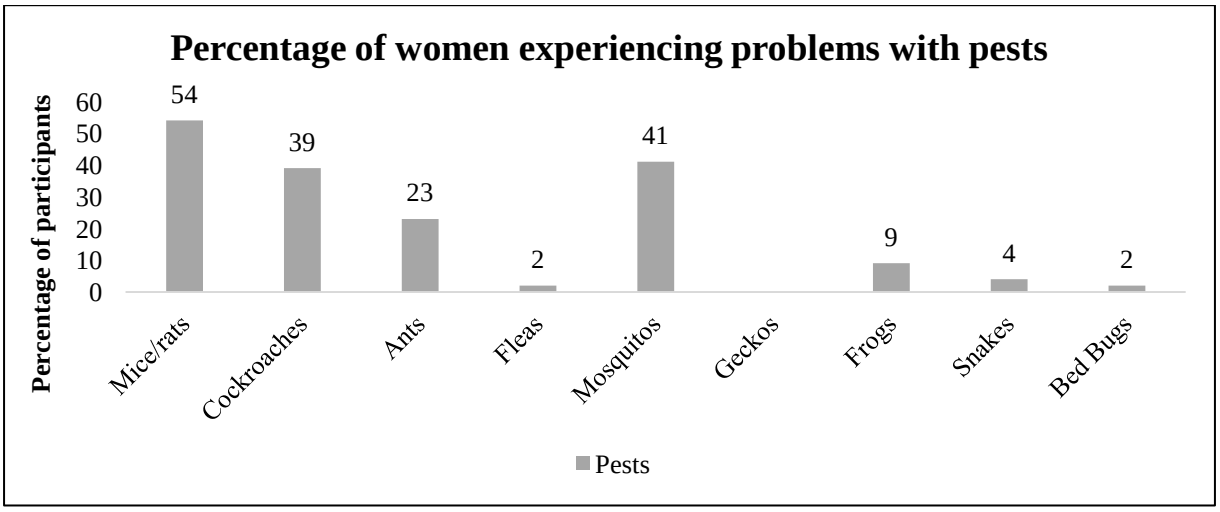


Figure 4.2: Percentage of women experiencing problems with pests

With regard to the employment status of the 100 participants, 35% of participants were described as being employed whereas 65% of participants were unemployed. In addition, only 28% of those who were unemployed were actively seeking employment at the time of the study, whereas 37% were not seeking any form of employment as seen in figure 4.3.

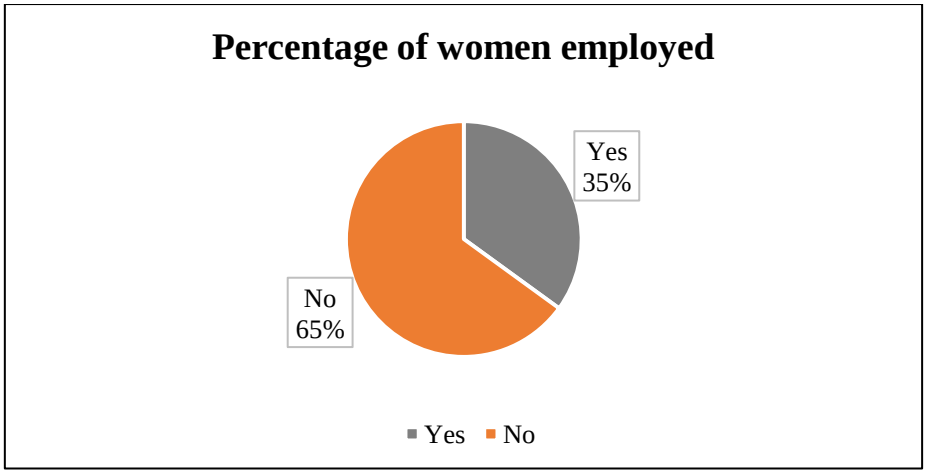


Figure 4.3: Employment status of pregnant women (n=100)

Of those participants who were employed, half had temporary employment (50%; n=18), 41% (n=15) were permanently employed and 8% (n=3) were on a fixed term contract. Those who were employed in different capacities carried out various jobs including bookkeeping, general factory work, caretaking and hairdressing to name a few. Furthermore, of those who were described as being unemployed, 42% (n=11) had been seeking employment for a period of less than six months, 23% (n=6) between six and 12 months, 19% (n=5) between one and three years and 15% (n=4) had been seeking employment for a period of over three years (see table 4.6).

Table 4.6: Current job for employed participants and period seeking employment

Variables	
Current job	**Percentage (n=35)**
Permanent	41.7 (n=15)
Temporary	50.0 (n=18)
Fixed term contract	8.3 (n=3)
Total	100.0
Period seeking employment	**Percentage (n=26)**
<6 months	42.3 (n=11)
6-12 months	23.1 (n=6)
1-3 years	19.2 (n=5)
>3 years	15.4 (n=4)
Total	100.0

As unemployment rates were high among this community, income was limited and low as expected. According to table 4.7, the majority of the participants (67%; n=43) had a total monthly income of less than R1500 per month, 15.6% (n=10) between R1501 and R3000,

13% (n=9) between R3000 and R9000 and only 2% (n=2) fell within a higher income bracket with a total monthly income of between R11 001 and above R21 000. Furthermore, the majority of participants (59%; n=59) had one other person contributing to the total monthly income, while 23% (n=23) had two people, 8% (n=8) had three people and 1% (n=1) had four other people contributing to the total monthly income.

Table 4.7: Work status, household income and number of people contributing to total household income

Current work status	**Percentage (n=68)**
Unemployed	60.3 (n=41)
Vendor	4.4 (n=3)
Housewife	1.5 (n=1)
Student	30.9 (n=21)
Part time	2.9 (n=2)
Total	100.0
Total household income	**Percentage (n=64)**
<1500	67.2 (n=43)
R1501-R3000	15.6 (n=10)
R3001- R5000	7.8 (n=5)
R5001-R7000	3.1 (n=2)
R7001-R9000	3.1 (n=2)
R11001-R13000	1.6 (n=1)
R<21000	1.6 (n=1)
Total	100.0
No. of people contributing to household income	**Percentage (n=99)**
None	8.1 (n=8)
1 person	59.6 (n=59)
2 people	23.2 (n=23)
3 people	8.1 (n=8)
4 people	1.0 (n=1)
Total	100.0

With most participants (43%) earning less than R1500 per month as previously mentioned it would be fair to assume that many participants would experience not having enough money to buy food. According to table 4.11, this is evident as 25% (n=24) of the participants sometimes did not have money to purchase food, 7% (n=7) experienced this often and 2% (n=2) experienced this on a daily basis. While these figures do not represent the majority, it is still detrimental for a pregnant woman to not have the funds needed to ensure nutritious and sufficient food is purchased to benefit both her and the foetus. However, 41% (n=39) of

participants did not experience any shortage of money needed to buy food and 24% (n=23) seldom did not have money for food. Frequency of food bought, amount spent on food and stores in which food is bought can also indicate an individual's financial position. With regards to purchasing of food, 2% of participants bought food every day, 8% once a week, 87% once a month and 3% bought food bi-weekly. Five percent of participants bought food from tuck shops, 1% from street vendors, 66% from wholesalers and 28% of participants bought food from supermarkets. As most participants indicated no shortage of money to purchase food, 40% spent over R500 a month on groceries, whereas 6% spent between R0 and R50, which is an incredibly low and alarming amount, 7% between R51 and R100, 4% between R101 and R150 and 6% between R151 and R500 per month. In addition, 37% of participants were unsure of the amount of money that was spent on food monthly and could not provide any indication thereof. Furthermore, according to table 4.8, the primary source of transport used by participants to purchase food was by taxi (88%), followed by own car (5%), bicycle (2%), train and bus (1%) and 3% indicated that walking was the main source of transport.

4.2.3 Financial and food security status

Table 4.8: Food Security/ Insecurity Status

Frequency of no money for food	**Percentage (n=95)**
Always	2.1 (n=2)
Often	7.4 (n=7)
Sometimes	25.3 (n=24)
Seldom	24.2 (n=23)
Never	41.1 (n=39)
Total	100.0
How often do you buy food?	**Percentage (n=100)**
Every day	2.0
Once a week	8.0
Once a month	87.0
Other	3.0
Total	100.0
Where do you buy food?	**Percentage (n=100)**
Tuck shop	5.0
Street vendor	1.0
Wholesalers	66.0
Supermarket	28.0
Total	100.0
Amount spent on food per month	**Percentage (n=100)**
R0-R50	6.0
R51-R100	7.0

Table 4.8: Food Security/ Insecurity Status - continued

R101-R150	**4.0**
R151-R200	2.0
R201-R250	3.0
R251-R500	1.0
>R500	40.0
Do not know	37.0
Total	100.0
Transport used to purchase food	**Percentage (n=100)**
Taxi	88.0
Bus	1.0
Train	1.0
Own car	5.0
Bicycle	2.0
Other (walking)	3.0
Total	100.0

4.2.4 Education and language

According to table 4.9, 5% of participants did not obtain any level of education, 6% obtained a primary school education, 24% obtained standard eight or grade ten, 48% obtained a matric, 11% obtained a college or FET qualification, and 6% obtained 'other', which was considered to be a private course or skill. In addition, participants who were interviewed varied in terms of primary language spoken; however, most participants (49%) spoke Zulu, which was to be expected of KZN residents, whereas 26.5% spoke Sotho, 18.4% Xhosa, 2% Pedi and 4% spoke other languages including Malawian, Portuguese, Shona and SiSwati (refer to table 4.12).

Table 4.9: Level of education and language

Level of education	**Percentage (n=100)**
None	5.0
Primary school	6.0
Standard 8/ grade 10	24.0
Standard 10/ matric	48.0
College/ FET	11.0
Other	6.0
Total	100.0
Language	**Percentage (n=100)**
Sotho	26.5

Table 4.9: Level of education and language - continued

Xhosa	**18.4**
Zulu	49.0
Pedi	2.0
Other	4.1
Total	100.0

4.2.5 Food acquisition and household assets

According to table 4.10, 56% (n=52) of the participants already had children of their own and only 15% of participants had completed immunization for all children, whereas 38.3% (n=23) had not completed immunization for any of their children. Some participants (5.8%; n=5) also indicated that children in the household had passed away previously due to illnesses such as food poisoning, pneumonia as well as heart defects.

Table 4.10: Children of your own, birth certificates, immunization and deceased children

Variables	
Children of your own	**Percentage (n=95)**
Yes	56.1 (n=52)
No	43.9 (n=43)
Total	100.0
Birth certificates	**Percentage (n=61)**
One	18.0 (n=11)
Two	47.5 (n=29)
Three	14.8 (n=9)
Four	4.9 (n=3)
All	14.9 (n=9)
Total	100.0
Immunization	**Percentage (n=60)**
None	38.3 (n=23)
One	33.3 (n=20)
Two	11.7 (n=7)
Three	1.7 (n=1)
All	15.0 (n=9)
Total	100.0
Deceased children	**Percentage (n=86)**
Yes	5.8 (n=5)
No	94.2 (n=81)
Total	100.0

Of the 65% of participants who did have children of their own, the majority (56.9%; n=36) had between one and three children attending school, 6.1% (n=5) had four and above, whereas 36.9% (n=24) indicated no children were attending school (refer to table 4.11). The main means of transport for the children that were attending school at the time of the study was on foot (50%), 32.5% (n=13) used a taxi, 12.5% (n=5) used a bus and 5% (n=2) made use of a private lift club service.

Table 4.11: Children attending school and transport

Variables	
Children attending school	**Percentage (n=65)**
None	36.9 (n=24)
1-3 children	56.9 (n=36)
4 children and above	6.1 (n=5)
Total	100.0
Method of getting to school	**Percentage (n=40)**
Walk	50.0 (n=20)
Bus	12.5 (n=5)
Taxi	32.5 (n=13)
Lift	5.0 (n=2)
Total	100.0

The number of meals consumed daily by participants varied as 31% consumed over three meals a day, 40% three meals, 20% two meals and 6% one meal per day. Sadly, 2% of respondents admitted to not consuming any meals in the day, although snacks may have been consumed; this is still an alarming statistic as both the woman and foetus have increased nutrient needs that need to be met through a proper and sufficient diet (Dunneram and Jeewon, 2015: 166). Most meals consumed throughout the day were eaten at home (83%) or at work (9%), school or university (3%) or at a friend's house (1%). Furthermore, children of the household consumed their meals mostly at home (46%) or at school (6%) (Refer to table 4.12).

Table 4.12: Meals consumed per day and where meals are consumed

Variables	
Number of meals eaten daily	**Percentage (n=100)**
None	2.0
One	6.0
Two	20.0
Three	40.0

Table 4.12: Meals consumed per day and where meals are consumed - continued

>3	**31.0**
Total	99.0
Where women consumed meals	**Percentage (n=100)**
Home	83.0
Friend's house	1.0
Work	9.0
School/varsity	3.0
Total	100.0
Where children ate meals	**Percentage (n=52)**
Home	46.0 (n=46)
School	6.0 (n=6)
Total	100.0

There are a number of food responsibilities that need to be fulfilled in the household which can be carried out by various members of the family, ultimately influencing what the family consumes and whether or not healthy and nutritious food is consumed by the pregnant women. According to table 4.13, the mother of the house (not the participant) appeared to be the main member of the family responsible for duties such as preparing the food (40%), deciding what food will be bought (48%), feeding the children (44.9%), as well as deciding on the amount of money to be spent on food per month (48%). It is then no surprise that in 38.8% of the households the mother also took on the role of head of the household in this particular sample group. The participants themselves took on much of the food responsibilities after the mother with regards to food preparation (43%), food decisions (37.4%), feeding the children (35.9%), deciding on amount spent on food (17%) as well as taking on the role as head of the household (16.3%). When the mother or participant themselves did not take on these roles, such responsibilities were seen to be distributed among various people including the father, siblings, grandmother, aunts, cousins or friends.

Table 4.13: Food distribution responsibilities

Percentage	**Food Prep (n=100)**	**Food decision (n=100)**	**Feeding children (n=100)**	**Head of household (n=100)**	**Amount Spent (n=100)**
Father	2.0	3.0	2.6	28.6	16.0
Mother	40.0	48.0	44.9	38.8	48.0
Sibling	6.0	4.0	9.0	9.2	9.0

Table 4.13: Food distribution responsibilities - continued

Grandmother	**2.0**	**0.0**	**2.6**	**0.0**	**1.0**
Aunt	3.0	4.0	2.6	5.1	5.0
Cousin	2.0	2.0	1.3	2.0	2.0
Friend	2.0	2.0	1.3	0.0	2.0
Participant	43.0	37.4	35.9	16.3	17.0
Total	100.0	100.0	100.0	100.0	100.0

According to table 4.14, 77% of households owned an electrical stove, 13% a gas stove, 19% a primus or paraffin stove, 43% a microwave oven, 36% a hot plate, 63% a radio, 76% a television, 54% a refrigerator, 33% a freezer, 30% owned a telephone or cell phone, 84% between one and five mattress beds, 14% owned only a mattress, 26% a lounge suite and 29% of participants had one dining room suite in the household. Furthermore, 74% of the participants owned an electric iron 73% an electric kettle and with regards to transportation, 15% owned between one and two cars and 2% owned one bicycle.

Table 4.14: Household assets

Variables	Percentage **(n=100)**	**Quantity**
Electric stove	77.0	1
Gas stove	13.0	1
Primus or paraffin stove	19.0	1
Microwave oven	42.0 1.0	1 2
Hot plate	36.0	1
Radio	63.0	1
Television	76.0 2.0	1 2
Refrigerator	54.0	1
Freezer	33.0	1
Telephone/cell phone	30.0	1
Mattress and bed	80.0 4.0 1.0 1.0	1 2 3 5
Mattress only	14.0	1
Lounge suite	26.0	1
Dining room suite	29.0	1
Electric iron	73.0 1.0	1 2
Electric kettle	73.0	1

Table 4.14: Household assets - continued

Car	**13.0** **2.0**	**1** **2**
Bicycle	2.0	1

With regard to the fuel source used in the home, the primary source used by 94 of the participants was electricity (94.9%; n=94), whereas 4% (n=4) used paraffin and 1% (n=1) used gas. Furthermore, the material of the main cooking utensils used was aluminium (64.3%; n=63), followed by stainless steel (30.6%; n=30) and finally, 5.1% (n=5) used cast iron (refer to table 4.15).

Table 4.15: Fuel and material of utensil used to cook food

Variables	
Fuel	**Percentage (n=99)**
Paraffin	4.0 (n=4)
Electricity	94.9 (n=94)
Gas	1.0 (n=1)
Total	100.0
Material	**Percentage (n=98)**
Cast iron	5.1 (n=5)
Aluminium	64.3 (n=63)
Stainless steel	30.6 (n=30)
Total	100.0

4.2.6 Multi-Dimensional Poverty Index (MPI)

According to the multi-dimensional poverty index (MPI) calculated from the indicators in the socio-demographic questionnaire, the three dimensions used to reflect deprivation are health, education and standard of living. Several factors including access to drinking water, proper sanitation, children enrolled in schooling, access to electricity and cooking fuels used as well as years of schooling obtained are looked at to determine basic services for people.

Table 4.16 shows that pregnant women residing in the Cato Manor community had a score of 15.35 which is below the number (>30) indicating that participants were living in poverty.

Table 4.16: MPI calculation

MPI measure	Results of middle-income pregnant women in Cato Manor (n=100)	Weight	MPI Score
Health			
Child mortality	5.8% households indicated that a child had died in the past	x 1/6	0.97
Nutrition	2% respondents presented with being in the underweight classification of BMI	x 1/6	0.33
Education			
Years of schooling	5% of participants had no schooling	x 1/6	0.83
Child enrolment	37% children of school-going age were not attending school	x 1/6	6.17
Standard of living			
Electricity	8% had no access	x 1/18	0.44
Drinking water	39% had no access	x 1/18	2.17
Sanitation	3% had no access	x 1/18	0.17
Flooring	5% of households had dung, sand, mud as floor	x 1/18	0.28
Cooking fuel	0% households used wood or charcoal to prepare food	x 1/18	0
Assets	**% Owning <2**		
Radio	63%	x 1/108	0.58
Television	98%	x 1/108	0.91
Tele/cell phone	30%	x 1/108	0.28
Motorbike	100%	x 1/108	0.93
Refrigerator	54%	x 1/108	0.5
Assets	**% not owning a vehicle**		
Car	85%	x 1/108	0.79
TOTAL			**15.35**

4.3 Anthropometric and health indicators

4.3.1 Anthropometric data

Anthropometric data was used to determine the weight and height of the pregnant women and further established whether the participant's BMI fell within the acceptable range of a pregnant woman as recommended by the WHO (1995: 47).

The mean age ±SD for the women as indicated in table 4.17 was 26±6.216, with a mean weight ±SD of 67.10±14.849kg and mean BMI of 27.09±6.339 as seen in table 4.17.

Table 4:17: Means and standard deviations for age, weight and BMI (n= 100)

Variable n=100	Mean age (years)	Mean weight (kg)	Mean BMI
Pregnant women	26	67.10	27.09
Standard deviation (±SD)	±6.216	±14.849	±6.339

According to figure 4.4, it is evident that 40% of the participants had a BMI that fell within a normal BMI range (18.5-24.9), 28% were considered overweight (≥25-29.9), 20% fell within obese class 1 (≥30-34.9), 7% fell within obese class 2 (≥35-39.9) and 3% were considered morbidly obese (≥40). Only 2% of participants were considered as underweight with a BMI of <18.5, which is a small but alarming statistic nonetheless as it poses a great risk to the health of both the mother and the foetus.

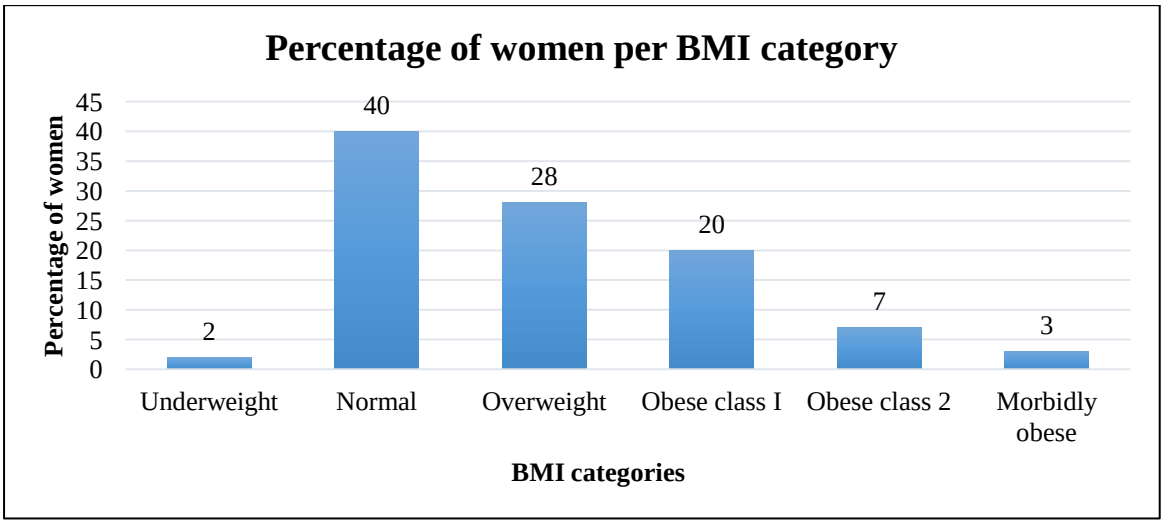


Figure 4.4: Percentage of women per BMI category

4.3.2 Blood pressure

The results in table 4.18 indicate that the pregnant women were all in different stages of hypertension ranging from low to severely high blood pressure, with both extremes presenting health implications for both the mother and the foetus. According to the American Heart Association (2014: 3) a participant is considered to have normal blood pressure when both the systolic and diastolic readings fall within the required cut-off points, with the systolic reading being the number on top and the diastolic reading being the number below.

Normal systolic blood pressure occurs when a participant has a reading of between <120 and 129mm Hg and according to table 4.21, 82% of participants had a mean (±SD) and had a reading of 110.66±9.578, which fell within the normal blood pressure range. In addition, 65% had a diastolic reading of 69.45±6.486, which also fell within the normal diastolic blood pressure range. In other words, normal blood pressure during pregnancy occurs when the blood pressure is below 140/90mm Hg, therefore, the majority of the participants were considered to have normal blood pressure due to the mean blood pressure reading of 110/69mm Hg.

Mildly high blood pressure occurs when the reading is 140/90 to 149/99m Hg, therefore, 6% of participants were considered to have mildly high blood pressure as the mean reading was 142/96mm Hg and 3% had moderately high blood pressure with a mean reading of 169/106mm Hg. Furthermore, a blood pressure reading of <90/<60mm Hg results in an individual being classified with low blood pressure, therefore, 31% of participants had low blood pressure with a mean reading of 78/54mm Hg.

Furthermore, hypertension in pregnancy is said to occur when a person has a systolic blood pressure reading above 140mm Hg or a diastolic blood pressure reading above 90mm Hg. Therefore, 10% of the participants were considered to be suffering from hypertension, and consequently, increasing the risk of experiencing adverse pregnancy outcomes.

Table 4.18: Blood pressure indicators for systolic and diastolic blood pressure (n=100)

Blood pressure cut-off points	**Pregnant women (n=100)**	
	Mean (Mean±SD)	**%**
Systolic blood pressure		
Low blood pressure (<90mm Hg)	77.75±18.733	4.0
Normal blood pressure (<120 to 129mm Hg)	110.66±9.578	**82.0**
High-normal blood pressure (130 to 139 mm Hg)	132.25±2.630	4.0
Mildly high blood pressure (140 to 159 mm Hg)	142.5±1.291	4.0
Moderately high blood pressure (160 to 179 mm Hg)	169±0.000	1.0
Severe high blood pressure (pre-eclampsia: >180 mm Hg)	181±0.000	1.0

Table 4.18: Blood pressure indicators for systolic and diastolic blood pressure (n=100) - continued

Diastolic blood pressure		
Low blood pressure (<60 mm Hg)	53.70±5.105	27.0
Normal blood pressure (<80 to 84 mm Hg)	69.45±6.486	**65.0**
High-normal blood pressure (85 to 89 mm Hg)	0.0±0.000	0.0
Mildly high blood pressure (90 to 99 mm Hg)	96.0±1.414	2.0
Moderately high blood pressure (100 to 109 mm Hg)	106±1.414	2.0
Severe high blood pressure (pre-eclampsia: > 110 mm Hg)	0.0±0.000	0.0

According to figure 4.5, it is clear, as previously stated, that the majority of participants had normal blood pressure (n=68) as evident from the grouping below whereas only a few outliers were found to have pre-high blood pressure (n=21), low blood pressure (n=2), high blood pressure (n=7), and severely high blood pressure (indicated as outlier) with n=2.

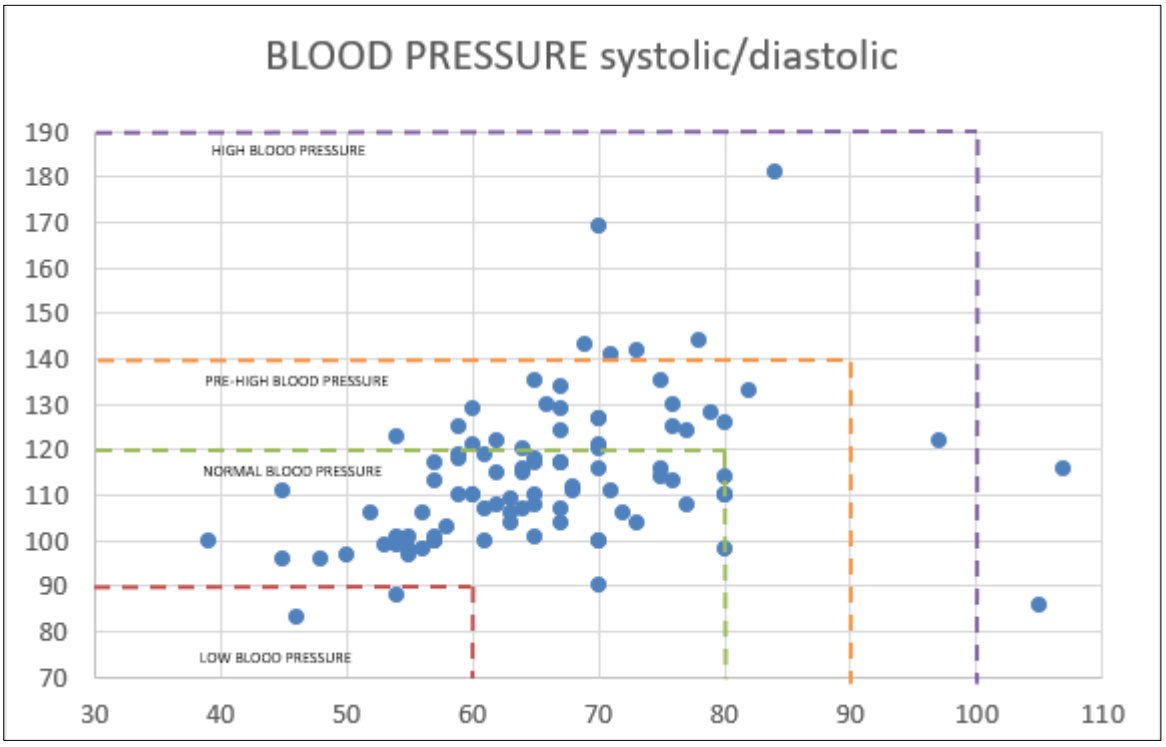


Figure 4.5: Combined systolic/diastolic blood pressure indication (mmHg)

4.4 Food Variety Score, Dietary Diversity Score and Nutrient Adequacy

The Food variety score (FVS) and Food group diversity score (FGDS) was calculated over a period of seven days to understand the longer-term food variety in the diet of the participants. The total range of individual food items consumed by an individual during the seven-day data collection period was between six and a maximum of 62 different foods.

The food groups with the most variety were the cereal group with 18 different food items consumed, the vegetable group with 12 items and the other fruit group with 12 different food items consumed as seen in table 4.19. Four different vegetables were consumed by 23% of participants, 33% consumed between zero and three different vegetable types, whereas 6% did not consume any vegetables within the seven-day period. Eighteen participants (18%) consumed three different vitamin-rich fruits, 16% consumed between four and five and 14% consumed six different vitamin A rich fruit varieties. However, seven participants (7%) did not consume any vitamin A rich fruits during the seven-day period, which in turn could increase the likelihood of the foetus developing deficiencies during the pregnancy and in early childhood. Within the other fruit group, 23% of participants consumed four different varieties, 40% between zero and three different fruit types, and 28% between five and six types.

Twenty-eight (28%) participants did not consume any egg variants and six percent did not consume any dairy food items within the seven-day period. Ten participants (10%) consumed five different dairy food items, 65% consumed between one and four dairy food items and 19% consumed between six and nine dairy food variants within the seven-day period. Protein-based foods did not have great variety as only one participant (1%) consumed six different legume and nut food group items, 39% consumed only one variant and 20% did not consume any legume food types during the seven-day period. Furthermore, twenty-two participants consumed four different meat-based food items, 40% between five and seven variants, 30% between one and three items and three percent (3%) did not consume any protein-based food items. The cereal group displayed the most variety with 18 different food items consumed; but only by 1% of the participants, while 18% consumed between ten and 13 cereal group variants, 37% consumed between six and nine variants, 21% consumed five different cereal group food items, 21% (n=21) consumed between one and four cereal group food items and 2% of the participants did not consume any cereal products within seven days.

Finally, 11% (n=11) of participants did not consume any fats and oil-based food items, 20% (n=20) only consumed one variant, 65% (n=65) consumed between two and four variants and 4% (n=4) consumed five different fats and oils food items.

Table 4.19: Household food consumption as measured by the Food Variety Score over a period of seven days by the participants (n=100).

Meat group (n=10)	**Egg group (n=1)**	**Dairy group (n=10)**	**Cereal group (n=18)**	**Legume and nut group (n=6)**	**Vitamin A rich group (n=8)**	**Other fruit group (n=12)**	**Vegetable group (n=12)**	**Fats and oil group (n=5)**	**Total individual items eaten from all groups**
0=3	0=28	0=6	0=2	0=20	0=7	0=6	0=6	0=11	0-6=1
1=8	1=72	1=13	1=2	1=39	1=8	1=3	1=4	1=20	7-12=5
2=5		2=16	2=5	2=23	2=14	2=14	2=9	2=24	13-18=8
3=17		3=19	3=5	3=6	3=18	3=17	3=20	3=27	19-24=10
4=22		4=17	4=9	4=6	4=16	4=23	4=23	4=14	25-30=25
5=18		5=10	5=21	5=5	5=16	5=13	5=11	5=4	31-36=22
6=10		6=6	6=14	6=1	6=14	6=15	6=10		37-42=16
7=12		7=6	7=7		7=5	7=4	7=8		43-48=7
8=1		8=2	8=11		8=2	8=1	8=4		49-55=5
9=2		9=3	9=5			9=3	9=0		56-62=1
10=2		10=2	10=8			10=0	10=4		
			11=7			11=0	11=0		
			12=1			12=1	12=1		
			13=2						
			14 - 17=0						
			18=1						

Low food variety – 0-3 food groups or < 30 individual foods
Medium food variety – 4-5 food groups or 30-60 individual foods
High food variety – 6-9 food groups or >60 individual foods

A summary of the food variety within the food groups is presented in table 4.20, representative of the pregnant women with a mean of 31.02 (SD11.029) different foods within the nine food groups consumed in a seven-day period and indicating a medium food variety score (FVS). Furthermore, the cereal group reported the highest individual mean FVS

(±SD) of 6.60 (±3.000), followed by the vegetable group 4.56 (±2.217) and the meat group with a mean of 4.51 (±2.011).

Table 4.20: Mean, standard deviations and the range of scores for the 9 food groups (n=100)

Food group	Mean	Standard deviation	Range of scores
Meat group	4.51	2.011	0-10
Egg group	1.0	.000	0-1
Dairy group	3.84	2.235	0-10
Cereal group	6.60	3.000	0-18
Legume and nut group	1.98	1.283	0-6
Vitamin A rich group	3.97	1.790	0-8
Other fruit group	4.30	1.956	0-12
Vegetable group	4.56	2.217	0-12
Fats and oil group	2.53	1.139	0-5
Total food items	31.02	11.029	6-62

Low food variety – 0-3 groups or < 30 individual foods
Medium food variety – 4-5 groups or 30-60 individual foods
High food variety – 6-9 food groups or >60 individual foods

In table 4.21, the food group diversity is summarised as the majority of participants (95%; n=94) could be classified with a high food group diversity score, as 6-9 food groups were consumed during the seven-day period, and furthermore, 52% (n=520) of participants consumed all nine nutritious food groups within the seven-day data collection period.

Table 4.21: Summary of food group diversity (n=100)

Number of food groups consumed	Frequency	Percentage
1-2	0	0.0
3	2	2.0
4	1	1.0
5	3	3.0
6	6	6.0
7	6	6.0
8	30	30.0
9	52	52.0

Low food variety – 0-3 groups
Medium food variety – 4-5 groups
High food variety – 6-9 food groups

4.5 Dietary Intake and Top 20 Foods Consumed

In table 4.22, the mean of two 24-hour recall nutrient analyses indicates that the majority of participants did not meet the recommended DRIs for several macro- and micronutrients. The mean EER for energy of 5772.72kJ was not met by 95% of the participants as compared to the recommended EER of 10 093kJ for pregnant women. In addition, 84% of the participants consumed <100% percent of the RDA for protein with a mean intake of 50.44g compared to the recommended RDA of 71g per day. It is important to note that the recommended EAR for carbohydrates was met by the majority of participants with a mean consumption of 191.82g (SD±68.718) per day compared to the recommended 135g. Furthermore, the total dietary fibre intake was also notably much lower than the recommended AI of 28g per day, with a mean intake of only 15.05g consumed per day by participants.

The mean intake of calcium was almost three times lower than the recommended AI with only 308.86mg (SD±235.238) consumed per day rather than the 1000mg recommended for pregnant women, resulting in 98% of participants not meeting the AI.

It is important to note that more than 50% of participants did not meet the EAR for the following nutrients: selenium (91%) with an intake of 22.06µg (SD±16.422), iodine (99%) with an intake of 31.12µg (SD±22.081), riboflavin (61%) with an intake of 0.99mg (SD±0.892), folate (74%) with an intake of 270µg (SD±129.383), vitamin C (72%) with an intake of 64.64mg (SD±84.274) and vitamin E (86%) with an intake of 7.52mg (SD±5.500). Additionally, participants did not meet the AI for both pantothenic acid (66%) and biotin (75%) with intakes of 4.37mg (SD±2.564) and 25.22µg (SD±13.365) respectively. Other micronutrient intakes that did not meet the recommended EARs included iron (25%) with an intake of 10.70mg (SD±4.175) consumed, zinc (32%) with an intake of 9.02mg (SD±4.377) consumed, thiamine (40%) 1.03mg (SD±0.408), vitamin B12 (48%) 5.71µg (SD±14.782) as well as the AI for vitamin D (20%) with a mean intake of 3.02µg (SD±3.156) consumed. Furthermore, the RDA for magnesium was also not met by participants (96%) as evidenced by a mean intake of 170.53mg (SD±57.698) being consumed as opposed to the recommended RDA of 350mg per day.

Several micronutrients did, however, meet the recommended EARs which included phosphorous with an intake of 696.93mg (SD±256.579), vitamin A with an intake of

643.53µg (SD±1450.346), niacin with an intake of 18.19mg (SD±8.539), vitamin B6 with an intake of 2.95mg (SD±1.661) and carbohydrates with a mean intake of 191.82g (SD±68.718). Furthermore, the recommended AI for vitamin K was also met by participants with a mean intake of 100.61µg (SD±198.269) compared to the recommended AI of 90µg per day.

Table 4.22: Dietary Intake Nutrient Analysis measured using the average of two 24-Hour Recall Questionnaires (n=100)

Nutrients p/day	Unit of measure	Mean ±SD	Mean % of the DRIs	% women consuming <100% of DRIs	DRI's
Energy	kJ	5772.72±2057.882	58.04	95.00	10 093 EER
Total protein	g	50.44±20.441	71.04	84.00	71 RDA
Total fat	g	37.81±19.762			
Carbohydrates	g	191.82±68.718	142.09	16.00	135 EAR
Total dietary fibre	g	15.05±6.225	53.74	98.00	28 AI
Calcium	mg	308.86±235.238	30.81	98.00	1000 AI
Iron	mg	10.70±4.175	48.65	98.00	22 EAR
Magnesium	mg	170.53±57.698	58.80	96.00	290 EAR
Phosphorus	mg	693.63±256.579	119.55	38.00	580 EAR
Zinc	mg	9.02±4.377	94.98	32.00	9.5 EAR
Selenium	µg	22.06±16.422	45.01	91.00	49 EAR
Vitamin A	µg	643.53±1450.346	117.01	79.00	550 EAR
Thiamine	mg	1.03±0.408	85.47	40.00	1.2 EAR
Riboflavin	mg	0.99±0.892	82.78	61.00	1.2 EAR
Niacin	mg	18.19±8.539	129.89	18.00	14 EAR
Vitamin B6	mg	2.95±1.661	184.13	14.00	1.6 EAR
Folate	µg	270.83±129.383	52.08	74.00	520 EAR
Vitamin B12	µg	5.71±14.782	259.70	48.00	2.2 EAR
Pantothenic acid	mg	4.37±2.564	72.82	66.00	6.0 AI
Biotin	µg	25.22±13.365	84.06	75.00	30 AI
Vitamin C	mg	64.64±84.274	107.74	72.00	70 EAR
Vitamin D	µg	3.02±3.156	60.39	20.00	5.0 AI
Vitamin E	mg	7.52±5.500	62.65	86.00	12 EAR
Vitamin K	µg	100.61±198.269	111.79	80.00	90 AI

EER: Estimated Energy Requirements (Institutes of Medicine, 2003)
EAR: Estimated average requirements
AI: (Adequate Intake) used where EAR (Estimated Average Requirement) is not available
RDA (Recommended Dietary Allowance)

As seen in table 4.23, the results of the Acceptable Macronutrient Distribution Range (AMDRs) from the two 24-hour recalls, compared against the WHO dietary goals (2003),

indicates that the mean carbohydrate and fibre (60.92%) contribution to energy intake for pregnant women is within the range of 55-75%. In addition, the mean protein (14.85%) and fat (24.24%) contribution to energy was also within the range of 10-15% and 15-30% respectively.

Table 4.23: AMDRs of macronutrients from the average of two 24-Hour recalls (n=100)

Macronutrients	Mean % Energy contribution Women (n=100)	AMDR WHO Goal
Total fat (g)	24.24	15-30 %
Protein (g)	14.85	10-15 %
Carbohydrate and fibre (g)	60.92	55-75 %

As described in table 4.24, the per capita intake of the fruit and vegetable intake of 165.73g per day was significantly lower than the WHO goal of ≥400g. Furthermore, the mean intake of 12.55g dietary fibre per day was less than half of the recommended amount of 25g per day for pregnant women. Moreover, having a fruit and vegetable intake considerably lower than the recommended goal increases the risk of the foetus developing micronutrient deficiencies, and this in turn can be detrimental to the development of the child later on in life.

Table 4.24: Comparison of fruit and Vegetables g/day per capita intake with WHO (2003: 3).

Dietary factor	Mean ± SD	Per capita intake for 1 day (g) (n=100)	WHO Goal (g) per day
Fruit and vegetables (g)	108.67±64.509	165.73	≥400g

Table 4.25 indicates the top 20 most popular food items consumed and the average daily intake of the sample population who consumed these foods over one weekday and one weekend day included in the 24-hour recall. As stated in table 4.25, the top five foods consumed over a period of two days included bread/rolls (168 times) with a per capita intake of 133.14g and a mean intake for one day being 10 314g across the participants. Rice was ranked second with a per capita intake of 100.13g and maize meal was ranked third with a per capita intake of 117.91g.

Protein appeared for the first time at number four in the form of chicken with a frequency of 38 times over one day and a per capita intake of 49.88g. Although protein appeared fourth on

the top 20 food list, the per capita intake indicates that protein is consumed only in small amounts by the pregnant women, therefore putting the participants at risk of not consuming the recommended daily requirements needed for sufficient growth and development of the foetus. In addition, eggs, beef curry and polony ranked at 13th, 14th and 17th respectively; however, the per capita intake was only 15.68g, 17.88g and 2.63g among participants. Furthermore, meat-based products such as polony contain high amounts of salt and saturated fat which can be harmful to the mother by increasing the risk of hypertension and other diet-related diseases.

Cold drink such as squash appeared fifth on the top 20 foods list with a per capita intake of 116.15g and a frequency of 38 per one day. Such drinks are known to contain high amounts of sugar, and together with carbonated drinks, which ranked 12th on the top 20 list with a frequency of 19, the sugar content of the diet of the participants could be amplified greatly, therefore, increasing the risk of a high pregnancy weight gain in the mother.

Milk was ranked 7th on the top 20 foods list and was the only dairy product consumed by the participants with a frequency of 72 times and a per capita intake of 61.10g. The only fresh fruits consumed were apple, banana and orange ranking 8th, 9th and 19th respectively and with frequencies of 32 and 30 and 10. Fruit juice consumed by participants and was ranked 16th; however, fruit juice contains high amounts of sugar and not as much fibre as fresh fruit; therefore, many participants would not have received adequate amounts of vitamins and minerals due to the low frequencies consumed. Furthermore, vegetables were not among the top 10 consumed foods with cooked cabbage (15th) with 14.40g consumed per capita intake and vegetable curry (18th) with 5.73g consumed per capita intake being the only vegetables consumed over a two-day period.

It is evident that the majority of participants consumed foods that are carbohydrate-based on a frequent basis as well as foods that are high in sugars and saturated fats therefore, further concluding that the diet of the pregnant women was not nutrient-rich and did not contain adequate diversity.

Table 4.25: Top 20 food items ranked by the mean intake portion size by the number of participants as measured by two 24-Hour Recalls (n=100).

No.	Food item	Total intake over 2 days (g)	Mean intake for 1 day (g)	Frequency (1 day)	Portion size per frequency (g)	Per capita intake (g)
1	Bread/Rolls	20 628	10 314	84	122.79	103.14
2	Rice	20 025	10 012.5	73	138.10	100.13
3	Maize meal	23 580	11 790	66	178.64	117.90
4	Chicken	9 975	4987.5	38	133.00	49.88
5	Cold drink, squash	23230	11615	38	309.73	116.15
6	Tea, brewed	18335	9167.5	37	247.77	91.68
7	Milk	12220	6110	36	169.72	61.10
8	Apple	10000	5000	32	156.25	50.00
9	Banana	5505	2752.5	30	91.75	27.53
10	Sugar	755.5	377.75	22	17.57	3.78
11	Margarine	485	242.5	20	12.13	2.43
12	Cold drink, carbonated	14300	7150	19	386.49	71.50
13	Egg, fried in sunflower oil	3135	1567.5	18	89.57	15.68
14	Beef curry, stew	3575	1787.5	15	123.28	17.88
15	Cabbage, cooked	2880	1440	14	102.86	14.40
16	Fruit juice	9250	4625	14	330.36	46.25
17	Polony	525	262.5	14	19.44	2.63
18	Vegetable curry	1145	572.5	13	45.80	5.73
19	Orange	3180	1590	10	159.00	15.90
20	Soup powder, prepared with water	495	247.5	10	24.75	2.48

Figures 4.6 and 4.7 illustrates the relationship between the food group diversity score (FGDS) and Nutrient Adequacy Ratios (NARs) of energy, protein, selected minerals and vitamins. The NARs were calculated by working out the percentage of the average intake in relation to DRIs. In figure 4.6, the NAR for all the nutrients increased only slightly as the FGDS increased. For iron and zinc specifically, the NAR increased above 100% as the FGDS score increased from three to four food groups. However, the NAR for protein, calcium and energy increased only slightly as the FGDS increased but remained below 100%.

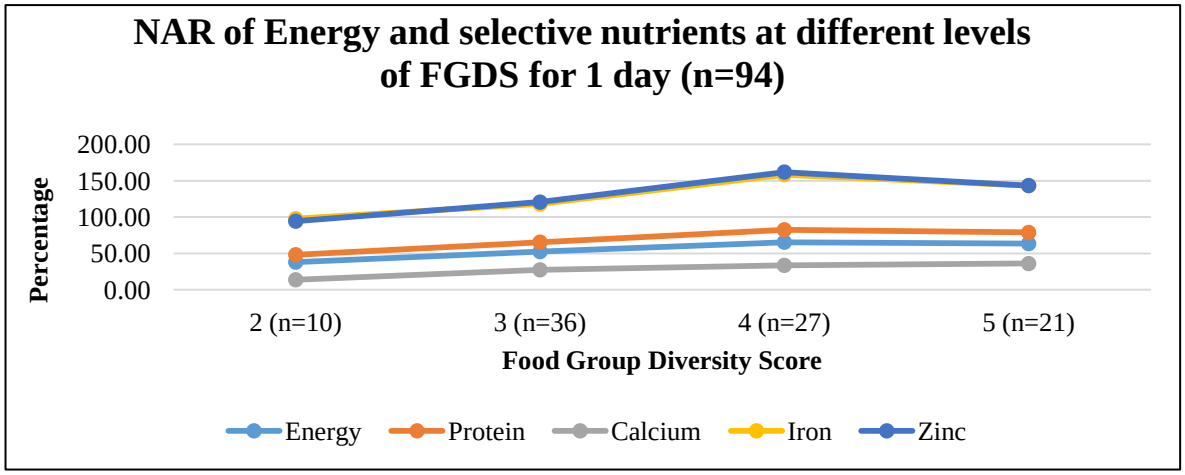


Figure 4.6: Mean Nutrient Adequacy Ratio (NAR) expressed as (%) of Energy and Nutrients at different levels of the Food Group Diversity Score (FGDS).

According to figure 4.7, the NAR for vitamin B6 showed a consistent increase as the FGDS increased; however, vitamin A did increase to above 100% from food group four but declined quickly from food group five onwards. Riboflavin showed an increase above 100% from food group four onwards but the NAR for folate and vitamin C displayed very little increase as the food group score increased.

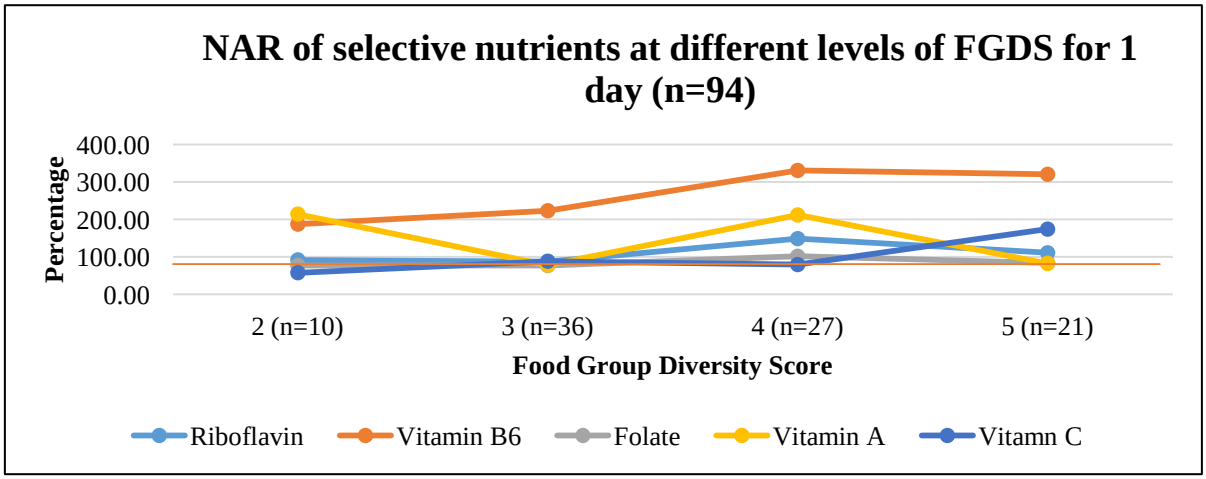


Figure 4.7: Mean Nutrient Adequacy Ratio (NAR) of selected vitamins at different levels of the Food Group Diversity Score (FGDS)

4.5 Correlations

The correlations were carried out using the ANOVA statistical test program which is designed to determine whether a statistical significance occurs among various sample means. When testing the statistical significance of a sample, the *p*-value must reflect less than 0.05 otherwise it can be concluded that there is no statistical significance between two samples. The researcher decided to compare the nutrient intake of the various BMI cut-off points of the groups as well as the difference in variables between the food secure and food insecure groups.

According to table 4.26, the BMI group for underweight (<18.5), normal range (18.5-24.9), overweight (25-29.9), obese class 1 (30-34.9), obese class 2 (35-39.9) and morbidly obese (40+) all consumed over 100% NAR of the daily recommended intake of 135g for carbohydrates. The group who consumed the highest mean amount of carbohydrates were those who had a BMI of 35-39.99 with a mean consumption of 213.89g, whereas the BMI group of 25-29.99 consumed the lowest mean amount of 188.12g although both groups still consumed above the recommended EAR of 135g per day. The BMI group that consumed the least mean amount of fibre was the 18.5-24.99 group with 13.71g which was less than half the recommended AI for fibre of 28g. The 40+ BMI group consumed the highest mean fibre amount of 18.46g; however, this group together with all the BMI groups, did not meet the recommended AI for fibre and consumed less than 100 percent NAR. Participants that fell within the BMI groups 40+, 35-39.99, 25-29.99 and 18.5-24.99 all consumed over 100 percent NAR for both vitamin A and vitamin B6 and the <15.5, 40+ and 35-39.99 groups also consumed over 100 percent NAR for zinc.

Unfortunately, no participants from any of the BMI groups consumed the 100 percent recommended AI for calcium; this is an alarming result due to the fact that calcium is a vital micronutrient for the proper development and growth of the bones and teeth of the foetus. The least amount of calcium consumed from food sources was by the 40+ BMI group with only 205.99mg consumed compared to the recommended AI of 1000mg, whereas the highest calcium intake from food sources was by the <18.5 group with 557.54mg; however, this is still a significantly low amount compared to the recommended AI.

None of the BMI groups met the recommended EAR of two of the most important micronutrients for pregnant women to consume for the proper development of the foetus: iron and folate. The highest mean intake of iron was 12.77mg by the 40+ BMI groups; however, this is still significantly lower than the recommended 22mg, contributing only 58.08% of the total NAR. In addition, the 25-29.99 BMI group consumed the least amount of calcium with a mean intake of 10.24mg, contributing only 46.57% of the NAR. Furthermore, although no participants met the recommended intake of folate, the highest intake was also consumed by the 40+ group with a mean intake of 368.14µg, contributing 70.80% of the NAR and the least mean amount consumed was 254.31µg which was almost half of the recommended 520µg.

4.5.1 Nutrient adequacy vs. BMI

Table 4.26 Nutrient adequacy compared to BMI cut-off points

Nutrients DRIs	**BMI**																	
	<18.5 (n=2)			**18.5-24.99 (n=40)**			**25-29.99 (n=28)**			**30-34.99 (n=20)**			**35-39.99 (n=7)**			**40+ (n=3)**			
	Mean	±SD	NAR %	Mean	±SD	NAR %	Mean	±SD	NAR %	Mean	±SD	NAR %	Mean	±SD	NAR %	Mean	±SD	NAR %	EAR/AI
CHO (g)	195.95	4.39	145.14	187.70	62.26	139.04	188.12	80.44	139.35	197.48	73.63	146.29	213.89	72.61	158.43	189.20	29.89	140.15	135g EAR
Fibre (g)	16.71	8.174	59.68	13.71	4.70	48.96	14.24	7.36	50.84	17.13	6.01	61.19	18.06	8.42	64.51	18.46	4.98	65.94	28g AI
Calcium (Mg)	557.54	29.51	55.75	324.51	284.88	32.45	283.36	215.15	28.34	305.58	176.86	30.55	292.39	208.41	29.23	205.99	105.12	20.60	1000Mg AI
Iron (Mg)	10.51	4.60	47.48	10.71	4.551	48.67	10.24	3.65	46.57	10.58	3.87	48.13	11.99	5.64	54.54	12.77	3.97	58.08	22Mg EAR
Magnesium (Mg)	212.64	43.79	73.32	168.77	52.12	58.20	159.39	67.53	54.96	183.48	52.31	63.27	178.10	73.40	61.41	166.06	40.55	57.26	290Mg EAR
Zinc (Mg)	11.79	5.36	124.11	9.29	5.052	97.83	8.30	3.44	87.34	8.45	3.47	88.97	9.65	5.53	101.65	12.66	5.39	133.35	9.5Mg EAR
Vitamin A (µg)	301.10	69.86	54.75	556.56	1400.13	101.19	592.04	911.89	107.64	385.54	198.90	70.10	1690.49	3708.53	307.36	1788.91	2501.35	325.26	550µg EAR
Vitamin B6 (Mg)	3.28	1.72	205.00	3.15	1.85	196.81	2.63	1.27	164.58	2.75	1.45	172.14	3.02	2.28	189.20	4.02	2.51	251.77	1.6Mg EAR
Folate (µg)	292.97	169.33	56.34	254.31	128.92	48.91	255.61	119.45	49.16	278.33	112.76	53.53	356.59	201.00	68.58	368.14	76.63	70.80	520µg EAR

4.5.1 Selective variables per food security status of the women (n=95)

According to table 4.27, no statistical significance was found between participants who were considered food insecure and those who were food secure with regards to age, weight and BMI. A slight difference was found when comparing the systolic blood pressure of the two groups as food insecure participants had a mean (SD) systolic blood pressure of 111.39mm Hg ±13.460 compared to the mean (SD) of 114.37mm Hg ±18.679 of the food secure group. In addition, little difference was found when comparing the diastolic blood pressure of the two groups. Surprisingly, the mean (SD) energy intake of the food insecure group was higher than the food secure group with a mean intake of 5864.78kJ ±2404.91 for the food insecure group compared to the mean intake of 5786.74kJ ±1927.561 for the food secure group. However, although the food insecure group had a higher mean energy intake, the food variety score of this group over the course of seven days was significantly lower with a mean (SD) of 28.52 ±10.745 compared to the mean (SD) of 31.69 ±11.204 of the food secure group.

Generally speaking, people who have access to a greater food variety typically do not suffer from food insecurity, as consuming a diet high in energy does not compare to consuming several items within different food groups and in varying amounts (Peltzer and Phaswana-Mafuya, 2012: 3). Furthermore, the slight difference in the mean (SD) number of people in the household could have contributed to food security of the household as more people would be able to contribute financially and therefore contribute to the purchasing of food.

Table 4.27 Statistical differences between the food secure and food insecure groups

Variables	**Food insecure (n=33)**	**Food secure (n=62)**
Mean age	26.48 ±6.042	25.61 ±6.395
Mean weight	64.78 ±12.196	68.26 ±15.249
Mean BMI	26.90 ±5.225	27.66 ±15.902
Mean systolic blood pressure	111.39 ±13.460	114.37 ±18.679
Mean diastolic blood pressure	66.55 ±10.538	66.90 ±12.576
Mean energy intake	5864.78 ±2404.909	5786.74 ±1927.561
Mean FVS over 7 days	28.52 ±10.745	31.69 ±11.204
Mean number of people in the household (range)	2.78 (1-9)	3.09 (1-9)

4.6 Discussion

The wealth of data collected in this research demonstrates the nutritional status and dietary intake patterns of pregnant women in the first trimester attending an antenatal clinic in KwaZulu-Natal and residing in the municipal area of Cato Manor, Durban.

A socio-demographic questionnaire was used to collect information relating to the participants' general living conditions, income and education status as well as access to basic resources which all play a role in the nutritional status of the participants. This revealed that the majority of participants had adequate living conditions, residing in brick houses in a rural area and with access to gravel roads. However, a lack of running water inside the household indicates that housing conditions were not satisfactory among 39% of the participants and therefore participants were forced to use an outside tap or travel some distance to obtain fresh, clean water. However, according to Stats SA (2015: 4), the number of households with access to running water has increased to 89.4% from 75% in 2011. Furthermore, in a recent study by Hunter, Macdonald and Carter (2010: 4), inadequate water supply still affects thousands of South Africans and therefore contributes to the increased risk of disease and illness caused by unclean and unsafe water, thus increasing the risk of neonatal mortality in many cases. However, according to Stats SA (2016: 64) community survey 2016, 74.17% of South African households had access to water either in or outside the house.

Twenty-six percent of participants were required to use a pit latrine as the main form of sewerage and were therefore more exposed to diseases related to poor sanitation. In addition, Padhi, Baker, Dutta, Cumming, Freeman, Satpathy, Das and Panigrahi (2015: 1) stated that pregnant women residing in Sub-Saharan countries are more likely to have to practise open defecation and are more exposed to disease and illness associated with inadequate hygiene practices. However, the results published in the Community Survey 2016 by Stats SA (2016: 64) stated that in 2016, 80% of households in South Africa did have adequate sanitation and that 61% of South Africans have access to refuse removal services at least once a week: this indicates an increase of 5.6% from the previous 55.4%. The 2016 National Education Infrastructure Management System Standard Report also states that girls of child bearing age attending schools in South Africa are

forced to use pit latrines as 9023 schools in South Africa have no adequate sanitation or appropriate ablutions (Department of Education 2016: 3). Furthermore, Stats SA (2015: 4) states that 80% of the population had adequate access to proper sanitation ─ a much-improved increase from 62.3% in 2002; however, this statistic is higher than the 70% of participants in this study who did not have access to adequate sewerage/sanitation facilities.

In addition, Stats SA (2015: 5) states that a high percentage of pests present in the community could be the result of inadequate waste removal and lack of proper sanitation as only 63.5% of households in South Africa receive a waste removal service at least once a week, which correlates with the access the participants had to waste removal. Some of the biggest problems with pests were mice/rats (54%), mosquitoes (41%) and cockroaches (39%). In addition, other problems with pests included ants, fleas, frogs, snakes and bed bugs. Furthermore, Amnesty International states that adolescent girls and women living in Sub-Saharan Africa are still some of the most disadvantaged groups when it comes to living conditions and poor sanitation. This, in turn, increases the infant mortality rates significantly as of 2015, 1.4 million people died due to poor sanitation and diseases related to unsanitary living conditions and disease-carrying pests (WHO 2015: 1). Therefore, the participants in the study received adequate sanitation when compared to other areas of the country as the majority of the participants had access to adequate waste removal as well as having running water inside their houses.

Problems such as poor sanitation as well as living with various pests in the household pose a risk for pregnant women due to an increased exposure to diseases associated with pests, and resulting in an increased risk of sickness which does not only affect the health of the mother adversely but that of the foetus as well as stated by Scorgie *et al* (2015: 37). In addition, according to Care (2014: 80), 39% of black South Africans were more likely to live in informal areas with high exposure to poor sanitation and pest-related diseases than any other race. In addition, littering and a lack of waste removal services continue to be two of the biggest problems faced by informal dwellers in rural communities (Stats SA 2015: 4). Furthermore, pregnant women living in unhealthy environments are susceptible to an increased negative effect on both their health and

wellbeing and that of the foetus and this greatly increases the risk of neonatal mortality by a large margin (Hunter, MacDonald and Carter 2010: 11).

Another main finding revealed in this study was the poor socio-economic status of the pregnant women and the high prevalence of poverty and poor living conditions experienced by the participants. This was evident from the 48% of participants who resided in squatter camps and 38% of participants who resided in townships. As per Wilkinson (2014: 1), as found in the 1996 national census in South Africa, 16% (1.4 million) of the population living in households resided in shacks, or informal settlements; however, as of 2011, that figure increased to 1.9 million South Africans living in shacks, or informal settlements. Scorgie *et al* (2015: 2) further suggests that pregnant women living in poverty and with poor external surroundings are more likely to suffer from the negative impacts of their environments including increased risk of malnutrition as well as poor nutritional status and deficiencies experienced by the foetus. In addition, a high unemployment rate with 65% of the participants having a total monthly income of <R1500 (67%) indicated that the majority of participants lived in poverty with no potential job prospects to supplement their income as it was found that many participants were not actively seeking employment at the time of the study and furthermore, it confirms the MPI result of 15.35, providing a further indication that the participants of this study were living in poverty but still had access to a proper sewerage system and running water. In addition, Tomlinson, O'Connor, Le Roux, Stewart, Mbewu, Harwood, and Rotheram-Borus, (2014: 5) stated that women living in low income areas or who receive little to no income per month, have poor access to adequate and accessible health care and therefore are more at risk of having an adverse birth outcome at childbirth. Although the income levels of the participants were generally low, many owned a variety of household assets including an electric stove (77%), microwave oven (42%), television (76%), refrigerator (54%) and a bed with a mattress (82%) while only 13% owned a car. In addition, these figures are in line with the 2015 General Household Survey as 74.9% of rural households owned electric stoves, 69.8% a television, 57.7% a refrigerator and 13.9% a vehicle.

Furthermore, many participants (49%) had achieved a matric level education whereas 4% had not received any level of formal education. In a study conducted in KwaZulu-

Natal in 2011, 60% of pregnant women were considered uneducated and in 2015, only 28% of women over the age of 20 had obtained a matric education (Stats SA 2015: 2). Therefore, although education levels seem to have increased since 2011, the lack of education among women of child-bearing age can contribute significantly to poor nutrition and health as only 52% were aware of any "dangers" associated with pregnancy (Hoque and Hoque 2011: 947).

Overall, the mother of the household featured as the primary caregiver and was responsible for food decisions, food preparation as well as how much money was spent on food. These decisions could impact what food was consumed and how food was prepared in the household, which in turn could contribute to the nutritional status of the participants. Although the majority of the participants had enough money to purchase food, 25% of the participants sometimes did not have enough money for food and often only ate a meal twice a day. All the participants had sufficient cooking equipment including a stove and used electricity as the main source of power but in some cases gas and paraffin was used. Scorgie, Blaauw, Dooms, Coovadia, Black and Chersich (2015: 5) further concluded in a study done on the living conditions and food availability of pregnant women in South Africa, that the majority of pregnant women living in informal sectors were unemployed and admitted to having insufficient food in the household due to income constraints. This poses a great risk to pregnant women as the ability to meet necessary dietary requirements for pregnancy is not guaranteed and increases the risk of a poor birth outcome for the foetus. Furthermore, the rate of child-headed homes in South Africa has increased significantly with many teenage mothers acting as the primary caregiver of the household as it has been shown that 13% of mothers in South Africa are teenagers and are responsible for many facets of running the household (Hoque and Hoque, 2011; 948). However, this statistic did not correlate with the participants of this study as the mean age of the women was 26 years old.

With regard to the overall nutritional status of the participants, it was found that most participants (40%) had a normal BMI of between 18.5 and 24.5, 28% were overweight, 27% were obese, 3% were morbidly obese and only 2% were considered underweight. However, these results contradict a 2013 study done in Durban, KwaZulu-Natal by Devananthan *et al* (2013: 6) which showed that the majority of women in the child-

bearing age bracket were considered either overweight or obese. Furthermore, a study by Cois and Day (2015: 42) also stated that the prevalence of overweight and obesity tends to be higher in South African women, particularly between the ages of 25 and 40+ than in men. In addition, according to a study done on the prevalence of obesity in African countries, the incidence of obesity among pregnant women ranges from 6.5% to 51% with the figure still growing among women of children-bearing age. Such statistics pose a great risk to mothers, particularly during childbirth and considerably increase the prevalence of obesity in the child later on in life (Onubi, Marais, Aucott, Okonufa and Poobalan 2015: 218-129). In another study conducted in Gauteng in 2010 on the prevalence of obesity and its effect on pregnant women, 44% of pregnant women were considered obese or morbidly obese and presented with increased complications during pregnancy and labour (Basu, Jeketera and Basu, 2010: 101). Furthermore, a study by Ngoga, Hall, Mattheyse and Grové (2009: 5) suggests that women who are morbidly obese throughout pregnancy experience one or more complications including at least one miscarriage as well as diabetes, urinary tract infection and high blood pressure. Although some participants were classified as underweight in the study, underweight in pregnancy is not as often observed in Africa as overweight and obesity; however, Lartey (2008: 105) states that up to 20% of pregnant women in South Africa suffer from malnutrition and a low BMI due to poverty and lack of food availability.

Although the majority of participants had normal systolic and diastolic blood pressure, 10% suffered from hypertension and according to Sliwa *et al* (2014: 515), 30.4% of the total South African population and 41.4% of women of child-bearing age suffer from hypertension and associated complications. Furthermore, a study conducted in Johannesburg on maternal and foetal outcomes due to pre-eclampsia showed that 34% of women with pre-eclampsia suffered from maternal complications, with 2% of the complications resulting in death (Tomlinson *et al* 2014: 277).

The mean energy intake of the participants in the current study was 5772.72kJ ─ an inadequate consumption compared to the recommended EER of 10 093kJ for pregnant women; however, all participants exceeded the recommended EAR for carbohydrates of 135g by consuming a mean intake of 191g. Similarly, according to a study conducted on the nutritional status of pregnant women in Cape Town, the majority of the

participants did not meet the recommended intake for energy but did, however, meet the EAR for carbohydrates and exceeded the recommended fat intake (De Bruyn 2015: 119). Furthermore, the carbohydrate and fat consumption of 60.92% and 24.24% of the total energy intake as measured by the two 24-hour recalls fell within the levels of 55-75% and 15-30% respectively as recommended by the World Health Organization. This was further reflected in the top 20 food list as bread, rice and maize meal were the top three foods consumed and foods high in saturated fat and sugar were consumed including polony, carbonated drinks and margarine. The foods high in fat and carbohydrates ranked high in the top 20 food list and thus indicated that the diets of the pregnant women are energy-dense. This further correlates with a study conducted on the diets of pregnant women in Cape Town, which concluded that many South African women consume energy-dense foods that are high in saturated fats and consume high amounts of junk, or fast, foods (Hunter-Adams and Rother 2016: 405).

The overall fruit and vegetable consumption of the pregnant women was generally quite poor, as the per capita of 109g per day was significantly lower than the WHO recommended intake of ≥400g (WHO 2003: 3). This was further seen in the lack of fruit and vegetable sources found in the top 20 food list, as fruit was only seen at 7th, 8th and 19th positions on the list; however, a combined FVS of 8.37 for fruit showed a high food variety was consumed within the fruit group. In addition, vegetables were only seen in 15th position in the form of cooked cabbage and in 18th position in vegetable curry but had a mean FVS of 4.56, indicating a medium food variety was consumed within the vegetable group. Furthermore, it is evident that the vegetable sources consumed by the participants were not sufficient in relation to the various micronutrients required by pregnant women, which can only be obtained through the intake of a diverse selection of fruit and vegetables. In addition, in a study conducted in Cape Town, women with lower levels of education were seen to consume fewer fruit and vegetables and this could correlate with the low education levels of the participants of this study as not even 50% of the participants achieved a matric education (Pereira 2014: 142). Moreover, Peltzer and Phaswana-Mafuya (2012: 3) state that the prevalence of insufficient fruit and vegetable intake among South African women is 71.4% ─ which is a higher prevalence compared to men who had an insufficient fruit and vegetable intake of 64.8%. The low fruit and vegetable intake of the participants is cause for concern as it further reflects the poor nutritional status of the pregnant women due to 98% of the

women not meeting the DRI for dietary fibre, which is not only obtained through carbohydrate-based foods but also through fresh fruit and vegetables, and this was being due to the majority of participants not meeting the recommended micronutrient DRI's. In addition, the low fruit and vegetable intake by participants further resulted in a low nutrient adequacy of vitamin A, vitamin C, riboflavin and folate in comparison to the DRI's as recommended by the World Health Organization.

The participants in the current study consumed a mean total of 31.02 food items over a period of seven days with a range of scores between 6 and 62 items for the group, thus indicating that a medium to high food variety was consumed. Furthermore, the most consumed food group was carbohydrate-based foods with a mean of 6.60 food items and the least consumed food groups by participants were the legume and nut groups as well as eggs. Similarly, according to a study done among pregnant women in South Africa, a mean dietary diversity score of 6.70 ± 2.22 was recorded by pregnant women mainly living in rural communities (Kiboi, Kimiywe and Chege 2017: 5). Furthermore, in the same study, the cereal group was also the most consumed food group. However, as stated by Labadarios, Steyn, and Nel (2011: 233), very few recent studies have been done to identify the dietary diversity of pregnant women and other vulnerable groups in South Africa. In addition, although the other vegetable group and the other fruit group ranked second highest with a mean FVS (±SD) of 4.56±2.217 and 4.30±1.956 respectively, many of the micronutrient intakes were insufficient. The FGDS indicated that the majority of participants consumed a high food variety of six to nine food groups; however, this was not reflected in the FVS and furthermore, did not indicate that a satisfactory and nutritious diet was consumed as both a good FVS and FGDS are needed to ensure dietary adequacy. In terms of the top 20 foods consumed, bread rolls, rice and maize were the top three food items consumed by the pregnant women. In addition, meat and eggs only appeared three times among the top 20 foods consumed and milk and dairy products only appeared once among the top 20 foods consumed by participants, suggesting that both protein and calcium were not adequately supplied through the diet of the participants. Kiboi *et al* (2017: 5) also state that the diet of pregnant women in South Africa consists predominantly of cereal-based items, much like the results detailed above. In addition, a study conducted in Cape Town further reinforced these results as many women in South Africa do not feel they consume

adequate amounts of protein either through meat or plant-based sources and as a result, suffer from low iron and anaemia (Hunter-Adams 2016: 403).

Furthermore, in another study conducted on the dietary intake and nutritional status of adolescent girls and young women in Durban, starchy foods were the most consumed food group with meat and dairy products ranking 3rd and 4th respectively, thus indicating that 42.3% and 59.9% of girls and women respectively did not meet 100% of the iron EAR (Napier and Oldewage-Theron 2015: 5). Moreover, a regional study conducted on the prevalence of anaemia in South African pregnant women showed that 42.7% were considered anaemic and 0.6% were severely anaemic (Tunkyi and Moodley 2016: 101), thus further indicating that iron consumption in women of child-bearing age in South Africa is severely low and is resulting in higher cases of anaemia, putting both the mother and foetus at risk of several health complications.

In addition, De Bruyn (2015: 111) states that in a study conducted on the adequacy of diets of pregnant women in Cape Town, South Africa, 80% of participants did not meet the recommended dietary intake for energy and protein, and various micronutrients such as vitamin A, D and E as well as folate, calcium and riboflavin all fell below the recommended DRIs for micronutrients. In addition, a study in rural communities in KwaZulu-Natal also suggested that the DRIs for several micronutrients including calcium, zinc and vitamin A, C, D, E, and B12 were not met by South African women (Kolahdooz, Spearing and Sharma 2013: 10).

Inadequate diets and insufficient access to nutritious food for pregnant women increases the risk of the development of micronutrient diseases as well as further increasing the prevalence of adverse outcomes (Kolahdooz, Spearing and Sharma 2013: 10). In addition, the lack of food security can encourage individuals to purchase items from tuck shops and fast food establishments due to lack of money to purchase a variety of food items. Furthermore, women who had a normal BMI of between 18.5 and 24.9 constituted the majority of those who had a normal blood pressure of 120/80mm Hg and were therefore considered to be generally healthier than participants who had a high BMI and blood pressure reading.

4.7 Conclusion

This chapter presents the results of the study conducted with pregnant women attending an antenatal clinic in KwaZulu-Natal. The results indicated several nutrition deficiencies faced by the women of child-bearing age based on the daily food intake as well as through the use of anthropometric measurements.

Based on the socio-demographic results from this study, the participants generally had good living conditions as the majority of participants lived in houses made from brick and had access to electricity and running water. There was very seldom any shortage of money to purchase food, although most participants were unemployed and earned less than R1500 per month. In addition, the majority of the food-related decisions including preparation and amount of money spent on food were made by the mother of the household or the participants themselves.

Overall, the participants reported to consume a diverse diet, as both the food group diversity score and food variety score proved positive with medium-high food varieties being consumed. However, participants did not meet the recommended intakes for several macro- and micronutrients including protein, fibre, calcium, iron, magnesium, zinc, folate, vitamin E, vitamin D, vitamin B6 and selenium. Furthermore, the top three foods consumed were carbohydrate based according to the top 20 food list, with the remaining foods consumed being high in sugar and some high in saturated fat.
Finally, the nutritional status of participants proved adequate as most participants had a normal BMI and blood pressure, although some participants were considered obese or overweight and suffered from mild to high blood pressure.

Chapter 5 – Main findings and Recommendations

5.1 Introduction

The previous chapter presented and discussed the results obtained through data collection with reference to Chapter two. The findings were discussed in order to identify objectives needed to formulate practical and nutrition-focused recommendations needed to promote the improvement of the nutritional status of pregnant women in South Africa. As malnutrition in pregnancy is still considered a crisis in Africa and in South Africa specifically, interventions need to be put in place to ensure pregnant women have access to safe, clean and nutritious food in order to nourish the foetus, ensure no adverse pregnancy outcomes result and the child is not born with nutritional deficiencies. According to Fanzo (2012: 37), many South Africans still experience hidden hunger as a result of under-nutrition due to the unavailability of sufficient nutritious food. In addition, many pregnant women also experience this condition whereby the individual may consume adequate energy resources but may have a deficiency in several macro- and micronutrients and therefore experience mild to severe health problems which directly affect the health of the foetus.

Furthermore, Tomlinson *et al* (2014: 277) states that there is an urgent need to not just develop but also to implement interventions that are based on sound evidence and that are, more importantly, cost effective in order for pregnant women suffering from poverty to benefit from them. This will allow them to benefit from positive health outcomes and prevent health problems occurring in the foetus.

The main aim of this study was to establish the socio-demographic profile, nutritional status, as well as food intake of pregnant women attending an antenatal clinic in a rural community to inform the development of nutrition education material (not part of this study) and it also formed part of the Medical Research Council (MRC) approved study "A multi-staged multi-disciplinary healthcare approach in reducing maternal morbidity and mortality rates in a selected district in KwaZulu-Natal."

5.2 Limitations of the study

- One of the first limitations to the study was the initial delay in getting the necessary approval for the MRC study to commence, and in which this study was nested. These initial delays included:

- Obtaining permission from the Department of Health as well as from the Cato Manor clinic to conduct the study at the clinic. This delayed the implementation of the study by several months. Obtaining permission from the Cato Manor clinic to allow a resident nurse hired for this study to have access to a designated area/room to conduct proceedings with participants also took time and this again delayed the start of the data collection process by several weeks.

- The second limitation of the study was ensuring participants remained at the clinic for the full duration of the data collection process. As participants were pregnant and relied on public transport, they were often hasty when answering questions and were not always fully committed to completing every part of the data collection process.

5.3 Main findings of the study

One hundred pregnant women within the first trimester of pregnancy participated in the study. Several socio-demographic variables were identified including socio-economic status, education level and living conditions. Mothers of the household made up a large percentage of those who were responsible for the amount of money spent purchasing food, for food preparation as well as deciding on the types of foods purchased. The majority of participants claimed to have enough money to buy enough food to eat three meals a day and the majority purchased food at wholesalers or supermarkets. Many participants had obtained a matric qualification at school, but only a small percentage had obtained a tertiary level education. In line with food insecurity, many participants did not have enough money to buy more food than they did on a regular basis; however, the majority of participants did have enough money to purchase food and did so predominantly from a wholesaler, spending more than R500 a month. With regard to the living conditions of the participants, a large percentage still live in an unclean and

inadequate environment making them more susceptible to exposure to harmful diseases, and putting both the mother and foetus at risk. Many of the participants lived in a squatter camp or townships and had between two and five other people living in the house with them. Despite this, most participants lived in houses that were built of brick and had lived in these houses for over five years while renting. However, most participants lived in houses with fewer than two bedrooms and many participants had other people or families living in structures in their backyard (so-called backyard dwellers).

More than half the participants did not have access to running water inside the house and therefore had to use an outside tap or, in some cases, fetch water from a nearby source so as to have access to safe and clean water on a daily basis. While most participants did have access to adequate sewerage facilities in the form of a flushing toilet, many participants did not have access to this basic need and had to use a pit latrine with no access to adequate waste removal, thus exposing both themselves and the foetus to harmful bacteria and sanitation-related diseases. Furthermore, most participants had access to electricity as well as tarred roads; however, in some instances participants had to travel along gravel or dirt roads when travelling was required. Finally, most participants reported experiencing problems with pests such as mice, rats and mosquitoes in the house and also reported problems of leaking and damp areas in the house.

Most respondents reported they were unemployed; however, less than half of the participants reported they were actively seeking employment. Of those participants who were employed, the majority did not have permanent employment and were only employed temporarily in jobs such as bookkeeping, hairdressing and cleaning. With unemployment so high among these participants, it is no surprise that more than half the participants received a monthly income of less than R1500 a month, making food security and food variety difficult to achieve and maintain. Furthermore, although income was limited within this population, most participants owned various household assets such as mattress beds, electric irons and kettles, microwave ovens, radios, stoves and refrigerators.

The results of the study illustrated several anthropometric concerns among the participants, particularly relating to blood pressure and BMI and the impact thereof on the health and well-being of both the mother and foetus. The mean age of the participants was 26 years old with a mean BMI of 27.09. In addition, while the majority of participants had a BMI that fell within the normal range as identified by the World Health Organization, many participants had a BMI that fell within the overweight and obese range while several participants were classified as obese or morbidly obese. With regard to blood pressure, more than half of the participants had normal and healthy systolic blood pressure; however, a large percentage of participants suffered from mildly high to severely high diastolic blood pressure, increasing the risk of an adverse birth outcome.

The results relating to the food security of the participants obtained through 24-hour recalls and the FFQ indicated that overall the participants were food secure but did not meet several of the recommended intakes for both macro- and micronutrients. Several participants were classified as either overweight or obese even though their mean energy intake did not meet the recommended DRI; however, the top three foods consumed according to the top 20 food list were carbohydrate based which may have led to the prevalence of high BMIs. Furthermore, the carbohydrate and fat consumption of 60.92% and 24.24% respectively of the total energy intake as measured by the two 24-hour recalls fell within the levels recommended by the World Health Organization of 55-75% carbohydrate consumption and 15-30% fat consumption respectively. In addition, the total dietary fibre intake was also notably much lower than the recommended AI and furthermore, participants did not meet the recommended RDA for protein although protein-based foods appeared fourth, 13th, 14th and 17th in the top 20 food list.

The overall fruit and vegetable consumption of the pregnant women was poor and was significantly lower than the WHO recommended intake of ≥400g (WHO 2003: 3). This was further seen in the lack of fruit and vegetable sources found in the top 20 food list, as fruit was only seen in 7th, 8th and 19th positions on the list and vegetables were only seen in 15th position in the form of cooked cabbage and in 18th position in vegetable curry which are not typically high in various nutrients. This could be further seen by the

severe number of women who were deficient in a variety of micronutrients that are vital to and ensure the adequate growth of the foetus.

The findings from the study indicated that the total range of individual food items consumed by an individual during a seven-day data collection period was between six and 62 foods. The majority of participants, accounting for 94% (n=94), consumed among six and nine food groups over the course of seven days. The mean FVS (±SD) for all the foods consumed from all the food groups in a seven-day period was 31.02 (±11.029) indicating a medium food variety.

5.4 Conclusion

This study concluded overall that although participants did not lack money to purchase food, many were unemployed and survived on a small amount of income per month. In addition, many were found to be living in unsatisfactory, unsanitary conditions and sometimes did not eat more than one meal a day, but did, however, consume a medium food variety over the course of seven days. This food insecurity and poor dietary intake of the pregnant women resulted in the majority of the nutrients not meeting the recommended DRIs. As the diets of the participants were predominantly carbohydrate based and high in sugar and saturated fat, it was no surprise to find that several women were overweight or obese and some had high blood pressure. To ensure vulnerable groups in South Africa such as pregnant women receive adequate nutritional food daily, further interventions need to be put in place to provide adequate nutritional education at (local) PHC clinics as well as nationally (on the part of government) to ensure women have the opportunity to have access to foods from the five basic food groups daily. This will help guarantee the health of the mother as well as ensure that the future well-being of the foetus is not jeopardized.

5.5 Recommendations

5.5.1 Recommendations for policy makers

- Pregnancy support grants

It is a known fact that pregnancy not only puts a huge strain on women physically and emotionally, but financially as well. As is evident in this study, many of the participants

suffered from extreme poverty and received very limited means of income to buy food and other necessities. For pregnant women to ensure they receive adequate nutrition, a pregnancy support grant needs to be implemented to allow women the opportunity to purchase healthy and nutritious food daily to guarantee the health of not only themselves but more importantly, of the foetus as well. Being able to access a grant of this nature as early as possible in pregnancy would improve the health outcomes for both the mother and child and will in turn reduce the maternal and child mortality and morbidity rates in South Africa.

- Agricultural intervention

One of the simplest ways of ensuring pregnant women in rural communities consume sufficient micronutrients is to provide sustainable and practical ways of increasing fruit and vegetable intakes. The simplest and most effective way would be to reach out to NGOs and other surrounding communities to establish fruit and vegetable gardens at PHC clinics. This will provide pregnant women with the opportunity to receive/purchase fruit and vegetables at a reduced price on each visit and in addition, provide the women with essential micronutrients needed to ensure optimal health of both themselves and the foetus.

5.5.2 Nutrition education intervention

According to Dunneram and Jeewon (2015: 116), in order to ensure positive pregnancy outcomes as well as optimal health for women throughout pregnancy, adequate nutrition education is essential and needs to be aimed at enhancing the dietary intake and food choice habits of participants. The lack of nutrition knowledge among pregnant women, particularly those with limited education qualifications, can have a detrimental effect on the health of the mother as well as the long-term health of the foetus. While the majority of PHC clinics do have nutrition advisors, and despite the efforts made by the Department of Health to implement pregnancy interventions, many women are misinformed on proper nutrition practices during pregnancy or lack basic understanding of which crucial foods to eat to meet the necessary vitamin and mineral requirements. Follow-up consultations should be conducted to fully assess progress during pregnancy and post-natal assessments should be conducted to assess birth outcomes.

5.5.3 Recommendations for future research

- This study clearly identifies several problems facing pregnant women in South Africa with the main issues being a lack of both dietary diversity and a basic understanding of nutrition. Further research should be conducted to investigate whether nutrition education interventions are being implemented correctly at all PHCs to determine whether the nutritional status and dietary diversity of pregnant women can be improved.
- Further research needs to be conducted to determine whether pregnant women making use of child support grants have improved dietary diversity and experience less financial burden.
- Further investigation needs to be conducted into the living conditions of pregnant women as the living conditions experienced by the participants of this study were extremely poor and posed a threat to the health and well-being of both the mother and the foetus. Pregnant women should have access to clean, running water as well as hygienic sewerage facilities on a daily basis.
- An important intervention would be to ensure proper procedures are put in place to ensure adequate follow-up and assessment of the women up until the time of birth to prevent adverse birth outcomes and to correctly monitor the nutritional status and food consumption of the women.
- The lack of a pregnancy grant in South Africa poses a significant risk to pregnant women as many suffer from financial burden and cannot afford to purchase a variety of foods required to ensure the recommended intake of both macro- and micronutrients are met. The implementation of a pregnancy grant would eliminate the need for women to purchase cheaper foods high in saturated fat and sugar as well as ensure the health of the foetus is maintained and no further developmental or growth problems are experienced. Therefore, a further study to investigate how a pregnancy grant could be implemented, administered and monitored is recommended in order to determine whether, if more wholesome, healthier food options were bought and consumed, it would impact positively on both the mother and the unborn foetus.

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Annexure A: IREC Approval

DUT
DURBAN UNIVERSITY OF TECHNOLOGY

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

P O Box 1334, Durban, South Africa, 4001

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

www.dut.ac.za

Annexure A: IREC Approval

19 June 2017

IREC Reference Number: **REC 10/15**

Ms K M Warriner
1 Brownsdrift Park
70 Brownsdrift Road
Umgeni Park

Dear Ms Warriner

Dietary diversity and nutritional status of pregnant women attending an anti-natal clinic in KZN

Your provisional approval letter dated 03 March 2015 refers.

Please be advised that ethics clearance has been granted for a period of 2 years, before the expiry of which you are required to apply for safety monitoring and annual recertification.

Please use the Safety Monitoring and Annual Recertification form to apply for recertification, this form can be found on http://www.dut.ac.za/research/institutional_research_ethics/

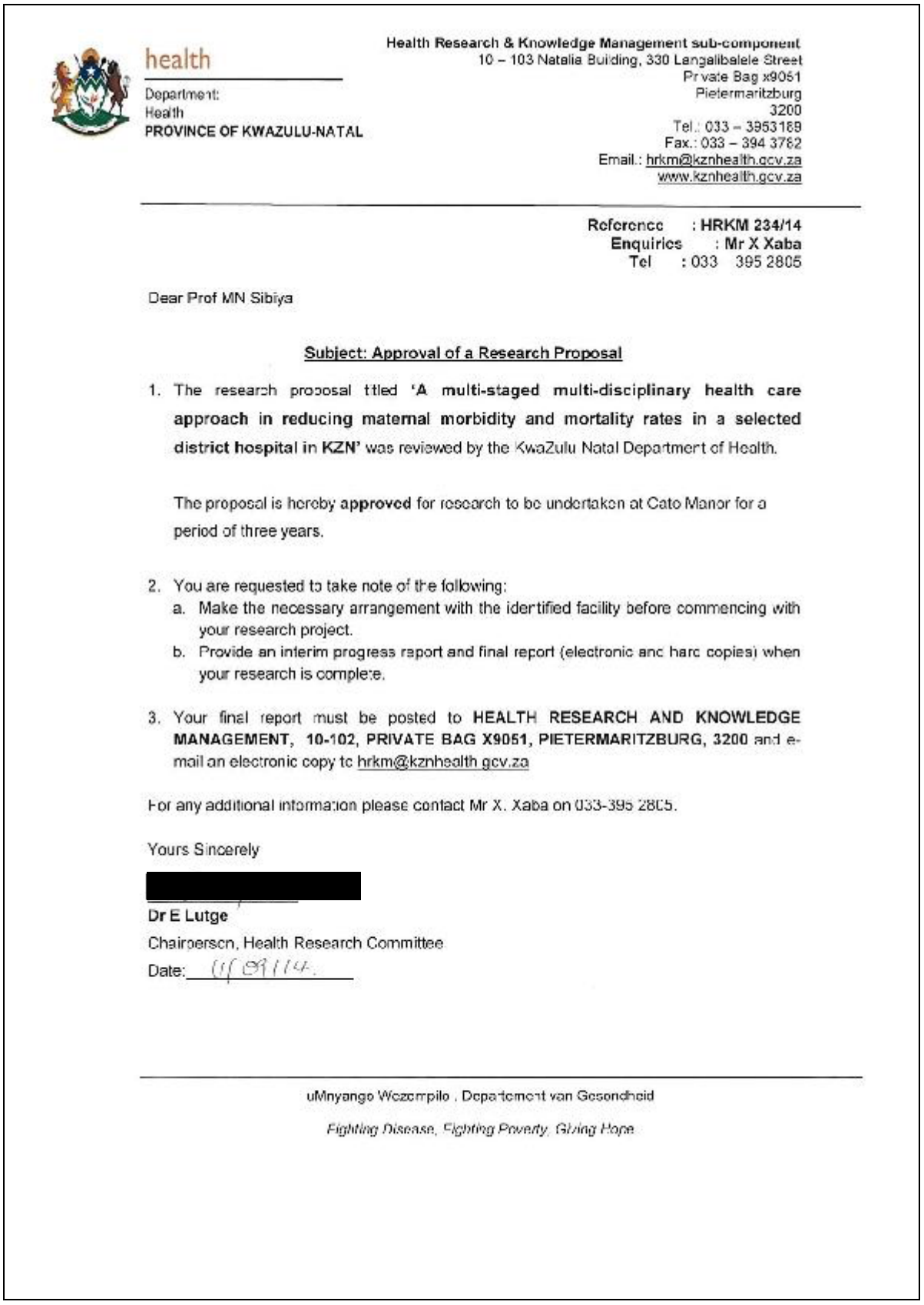
Please note that this form must be submitted to the IREC 3 months before ethics approval for the study expires.

Yours Sincerely

[redacted]
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2017 -03- 13
INSTITUTIONAL RESEARCH ETHICS COMMITTEE
DURBAN 4000 SOUTH AFRICA

Annexure B: DoH permission letter



health

Department:
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Health Research & Knowledge Management sub-component
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www.kznhealth.gov.za

Reference : HRKM 234/14
Enquiries : Mr X Xaba
Tel : 033 395 2805

Dear Prof MN Sibiya

Subject: Approval of a Research Proposal

1. The research proposal titled **'A multi-staged multi-disciplinary health care approach in reducing maternal morbidity and mortality rates in a selected district hospital in KZN'** was reviewed by the KwaZulu Natal Department of Health.

   The proposal is hereby **approved** for research to be undertaken at Cato Manor for a period of three years.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

[redacted]

Dr E Lutge
Chairperson, Health Research Committee
Date: 11/09/14

Annexure C: Consent letter in English

LETTER OF INFORMATION

Dear Participant

Thank you for allowing me to explain my research study for your consideration.

Title of the Research Study:

Dietary diversity and nutritional status of pregnant women attending an ante-natal clinic in KZN

Principal investigator/s/researcher:

Kelly Michelle Warriner, B. Tech: Consumer Sciences Food and Nutrition

Co-Investigator/s/supervisor/s:

Professor Carin Napier

Why is it important to do this study?

Pregnancy is an extremely significant time in any women's life and should be treated with caution and care. Proper health care and nutrition is vitally important throughout the pregnancy as it has a major influence on the outcome of both the pregnancy and health of the mother and baby.

What will it involve?

- You will have to sign a consent form to indicate that you agree to participate in the study after I have explained all the procedures to you.
- If you agree you will be asked to complete 4 questionnaires in an interview situation; it could take up to 1 hour.
- The questionnaires will include:
- A Socio- demographic questionnaire
- Three 24-hour food recall questionnaires.
- A Food Frequency Questionnaire to determine food variety and dietary diversity.
- We will also weigh you and measure your height in order to determine your BMI (Body Mass Index) once every trimester during your visit to the clinic - we will not ask you to remove your clothing except for shoes and jerseys/jackets.
- Participation is voluntary and you can withdraw at any time with no penalty**.**

Risks or discomforts to the participant: All measurements and weighing will be done in a private room. You will be requested to remove shoes and jackets and jerseys only and will not be requested to undress. No risks or discomfort will be experienced.

Benefits to the community: All information obtained will remain anonymous and the information will be used to develop nutrition education material for pregnant women. If you have any personal nutrition questions or concerns we are prepared to assist you after the data collection process has been completed.

Please note the following:

- Participation is voluntary and you can withdraw at any time with no penalty.
- No pay will be given to any of the participants.
- There is no cost involved to participate in this study.
- You will be given a participant number in order to ensure all participants' results remain anonymous.

Research-related Injury:

For any questions or concerns please feel free to contact my supervisor or our Ethics Committee.

Persons to contact in the event of any problems or queries:

Supervisor: Prof. Carin Napier D Tech: Food Service Management
(031-373-2326) or carinn@dut.ac.za

Researcher: Kelly Michelle Warriner B Tech Consumer Science Food and Nutrition:
(071-608-0791) or kel.warriner@gmail.com

The Institutional Research Ethics Administrator: +27 31 373 2900.

Complaints can be reported to the DVC: TIP, Prof F. Otieno on (031) 373 2382 or dvctip@dut.ac.za.

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)
CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), 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.
- 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 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 the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature or 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**

(Known to the participant and is literate)

Annexure D: Consent letter in Zulu

Sawubona Mhlanganyeli

Ngiyabonga ukungipha ithuba lokuchaza kabanzi ngocwaningo

Isihloko socwaningo

Ukudla okudliwayo ngokwehluka hlukana kanye nesimo somsoco kwabesimame abakhulelwe abahamba umtholampilo wabakhulelwe esifundazweni saKwaZulu Natali

Umcwaningi omkhulu:

Kelly Michelle Warriner (B. Tech: Consumer Sciences Food and Nutrition)

Umphathi

Usolwazi Carin Napier

Kungani kubalulekile ukwenza lolu cwaningo?

Ukukhulelwa isikhathi esibaluleke kakhulu empilweni kunoma imuphi umuntu wesifazane futhi udinga ukuphathwa anakekelwe ngokuqaphelelwa okukhulu. Ukunakekelwa kwezempilo kanye nokudla kubalulekile kakhulu ngalesisikhathi sokukhulelwa ngoba kunethonya elikhulu kumuphumela wokukhulelwa kanye nempilo kamama, nengane.

Kuzohilelani?

Okuhlelwe ukuba kulandelwe:

- Ngizodinga ukuba usayini incwadi yesivumelwano esho ukuthi uyavuma ukuba yingxenye yocwaningo, lokhu kuzokwenzeka uma sengikuchazele konke okuzolandelwa.
- Umangabe uvuma ukuba yingxenye yalolucwaningo ngizocela ukuthi siphendule imibuzo ngendlela yokuxoxisana. Lokhu kungathat ihora linye nje.
- Imibuzo izoqhamuka kulamaquestionnaire:
    - Socio- Demographic Questionnaire: Ukukala isimo sokuphila

    - 3 x 24-hour recall questionnaires: Ukuthola ukuthi udla kudla kuni
    - Food Frequency Questionnaire: Ukuthola ukuhluka kokudla okudlayo
- Uzokalwa isisindo kanye nobude kanye nobubanzi bokhalo lwakho. Lokhu kuzokwenziwa endlini yomtholampilo ngesikhathi esivumelana ngaso. Ngizocela ukuthi ungagqoki ijersey nazicathulo. Ngeke sicele ukukhumula izingubo.
- Awuphoqiwe ukuba yingxenye yalolucwaningo, Uyazikhethela wena. Uvunyeliwe futhi ukuhoxa ukuba yingxenye yalolucwaningo nganoma yisiphi isikhathi ngaphandle kwokuhlawula noma ukulahlekelwa ukusizakala.

Ingozi kulowo oyingxenye yocwaningo:

Konke okuhleliwe kuzokwenziwa endlini yomutholampil. Akulindelekile ukuba ulimale ngokuba yingxenye yalolucwaningo.

Okuzozuzwa/ Ukusizakala:

Ngalolucwaningo sizothola imininingwane ngesimo sempilo nokudla okudliwa abesifazane abakhulelwe okuzosiza kuthuthukise imfundo ngomusoco wabesifazane abakhulelwe.

Imiphumela yalolucwaningo izidluliselwa nekhansela kodwa igama lakho alizukubalulwa. Uma unemibuzo singabuya sizame ukukusiza uma sesiqedile ukuqoqa imininingwane.

Uyaziswa ukuthi:

- Awuphoqiwe ukuba yingxenye yalolucwaningo, Uyazikhethela wena. Uvunyeliwe futhi ukuhoxa ukuba yingxenye yalolucwaningo nganoma yisiphi isikhathi ngaphandle kwokuhlawula noma ukulahlekelwa ukusizakala.
- Awukho umuholo otholakala ngokuba ingxenye yalolucwaningo.
- Azikho izindleko othweswe zona mayelana nalolucwaningo.
- Konke okuzokwenziwa kuzokwenziwela ngasese, umnutu nomuntu ukuze umhlanganyeli akhululeke. Kuyagcizelelwa futhi njengoba bekushiwo encwadini yokwazisa ukuthi oyingxenye yocwaningo uzothola inombolo kunokuba abhalwe/ aziwe ngegama. Lokhu kozoqinisiseka ukuthi imiphumela ingaziwa ukuthi ngekabani.

Okungalimaza ngocwaningo:

Akulindelekile ukuba ulimale ngokuba yingxenye yalolucwaningo.

Ungaxhumana nalaba uma unemibuzo:

Umphathi: USolwazi Carin Napier D Tech: Food Service Management

(031-373-2326) noma carinn@dut.ac.za

Umucwaningi: Kelly Michelle Warriner B Tech Consumer Science Food and Nutrition:

(071-608-0791) or kel.warriner@gmail.com

Institutional Research Ethics administrator ku 031 373 2900.

Izikhalazo kuDVC: TIP, Solwazi F. Otieno ku 031 373 2382 noma dvctip@dut.ac.za

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC) CONSENT

Isivumelwano sokuba yingxenye yocwaningo:

- Ngiyavuma ukuthi ngichazeliwe ngu _____ ngalolucwaningi. Research Ethics Clearance Number:_____,
- Ngiyifundile imininingwane yalolu cwaningo, noma ngilalelile ngezwa kuchazwa ngokomlomo. Ngakho-ke futhi ngiyasho ukuthi ngiyayiqonda.
- Ngiyazi ukuthi imiphumela yocwaningo, kanye neminingwane yami ayizukudalulwa.
- Ngiyavuma ukuthi imininingwane yocwaningo ihlaziywe ngekhomputha ngumcwaningi.
- Angiphoqiwe ukuba yingxenye yalolucwaningo, Ngingahoxa ukuba yingxenye yalolucwaningo nganoma yisiphi isikhathi ngaphandle kwokuhlawula noma ukulahlekelwa ukusizakala.
- Lapho ebenginemibuzo khona, ngichazeliwe kabanzi. Ngiyazikhethela mina ukuba yingxenye yalolucwaningo.
- Imiphumela yalolucwaningo ephathelene nami ekuqhubekeni kwaocwaningo ngizokwazi ukuyithola.

_____ _____ _____ _____

Igama lakho eliphelele **Usuku** **Iskhathi** **Sayina**

Mina, _____ ngiyavuma ukuthi obhalwe ngaphezulu uchazelwe ngokuphelele ngalolucwaningo,

_____ _____ _____

Igama lomcwaningi **Usuku** **Sayina**

_____ _____ _____

Igama likafakazi **Usuku** **Sayina**

Annexure E: Socio-demographic questionnaire in English

Food and Nutrition Consumer Sciences

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

This questionnaire covers certain aspects of your life, including work and personal details, health and illness, lifestyle and social life 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.

1. GENERAL INFORMATION

Participant number:……..……. Date: ……

Fieldworker name: ……

Please answer all questions by marking the correct answer with **X,** except where otherwise indicated.

Where do you live?

.....

2. PERSONAL INFORMATION

2.1 Your role in the family

Daughter	Mother	Grandmother	Other, Specify……

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

2.3 How old are you? _____ years

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in?

Town/City	Farm	Squatter camp	Rural village	Hostel	Township	Other, specify….

3.2 How are you currently living?

Homeless	
Living with relatives	
Living with friends	
Hostel accommodation	
Squatter home	
Rented house/flat	
Own house/flat	
Employees Properties	
Other, specify…….	

3.3 Do other people live in the house with you?

Yes	No

3.4 How many people are permanent residents living in the house with you? (Only if these people eat and sleep in this house at least 4 days a week?)

1	2	3	4	5	6	7	8	9	10	10+

3.5 How long have you been staying permanent in this house?

< 1 year	1-5 years	>5 years

3.6 In what type of house are you staying?

Brick	Clay	Wood	Tin/shack

3.7 How many rooms does your house have?

1 room	2 rooms	3 rooms	4 room	>5 rooms

3.8 Are there other houses/shacks within the same yard of the main house?

Yes	No

3.9 Do you have the following facilities/ services at home?

3.9.1 Water

Tap in the house	
Tap outside the house (in yard)	
Borehole	
Spring / river / dam water	
Fetch water from elsewhere	

3.9.2 Toilet facilities

None	
Pit latrine	
Flush / sewage	
Bucket system	
Other, specify…….	

Waste removal	Yes	No	3.9.3
Tarred road in front of house	Yes	No	3.9.4
Gravel road in front of house	Yes	No	3.9.5
Access to electricity	Yes	No	3.9.6

3.10 To what extent do you have problems with the state of your house (e.g. size, repairs, damp, etc.)?

……
……

3.11 Do you have problems with the following?

Mice/ Rats	
Cockroaches	
Ants	
Flees	
Mosquitoes	
Geckos	
Frogs	
Snakes	
Bed Bugs	

3.12. What is the floor inside your house made of?

Cement	
Tiles	
Carpet	
No floor	
Sand/mud	
Dung	
Other, please state	

4. **WORK STATUS AND INCOME**

4.1. Are you currently employed?

Yes	No

If YES, go to Question 4.5.

4.2. If NO, how would you describe your current status (tick one box only)?

Unemployed	Vendor	Housewife	Student	Other, specify……

4.3. Are you actively looking for paid employment at the moment?

Yes	No

4.4. How long have you been unemployed?

< 6 months	6-12 months	1-3 years	> 3 years

4.5. If YES (question 4.1) is your current job a:

Permanent position	Temporary position	Fixed term contract	Other, specify……..

4.6. Are you doing part time jobs as a second job on weekends and school vacations?

Yes	No

4.7 What is the exact title of your current job?
(Including self-employed)

4.8. What is the total income in the household per month?

< R1500	R1501-R3000	R3001-R5000	R5001-R7000	R7001-R9000	R9001-R11 000
R11 001-R13 000	R13 001-R15 000	R15 001-R17 000	R17 001-R19 000	R19 001-R21 000	> R21 000

4.9. Please specify the monthly income in the household (if willing)……..

4.10 Do you receive any of the South African Government social grants?

Child grant	Disability grant	Foster grant

4.11. How often does it happen that you do not have enough money to buy food? for you and your family?

Always	Often	Sometimes	Seldom	Never

4.12. How many people e.g. partner, relatives & others (including yourself) contributed to your household income from any source, (including wages/salary from paid employment, money from second or odd jobs income from savings investments, pension, rent or property, benefits and or maintenance etc.) in the last 12 months?

People	0	1	2	3	4	5	6	7	8	9

4.13. How often do you buy food?

Every day	Once a week	Once a month	Other, specify……

4.14. Where do you buy food?

Tuck shop	Street vendor	Wholesalers	Supermarket	Other, specify……

4.15 What type of transport do you use to get around?

Taxi	
Bus	
Train	
Own car	
Bicycle/ Motorbike	
Other Specify	

4.16 How much money is spent on food PER MONTH? (Tick only one box)

R 0 – R 500	R 501 – R 1000	R 1001 – R 1500	R 1501 – R 2000	R 2001 – R 2500	R 2501 – R 3000	> R 3000	I do not know

5 EDUCATION AND LANGUAGE

5.1. What is your highest education level?

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

5.2 What language is spoken mostly in the house?

Zulu	Xhosa	English	Afrikaans	Other, specify……

5.3 Do you have any other children of your own?

Yes	No

Number: ……..

5.3 How many of your children have birth certificates?

None	1	2	3	4	5	6	7	8	All

5.4 How many of your children have completed their immunisation schedule?

None	1	2	3	4	5	6	7	8	All

5.5 Have any of your children died in the past?

Yes	No

Reason: ……..

5.6 Number of children attending school

None	1	2	3	4	5	6	7	8	All

5.7 How do the children get to school?

Walk	Bus	Taxi	Parents car	Other, specify…….

Food practices in the household

Tick one block for every question:	Father	Mother	Sibling	Grandma	Grandpa	Aunt	Uncle	Cousin	Friend	Other
5.8 Who is mainly responsible for food preparation in the house?										
5.9 Who decides on what type of food is bought for the household?										
5.10 Who is mainly responsible for feeding/serving the children?										
5.11 Who is the head of this household?										
5.12 Who decides how much is spent on food?										

5.13 How many meals do you eat per day?

0	1	2	3	> 3

5.14 Where do you eat most of your meals?

Home	Friends	Work	School	Other, specify…….

5.15 Where do your children eat most of their meals?

Home	Friends	School	Other, specify…….

6. ASSETS

6.1 Does your home have the following items and how many?

	Yes
Electrical stove	
Gas stove	
Primus or paraffin stove	
Microwave	
Hot plate	
Radio	
Television	
Refrigerator	
Freezer	
Telephone/ Cell phone	
Bed with mattress	
Mattress only	
Lounge suite	
Dining room suite	
Electrical iron	
Electrical, kettle	
Car	
Bicycle	
Motorbike	

6.2 What type of fuel do you usually use for food preparation?

Wood fire	Paraffin	Electricity	Gas	Coal/Charcoal	Other, specify……

6.3 What type/s of material are your pots made off (tick all relevant options)?

Cast iron	Aluminium	Stainless steel	Clay	Other, specify……

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

Annexure F: Socio-demographic questionnaire Zulu

SOCIO-DEMOGRAPHIC QUESTIONNAIRE:

Loluhlelo lemibuzo lo cwaninga izigaba ezithile ngempilo lezi zifana njenge msebenzi, imiiningwane yakho, izifo, indlela yokuphila no kugula. Izimpendulo zalemibuzo angeke ziyosentshenziswa omunye umuntu futhi ngeke itholakale budedengu kumphakathi.

2. GENERAL INFORMATION

Inombolo yakho:…….
Usuku:…….

Ngicela uphendule yonke imibuzo ngo faxa u **X ,** lakumele uphendule khona. Ngaphandle imibuzo imu ifuna enye indlela.

3. PERSONAL INFORMATION

3.1 Isigaba sakho emndenini

uMama	Gogo	Indodakazi	Other, specify……..

2.2 Imuphi unyaka owazalwa ngawo? Nyaka: Inyanga:
Usuku:

2.3 Mingaki iminyaka yakho? _____ years

3. UKUHLALA FUTHI NOMNDENDI

3.2 Uhlala kuphi?

Edolobheni	Emafamu	Emijondolo	Emaphandleni	Ehostelal	Elokishini	Enye.

3.3 Ngabe bakhona abanye ohlala nabo?

3.4 Bangaki abantu ohlala nabo endlini?

3.4	1	2	3	4	5	6	7	8	9	10	10+

< 1 year	1-5 years	>5 years

3.5 Uhla kuhlobo olunjani lwendlu?

Amablocks	Ubumba	Utshani	Ithini/Izakhiwo	Ipulangwe

3.6 Mangaki amagumbi ngaphakathi?

< 2 rooms	3-4 rooms	> 4 rooms

3.7 Ngabe ikhona yini enye indlu engaphandle egcekeni ?

Yebo	Cha

3.8 Ungayi chaza kanjani indawo ohla kuyona?

Anginakhaya/ Ndawo	
Nezihlobo	
Nabangani	
Ehostela	
Emijondolo	
Ngiqashile	
Muzi Wami/ Kwami	
La engiqashwe Khona	
Enye……	

3.9 Ngabe unazo yini lezinto endlini yakho?

3.9.1 Amanzi

Umpompi ngaphakathi endlini	
Mpomi engcekeni	
Borehole	
Isiphetho/ imfula	
Alandwa kwezinye izindawo	

3.9.2 Indlu yangasese

Ayikho	
Long drop	
Toilet	
Bucket system	
Okunye, specify…….	

3.9.3	Ukuthuthwa kuka doti	Yebo	Cha
3.9.4	Itiyela ngaphambi kwendlu	Yebo	Cha
3.9.5	Ubuqu ngaphambi kwendlu	Yebo	Cha
3.9.6	Ugesi	Yebo	Cha

3.10 Ingabe izipho izinkinga oba nazo endlini yakho (njenge. incane, ukulungiswa, umswakama, etc.)?

……
……

3.11. Ngabe unazo izinkinga zaloku okulandelayo?

Amangundane	
Amaphela	
Izintuthwane	
Amaselesele	
Izinyoka	
Ezinye izinambuzane, chaza	

3.12 Kwakhiwe Ngani Phansi?

Simende	
Amatiles	
Ukhapheti	
Umhlabathi/ Udaka	
Ubulongwe/ Kusindiwe	
Okunye	

5. **ISIMO SOMSEBENZI NEZIMALI**

5.1. Ingabe uyasebenza?

Yebo	Cha

Uma kuwu Yebo, iyaka ku Question 4.5.

5.2. Uma kuwu Cha, unga chaza ukuthi isimo sakho zinjani? (tick one box only)?

Angisebenzi	Ngiyazisebenza	Ngisebenze nje moma wekhaya endlini	Umfundi	Okunye, Chaza……

5.3. Ngabe usa bheka usembenzi okhokhelayo manje?

Yebo	Cha

5.4. Ngabe ususebenxe iminyakk emingaka?

< 6 months	6-12 months	1-3 years	> 3 years

5.5. Uma umsebenzi wakho (question 4.1) is your current job a:

Permanent position	Wesikhashana	Inkontileka	Okumenye, specify……..

4.8 Siyini isihloko somsebenzi wakho?
(Noma uzisebenza)

4.9 Evela Kuhulumeni?

Yebo	Cha

Uma kuwu Yebo, iyiphi?

……

4.8. Ingubani imali eba uhlelo lwase ?

< R1500	R1501- R3000	R3001-R5000	R4501-R7000	R7001- R9000	R9001- R11 000
R11 001- R13 000	R13 0001 – R15 000	R15 001- R17 000	R17 001- R19 000	R19 001- R21 000	>R21 000

4.9 Ngicela uchaze imali oyisebenzisayo nge nyanga(uma uvuma)……..

4.10. Kwenzeka kangaki ukuthi ungabi nemali ukudla yokuthenya?

Sonke isikhathi	Kuvamile	Ngesinye isikhathi	Akuvamile	Akwenzeki

4.11 Bangani abantu abafaka imali ngezindlela ezahlukene ku zidingo zomdeni wakho eminyakeni engu 12 edlulile?

People	0	1	2	3	4	5	6	7	8	9

4.12 Sikuthenga kangaki ukudla?

Zonke izinsuku	Kanye nge sonto	Kanye nge nyanga	Okunye, specify……

4.13 Uthenga kuphi ukudla?

Spaza shop	Street vendor	Isitolo Esikhulu (Supermarket)	Kwenye indawo, specify……

4.14. Ingaka nani imali oyichitha ekuthengeni ukudla ngenyanga? (Tick only one box)

R 0 – R 50	R 51 – R 100	R 101 – R 150	R 151 – R 200	R 201 – R 250	R 251 – R 300	> R 300	I do not know

4.15 Uhamba ngani ukuya ezindaweni?

Itekisi	
Ibhasi	
Isitimela	
Imoto	
Ibhayisikili	
Other……	

4.16 Yini engathuthukisa uku tholakala kokudla endlini yakho?

Ukulima	Ukuba neshishini	Umsebenzi	Qashwa kwezingame zami	Imali ka Hulumeni	Usuzo lwe

5 EZEMFUNDO NO LIMI LWASEKHAYA

5.2. Ingabe ugcine kabana ngokwe mfundo?

Angifunda nga	Amabanga Aphansi	Standard 8	Standard 10	Ikholiji	Imfundo Ephakeme	Other post school

5.2 Ingabe kusetshe nziswa luphi ulumi ekhaya?

Sotho	Xhosa	Zulu	Pedi	Olunye, chaza…….

5.3 Unazo ezinye izingane okungezatho?

Yebo	Cha

Isibalo……..

5.4 Zingaki izingane zakho ezinesitifiketi sokuzalwa?

Azikho	1	2	3	4	5	6	7	8	Zonke

5.5 Zingaki izingane zakho eseziqedile ukugonwa?

Azikho	1	2	3	4	5	6	7	8	Zonke

5.6 Ikhona/ Zikhona izingane zakho ezike zashona?

Yebo	Cha

Isizathu……

5.7 Zingaki izingane ezifundayo?

Azikho	1	2	3	4	5	6	7	8	Zonke

5.8 Zifika kanjani izingane esikoleni?

Ziyaha mbha	Nge Bus	Nge Taxi	Nge Lift	Ngokunye , chaza…….

6. IZINTO ZASE NDLINI

Khetha indawo efanele	Ubaba	Umama	Umfowethu/	Ugogo	Umkhulu	Anti	Umalume	Mzala	Umngani	Other
6.1 Ubani ophekhayo njalo ekhaya?										
6.2 Ubani unquma ukuthi ukuphi ukudla okuzothengwa?										
6.3 Ubani ophekela izingane?										
6.4 Ubani inhloko yekhaya?										
6.5 Ubani ohlela ukuthi malini yoku thenga ukudla?										

6.6 Ingabe udla kangaki ngosuku?

0	1	2	3	> 3

6.7 Ingabe ujwayela ukudla kuphi?

Ekhaya	Naba Ngani	Emsebenzini	Ngiyathenga	Kwenye indawo chaza……..

6.8 Ingabe izingane zidla kuphi zona?

Ekhaya	Naba Ngani	eSkoleni	Ngiyathenga	Kwenye indawo chaza……..

6.9 Ingabe unazo lezinto futhi zingaki onazo?

	Yebo	**Cha**	**Inani**
Electrical stove			
Gas stove			
Primus or paraffin stove			
Microwave			
Hot plate			
Radio			
Television			

Refrigerator			
Freezer			
Bed with mattress			
Mattress only			
Lounge suite			
Dining room suite			
Electrical iron			
Kettle, electrical			
Car			
Bicycle			
Motorbike			

6.10 Ingabe usebenzisa luphi uhlobo lwama futha okupheka?

Wood fire	Paraffin	Electricity	Gas	Coal	Amanye chaza, ……

6.11 Uluphi uhlobo lwama bhodwe owasebenzisayo(khetha zonke izinhlobo ozisebenzisayo)?

Cast iron	Aluminium	Stainless steel	Clay	Amanye, chaza……

Ngiyabonga kakhulu ngesikhathi sakho no kuzinekal kwakho

Annexure G: Food Frequency questionnaire in English

FOOD AND NUTRITION CONSUMER SCIENCES

FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

PLEASE INDICATE THE FOOD YOU ATE DURING THE PAST SEVEN (7) DAYS BY AN (X)

GROUP 1: Flesh Foods (Meat, Poultry, Fish) Diversity	Y	N
Meat (Chicken)		
Meat (Beef)		
Meat (Mutton, Lamb)		
Meat (Pork)		
Meat (Goat)		
Dried Meat (Biltong)		
All Mince		
All Tribe/Offals/Runners and Heads		
Fish (fresh / whole)		
Tinned Fish (Pilchards/Tuna)		
Processed Meats (Viennas / Polony, Russians, Boerewors Sausage)		
Seafood (Prawns, Mussel's, Calamari, Crab, Shrimp, Crayfish)		

GROUP 2: Eggs Diversity	Y	N
Eggs		
GROUP 3: Dairy Products Diversity	**Y**	**N**
All Milk		
Evaporated milk (Unsweetened)		
Condensed milk		
Maas/ Inkomasi		
All Cheese		
Custard		
Ice Cream		
GROUP 4: Cereals, Roots and Tubers Diversity	**Y**	**N**
All Rice		
Maize (Pap, Mealie Rice, Mealie Meal, Samp, Porridge, Corn on the cob, Popcorn, Sweet Corn)		
Macaroni/Pasta/Spaghetti		
All Bread (White/ Brown/ Whole Wheat)		
Dumpling/Steamed Bread/Fat Koek		
Scones/Biscuits		
Mageu		
Breakfast Cereals (Corn Flakes, Oats, Weet Bix, Matabela)		
All Tubers/Roots (Amadumbe, Sweet Potato)	**Y**	**N**
Potatoes		
GROUP 5: Legumes and Nuts	**Y**	**N**
All Beans Dried		

Dried Peas		
Lentils		
Peanuts and Nuts		
Soya		
GROUP 6: Vitamin A Rich Fruits and Vegetables Diversity	**Y**	**N**
Pumpkin		
Carrots		
Wild Leafy Vegetables Fresh and Dried		
Spinach		
Butternut		
Apricots (Appelkoos)		
Peach (yellow cling)		
Mango		
GROUP 7: Other Fruits (and juices) Diversity	**Y**	**N**
Deciduous Fruits		
Apple		
Peaches		
Pear		
Grapes (black/green)		
Plum		
Sub – Tropical Fruit	**Y**	**N**
Lemon		
Orange		

Naartjie		
Banana		
Pineapple		
Avocado		
Kiwi fruit		
Watermelon		
Guava		
Paw- Paw		
Juices	**Y**	**N**
Juice (100% pure juice e.g. Ceres/Liquifruit)		
GROUP 8: Other Vegetables Diversity	**Y**	**N**
Onions		
Cabbage		
Beetroot		
Tomatoes	**Y**	**N**
Green beans (fresh)		
Peas (fresh)		
Cauliflower		
Chili (red/green)		
Lettuce		
Green\ Yellow\ Red Pepper		
Frozen Vegetables (Mixed)		
Ginger & Garlic (Fresh)		
GROUP 9: Oils and Fats Diversity	**Y**	**N**

Butter		
Sunflower oil		
Margarine		
Lard		
Salad dressing/oil		
Potato Crisps		
Coffee Creamer (Cremora, Ellis Brown)		

Annexure H: Food Frequency Food List in Zulu

FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

Ngicela ungazise ukudla okudle ezinsukwini eziyishagalolunye (7) ezidlule ngokukhombisa ngo faka u (x)

GROUP 1: Izinhlobo zezinyama	Y	N
Inkhukhu		
Inkomo		
Ingulube		
Inhlanzi esekanini (pilchards)		
Inhlanzi ephelele (fresh / whole)		
Lekgotlwane (finely chopped, cooked meat)		
Igusha		
Ukuhamba kwenkukhu nekhanda		
Isibhindi senkukhu		
Inyama yembhuzi		
Mogodu and malana		
Umqwayiba (biltong)		
amaViennas / no polony		
ama Russians		
amaSausage (wors)		

Group 2: Izinhlobo zamaqanda		
Amaqanda enkukhu		
Group 3: Izakhiwo zo bisi		
Ubisi, unpasteurized (nkomo)		
Evaporated milk (unsweetened)		
amaMaas/ inkomasi		
Ubisi oluwu powder		
Ubisi olu Skim or low-fat milk (pasteurized)		
Ubisi olu Full cream milk (pasteurized)		
uCheese		
uCustard		
uIce cream		
iYoghurt		
iUltramel		
iYogisip		

Group 4: amaCereals, okukhula ngezimpande	Y	N
iRice		
iPap (Mbhila)		
iMacaroni/pasta/spaghetti		
Recipe lombhila		
iSitambhu (stampmielies)		
Isinkwa (esimhlophe nesi brown)		
Sinkwa sewhole wheat		
Idombolo		
Amagwinya		
amaScones		
amaBiscuits		
amaBuns / bread rolls		
amaMabele (soft porridge)		
Iphalishi lombhila		
amaCorn flakes		
iOats		
iWheat bix		
amaMageu		
ama ZambanePotatoes		
uBhatataSweet potatoes		
Amadumbe		
Umqombothi		
iSizulu (Traditional beer)		
Group 5: Obhontshisi nama Kinati		

uSugar beans (fresh/ dried/canned)		
uPeas (fresh/ dried/ canned)		
iMbhumbha (Cow peas / dried)		
uJugo/broad beans(fresh/ dried/ canned)		
uGreen beans (fresh/ dried/ canned)		
Ama ntongomane (raw/ roasted)		
uSoya beans (fresh/ dried/ canned)		
amaLentils (fresh/ dried/ canned)		
amaSoy chunks/mince		
iSoy milk		
iPeanut butter		
Group 6: Vitamin A rich amafruits nam vegetables ahlukene		
iThanga		
uCarrots		
amaWild leafy vegetables (morogo/ imfino) Fresh and dried		
isiSpinach		
iButternut		
amaApricots (Applelkoos)		
AmaPeach (yellow cling)		
uMango		
Group 7: Other fruits (and juices) diversity		
Deciduous fruits		

iAphula		
amaPeaches		
iPear		
iGrapes (black/green)		
amaPlum		

Sub – tropical fruit		
uLemon		
iOrange		
iNaartjie		
uBanana		
uPineapple		
uKotapheya		
amaBlueberry		
amaCherry		
iKiwi fruit		
amaRaspberry		
amaWatermelon		
amaWild watermelon(tsamma)		
uGuava		
Juices		
iJuice (100% pure juice e.g. Ceres/Liquifruit)		
Group 8: Izinhlobo zam vegetables diversity		
uOnions		

Ikabishi		
uBeetroot		
iRhubarb		
amaTurnips (raap)		
amaGem-squash (lemoenpampoen)		
uTomatoes		
uGreen beans (fresh)		
uPeas (fresh – green)		
iCauliflower		
Uphelephele (red/green)		
uLettuce		
amaMushroom		
amBaby marrow		
uGreen pepper		
iSweet-corn (baby)		
iCorn-on-the-cob(white)		
uGarlic		
Group 9: Izinhlobo zama futha ne oyela		
iBhotela		
uSunflower oil		
iMargarine		
iLard		
iSalad oil/dressing		

Annexure I: 24-hour recall questionnaire in English

24 – HOURS RECALL

Subject ID number: _____ Interviewer: - _____

Name: _____ Date: _____ / _____/ _____

Address: _____

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 you pick from the veld. 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, school, 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					

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

During the morning at work or at home					

Time (approximately	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
After dinner, before going to sleep					
* Do you take any vitamins (tablets or syrup)		Yes	1	No	2 X
Give the brand name and dose of the vitamin/tonic:					

Annexure J: 24-hour recall questionnaire in Zulu

24 – HOUR RECALL

Inombolo: _____ iInterviewer: _____

iDate: _____ / _____ / 20___

Ngitshele ukuthi udleni kulezinsuku ezidlule

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Ingabe ukudla okukhethile inhlobo ohlale uyidla njalo uma udla?

Yebo	1	Cha	2

Uma cha, chaza? _____

Ngifuna ukuthola ngayo yonke into oyidlile futhi wayiphuza. Ngicela ungitshele yonke leyomninigwane kusukela uvuka futhi noma usuyolala. Ngizobuza futhi ukuthi udlephi futhi udle ukudla okungakanani.

Isikhathi (approximately)	Indawo (Home, school, etc)	Ukudla, indlela okuphekwe ngawo	Inani	Amount in g (office use Only)	Code (office use only)
Kusekela uvuka ekuseni uya emsebenzi unga zenzi izinto ezingi					
Ekuseni emsebenzini noma ekhaya					

Isikhathi (approximately	Indawo (Home,	Ukudla, indlela okuphekwe ngawo	Inani	Amount in	Code (office

)	school, etc)			g (office use Only)	use only)
Emini (Lunch time)					
Ntambhama					

Ebusuku (dinner time)					

Isikhathi (approximately)	Indawo (Home, school, etc)	Ukudla, indlela okuphekwe ngawo	Inani	Amount in g (office	Code (office use

				use Only)	only)
Ebusuku phambi koko lala					

* Uyathatha loluhlobo lwe zikhuthaza mzimbha (tablets or syrup)	Yebo	1	Cha	2
Folate				
Iron				
Other				
Give the brand name and dose of the vitamins/tonic:				

Annexure K: Language editor's letter of proof

TO WHOM IT MAY CONCERN

Editing of Doctoral Thesis **28 February 2018**

This is to certify that I have edited the Doctoral Thesis as submitted to me by Kelly Warriner and entitled **Dietary diversity and nutritional status of pregnant women attending an ante-natal clinic in KZN**

I have edited the document in terms of linguistic and grammatical correctness and after the student had made corrections and attended to my comments it was resubmitted to me and I checked and proofread the document further. In my opinion it is now free from linguistic and grammatical errors. I was not able to edit in terms of content not was this requested of me.

Michael Vermeer

Editor, Proofreader