DURBAN UNIVERSITY OF TECHNOLOGY

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TRANS FATTY ACID CONTENT IN USED VEGETABLE COOKING OIL AND FOOD SAFETY HYGIENE PRACTICES OF INFORMAL FOOD VENDORS IN WARWICK TRIANGLE, DURBAN

Dissertation submitted in fulfilment of the requirements of the Master of Applied Science in Food and Nutrition in the Department of Food and Nutrition: Consumer Sciences in the Faculty of Applied Sciences at the Durban University of Technology

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2023

DECLARATION

I Mthokozisi Rubushe, Student Number 2120677 declare that this study titled: Trans fatty acid content in used vegetable cooking oil and food safety hygiene practices of informal food vendors in Warwick Triangle, Durban, presents my original work and it has not been submitted in any form to another academic institution. Where use was made of the work of others it was duly acknowledged in the text. The research described in this dissertation was carried in the Department of Food and Nutrition: Consumer Sciences, Faculty of Applied Sciences, Durban University of Technology, South Africa under the supervision of Professor Carin Napier.

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

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ABBREVIATIONS

African Food Security Urban Network (AFSUN) 20
cardiovascular diseases (CVDs) 46
Competition Commission South Africa (CCSA) 16
deep-frying (DF) 64
Department of Agriculture, Forestry and Fisheries (DAFF) 29
Faculty of Applied Sciences Research Committee (FRC) 49
Food advisory Consumer Services (FACS) 6
Food and Agriculture Organisation (FAO) 29
Food and Agriculture Organization (FAO) 3
FOOD HANDLERS (FH'S) 64
FOOD HANDLERS (FH'S) 64
free fatty acids (FFA) 56
Gas Chromatography (GC) 58
Global Hunger Index (GHI) 29
gross domestic product (GDP) 6
high-density lipoproteins (HDL) 40
Human Science Research Council (HSRC) 49
industrial trans fatty acids (iTFA) 40
Institutional Research Ethics Committee (IREC) 49
International Food Policy Research Institute (IFPRI) 29
low-density lipoprotein (LDL) 40
Ministry of Health of Malaysia (MoH) 4
National Development Plan (NDP) 29
non-communicable diseases (NCDs) 4, 46
Ruminant trans fatty acids (rTFA) 40
shallow frying

(SF) 64
Statistical Package for the Social Science
(SPSS) 60
Sustainable Development Goals
(SDGs) 29
Trans Fatty Acids
(TFA) 11
Warwick Triangle Avenue
(WTA) xii
World Health Organization
(WHO) 16

ABSTRACT

Aim: The aim of the study was to determine the food safety and hygiene practices and the safety levels of cooking oil used, by the informal food vendors in the Warwick Triangle Avenue (WTA) to prepare meals to sell to consumers by determining the trans-fatty acid content of the cooking oil used.

Objectives: The specific objective of the study is to investigate the oil safety, hygiene practices and food safety knowledge of informal food vendors at the WTA in eThekwini.

Methods: A total number of 40 informal food vending outlets, scattered in the WTA, participated in the study. Fried food prepared by vendors in the WTA were either deep-fried or shallow-fried. Therefor the vendors were divided into two groups: 20 deep-frying and 20 shallow-frying groups. This study was descriptive with an analytical component. The data collection exercise was quantitative, using a socio-demographic questionnaire and a food handler's questionnaire. A detailed observation sheet and a sheet for recording the results of 3M^{TM} oil quality test strips were also used. Used cooking oil samples were collected in small glass bottles for lab analysis. Data was captured in Excel and analyzed using a statistical package for social science (SPSS) version 24 for descriptive statistics.

Summary of Findings: Adequate cooking spaces was not present in 70.0% (n=14) of DF vendors and 65.0% (n=13) of SF vendors. Sixty-five percent (n=13) DF and 80.0% (n=16) of the SF vendors did not have access to safe water for food preparation. Most of the DF vendors (40.0%; n=8) kept food for less than 15 minutes and 30.0% (n=6) kept the food for more than 45 minutes. A small number of vendors (10.0%; n=2) kept the food from 30 to 45 minutes, while 20.0% (n=4) kept the food from 15 to 30 minutes. Most of the SF vendors (30.0%; n=6) kept food for more than 45 minutes and 25.0% (n=5) kept the food for less than 15 minutes, and 25.0% (n=5) kept the food between 15 – 30 minutes. A small number of vendors (20.0%; n=4) kept the food for 30 to 45 minutes. Cleaning or removal of rubbish by DF vendors took place once a day in 45.0% (n=9) of the cases, and twice a day in 6.0% (n=30) for the rest of the cases. Cleaning or removal of rubbish took place once a day in 5% (n=1) SF of the vending sites. Only 50.0% (n=10) of DF vendors and 30.0% (n=6) of SF vendors had rubbish bins with tightly fitting lids. Only 10.0% (n=2) of the DF vendors indicated that they clean their utensils during food preparation compared to 25.0% (n=5) of the SF vendors. The researcher's observation reveals that correct cleaning chemicals were not available in all the SF and DF vending sites (100.0%) such as detergent for clothes and sanitizers and dishwashing liquid. All the DF and SF vending sites were not sanitized during food preparation, and 65.0% (n=13) of

the areas were not cleaned during food preparation. Forty-five percent (n=9) of the DF vendors changed oil daily, while 30.0% (n=6) changed the oil frequently, with 15.0% (n=3) changing the oil weekly and 10.0% (n=2) changing it seldom. Forty-five percent (n=9) of the DF vendors' cooking oil was suitable for cooking, 20.0% (n=4) was probably suitable and 20.0% (n=4) was probably not safe depending on the quality of food and 15.0% (n=3) was not safe and had to be discarded.

Gas chromatography further revealed that a value of 4.62% for methyl palmate (sample A_1) was obtained implying an increase in viscosity, acid value as well as the saturation process. The highest saturation point was observed for samples A_{11} and A_{12}. This effect implies an increase from C_{17}: 1 (monosaturated) fatty acid to C_{17}: 2 (diunsaturated) fatty acid chains. Additionally, the results obtained indicate that fats and oils experience different degrees of proportionality in saturation during frying or cooking use, with the magnitude of these changes varying from sample to sample.

It was observed that most of the DF food handlers did not wash their hands before serving (90.0%; n=18), as 50.0% (n=10) of the DF vending sites did not have water available for food handlers to wash their hands.

Conclusion: It was observed that there was no evidence of monitoring of policies and procedures for all SF vending sites (100.0%; n=20) and for the majority (95.0%; n=19) of the DF sites. A high degree of composition is observed in the used frying oil samples. The results indicate high consistency (or repeatability) of used cooking or frying oil from the sampling points of WTA.

CHAPTER 1: THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

Street food, according to Hill *et al.,* (2019: 401) is food that is sold in stalls along the street, and is often unregulated. In both urban and rural areas, street food is sold on the pavements and on busy areas like street markets and major transport hubs. In many instances, in there is no permanent structure for informal street food vending (Steyn *et al.,* 2011: 1). In developing countries, the consumption of street food is very common and provides livelihood for many. In the informal sector street food is reported to be the largest employer in South Africa and the major contributor to the economy (Rogan and Skinner 2017: 2). South Africans of different ages have increased the consumption of street food as mentioned in various studies (Kroll 2017: 3, Sedibe *et al.,* 2018: 13; Steyn and Labadarios 2011: 462). Moreover, these studies show that the food consumed most often is highly salty and energy-dense, which can lead to significant weight gain, as well as health risks from overconsumption of total fat, saturated fat, salt and sugar (Steyn *et al.,* 2014). Additionally, street food consumption and its preparation can expose the public to hygienic hazards since street food in many countries is not regulated (Ma *et al.,* 2019: 2).

There is a prominent transportation and trading hub located in the Warwick Triangle (WTA) on the outskirts of Durban's inner city, attracting many street traders. The WTA is connected to the city centre by the main railway station, 5 bus terminals, 19 taxi ranks, roads, walkways and pedestrian bridges. Each day, 460,000 people use this area to commute. The area is served by 350 buses and 1550 minibus taxis. Additionally, 166 000 people use the WTA every day for public transportation, and 38 000 vehicles travel through the area. In addition, about 5000 to 8000 participants trade informally in the WTA, but it's not known how many of these people prepare their food on the street (Golovcsenko 2011: 13; Dobson and Quazi 2016: 243; Rogan and Skinner 2017: 35). Figure 1.1 provides an illustration of an aerial view of the WTA.

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Figure 1.1: The WTA showing its mains hubs

Informal food vending is one of the most important industries in developing countries, both economically and in terms of meeting the needs of the population. It is also responsible for significantly increasing household food expenditure within cities and towns. As a result, countless households headed by women are able to earn income from it (Emanuel *et al.,* 2015: 83).

According to Rane (2011: 100), the informal food vendors pose a serious threat to public health because they lack the basic infrastructures and services. There is also undisputed evidence that street vended food is challenging to control due to its many characteristics, its mobility, and its temporary nature. It is, however, widely appreciated for its convenience, inimitable aromas, and its impact on nutrition (Khairuzzaman *et al.,* 2014: 1). Contrary to the apparent benefits of informal food vendors, foods sold through them do not meet safety standards. A study by Monney *et al.,* (2013: 283) explains how street foods are associated with high mortality and morbidity due to foodborne illnesses and the impact on trade and development.

In addition, the street food vending industry is prone to violations of safe food handling procedures largely because it is difficult to regulate and monitor. According to Mack *et al.,* (2012: 227) the chief sources contributing to contamination are: the place of preparation; cooking and serving utensils; raw material; time and temperature, of food preparation, abuse of cooked foods and personal hygiene of vendors.

Frying is a method that is commonly used to create pleasing tastes and visual appeal in food preparation (Bansal *et al.*, 2010: 503). It can also be considered a fast and convenient method of cooking, since it just requires throwing food into hot oil for a few minutes, after which it can be consumed.

However, use of the same oil for frying food too frequently can lead to health problems (Leong *et al.*, 2015: 5). Thus, this study examines the food safety and hygiene practices employed by informal food vendors in the WTA, as well as the trans-fatty acid content of their cooking oil. In the eThekwini Municipality it will provide valuable information to Environmental Health Officers to help with the development of strategies related to street food preparation and handling practices, as well as preparation and food vending legislation and policies. As it is the first study of its kind involving the WTA, the study's results will be made available to the municipality, as well as the owners of the outlets (if requested), in order to address any problems and further train the employees in the future.

1.2 BACKGROUND TO THE PROBLEM

1.2.1 The international perspective

Due to its easy accessibility and affordability, street food is consumed by an estimated 2.5 billion people worldwide daily (Food and Agriculture Organization (FAO 2012: 7). It has been suggested by Singh *et al.*, (2016: 266) that street food vendors are largely uneducated, untrained, and poor. There is often an ignorance of food hygiene among food vendors, which is a vital control and measurement for ensuring food safety from production to consumption. In the absence of passable food hygiene, food-borne illnesses can be transmitted through inappropriate food handling processes and in extreme cases can result in death (Grwambi 2020: 3; Luo *et al.*, 2017: 5822; Kamboj *et al.*, 2020: 358).

Six hundred million people worldwide become ill every year after ingesting contaminated food. Approximately 420 000 people, including 125 000 children under five years of age, are affected (World Health Organization, 2015). Scallan *et al.*, (2011: 12) state that in the United States (US) unsafe food consumed was contaminated with 31 known agents of foodborne disease and caused an estimated of 9.4 million illnesses, 55 961 hospitalizations and 1351 deaths in 2009. In the Zhapo province of China, at a coastal resort of Guangdong, it was reported that roughly

15 cases of foodborne disease outbreak were reported from 2008 to 2011 and these were traced to the negligence of food vendors (Zhang *et al.,* 2015: 457). Furthermore, 90% of the respondents in the Zhapo study were aware that raw food cannot be mixed with cooked food and only 44.40% realized that cooked food cannot be stored more than two hours at room temperature. Lastly, the negligence of food safety practices still persisted, with more than 66% of food vendors in Shijiazhuang, China being unknowledgeable about food safety practices and sanitation. These consumers were also not conscious that food mishandling can lead to contamination and cross-contamination (Liu *et al.,* 2014: 214).

Burke *et al.,* (2016: 83) reported that foodborne pathogens cause most gastroenteritis cases in Canada. In Canada, it is estimated that there are 4 million local acquired cases of food borne illness annually (Thomas *et al.,* 2013: 639). According to the Ministry of Health of Malaysia (MoH) (2012: 5), there were approximately 6 097 cases of food and water-borne diseases per 100 000 inhabitants in Malaysia, with a mortality rate of 0.03. It was announced in Malaysia that 151 198 food handlers were trained in 2012 during a food handling program. Nonetheless, out of 132.526 outlets inspected that year, 3 447 (2,6%) were shut down under section 11 of the Food Act (MoH 2012: 280), because of poor hygiene practices. The vendors in Ho Chi Minh City, Vietnam, were exposed to direct sunlight on 52.5% of their vending sites, leaving them unshielded from wind and dust as well as without access to potable water. Furthermore, 47.5% of the population lacked sufficient hand washing facilities, and 30% lacked adequate waste water and food disposal facilities (Samapundo *et al.,* 2016: 78).

As part of World Health Day in 2015, an emphasis was placed on food safety as a way to achieve food security (Uyttendaele *et al.,* 2016: 16). Efforts to reduce foodborne illness risks are incorporated into the evaluation of all aspects of the food production system. In the past decade food systems have undergone dramatic change, as issues of food and nutrition, food security and environmental sustainability came into prominence (Hueston and McLead 2014). There has also been a growing interest non-communicable diseases (NCDs) and how they are linked to nutritional food quality. This study aims to contribute to a growing body of literature in the topic.

1.2.2 The African perspective

The government generally does not regulate or protect street food vendors in most developing countries (Alimi 2016: 141). The immeasurable growth of street vended food which is not regulated poses a serious burden on municipality resources. Street vending poses a problem to cities because of its associated problems such as water contamination, littering and ground contamination through the discarding of used oil (Muyanja *et al.,* 2011: 1552).

A prominent association between urbanization and the growth of informal food supply systems has been noted by (Proietti *et al.,* 2014: 144). The surprising and extraordinary growth of the urban population and the corresponding growth in the working population throughout the world have increased the demand in the food provision industry for non-traditional services (Rane 2011: 100). Throughout this process, street food has shed its bad image and risen to be a viable, substantial part of the informal sector.

Despite this, street food is consumed every day by approximately 2.5 billion people worldwide because of its low prices and accessibility (Steyn and Labadarios 2011: 462). Additionally, in developing countries, street vendors provide up to 40% of the daily dietary intake of urban consumers. Thus, this raises questions about whether low-priced foods from informal vendors are safe and healthy or if they are harmful to consumer health (Crush *et al.,* 2011).

As a result of the polluted municipal water system, Opera *et al., (*2012: 116) indicate that there were over 9000 cholera cases reported in Ghana with 250 deaths reported. A study conducted by Apanga *et al.,* (2014: 99) reported that although 96% of food vendors in the Nadowli district of Ghana washed their hands after handling food when preparing it, 13% did not use soap. A further 13 percent of participants reheated leftovers the following day with no refrigeration and a further 13 percent consumed leftovers with relatives and friends. A study in Northern Nigeria found that only 2.7% of vendors had formal training in food preparation and that vendors had poor basic hygiene training. Vendors with parental knowledge acquired skills from their parents at a rate of 63.3% while contractors with self-training acquired skills at a rate of 33.7%. When packaging food for customers, 44.5% of vendors blew open the bag with their mouths. Further, 60% of food vendors operated in unclean environments and exposed their food to flies (Nurudeen *et al.,* 2014:174).

1.2.3 The South African perspective

A country located at the southernmost tip of the African continent, South Africa covers a land area of 1,22 million square kilometers and has a population of approximately 58.751 million people. A total of nine provinces are located in the country. Based on regional estimates of gross domestic product (GDP), Gauteng accounts for 34.94% of South Africa's economy, Kwazulu-Natal for 16.04%, and Western Cape makes up 13.86%. South Africa is experiencing an increase in poverty, according to Stats SA (2019), with over 30.4 million people living in poverty. In South Africa, Dube (2016) says almost 2.2 million people were never enrolled in school and are illiterate. In addition, 287 655 of those illiterates are between 25 and 34 years of age. In the first quarter of 2017, unemployment in South Africa increased to 27.7%, the highest rate since September 2003, which represents a rise of 1.2% in a quarter.

The number of people at risk of getting ill because of foodborne diseases has been on the increase in the past few decades. There have been numerous reports of foodborne illnesses in South Africa recently (National Department of Health 2011: 5). The Food advisory Consumer Services (FACS) (2017), states that food poisoning is a notifiable disease in South Africa. The number of people affected has been increasing steadily as the industry continues to grow.

In South Africa, near 279 pupils from Bojanala district in North West Province became ill after eating food prepared by the school feeding scheme, according to the Communicable Diseases Communique (2014: 1). Overall, 174 patients attended different local health facilities, while 9 were hospitalized. The child had consumed food purchased from the street shortly before his death, presenting symptoms such as diarrhoea, nausea, vomiting, fever, and abdominal cramps before being taken to hospital. Finally, the results of the epidemiological investigation and the laboratory results strongly suggest contamination of the food served at the school. Of the 37 people potentially exposed in the Tshwane district, 37 reported cramps or abdominal pain; 32 reported vomiting, 13 reported nausea, 9 reported fever, and 12 reported diarrhoea. Among food handlers, poor hand hygiene practices were likely the source of the outbreak as *Staphylococcus enterotoxin A* was the likely cause of the outbreak (Ntshinqa *et al.*, 2015: 235).

In their study, Oguttu *et al.*, (2014: 91) found that 52.2% of vendors from Tshwane Metropolitan drank water from the tank, 31.6% from home and 13.2% obtained water from other sources like nearby toilets, boreholes, and garages. A study that was conducted in Alice in the Eastern Cape revealed that ready-to-eat foods from informal food vendors contained

more organisms than that from formal food vendors who had running water and cement floors (Nyenje *et al.,* 2012: 2614).

The nutritional value and impact of the food sold by informal vendors on the roads of the eThekwini municipality are, however, poorly documented. Table 1.1 below shows studies conducted on food safety knowledge in SA between 2006 and 2020.

Table 1.1: Studies conducted in South Africa (2006 – 2020) on food safety knowledge and hygiene practices of food vendors.

Author and year	Study Population – –	Measuring Instruments	Summary of results
DLOMO, K. N. 2019. *Food hygiene and safety practices of food handlers in tuckshops at secondary schools in Umlazi*	This study was conducted in Umlazi, Durban. The sample for this study was 18 Secondary Schools.	Food handler observation sheets to monitor food handling and cleanliness. Hand and environmental swabs. Food Handler's and Manager's questionnaire.	Majority of the food handlers had never received training on food hygiene and safety, which resulted in higher microbial outcomes and which posed the risk of food poisoning.
SIBANYONI, J. J.,TSHABALALA, P. A. & TABIT, F. T. 2017. Food safety knowledge and awareness of food handlers in school feeding programmes in Mpumalanga, South Africa. *Food Control,* 73, 1397-1406.	This study was conducted in Mpumalanga Province The sample for this study was 69 public schools.	Conducted interview with NSNP food service in schools to gather demographic characteristics, microbiological food safety hazard knowledge and food safety attitude.	In Mpumalanga the school feedingscheme showed that most food handlers participating in food preparation lacked adequate knowledge concerning microbial food safety hazards.
MJOKA, J. & SELEPE, M. 2017. Food hygiene practices and attitudes of the street food vendors at KwaDlangezwa, Northern KwaZulu Natal. *African Journal of Hospitality, Tourism and Leisure,* 6, 1-12.	This study was conducted in KwaDukuza, Northern KwaZulu Natal. The sample for this study was 8 vendors.	In order to gather information regarding the perceptions and knowledge of street food vendors, there were interviews conducted. Food safety and hygiene observation checklist for recording information.	Despite their ignorance, street food vendors do follow basic food safety practices.
KHULUSE, D. S. 2016. *Food hygiene and*	This study was conducted in Durban	Food preparation and cleanliness observation sheets for FHs.	It is urgently needed that decent food kiosks be built. A lack of practice or

Author and year	Study Population – –	Measuring Instruments	Summary of results
safety practices of food vendors at a University of Technology in Durban	University of Technology. The sample for this was 15 food vending stalls.		demonstration of knowledge was evident.
OGUTTU, J. W., MCCRINDLE, C. M., MAKITA, K. & GRACE, D. 2014. Investigation of the food value chain of ready-to-eat chicken and the associated risk for staphylococcal food poisoning in Tshwane Metropole, South Africa. *Food Control,* 45, 87-94.	Study participants were drawn from 2,345,908 people in the Pretoria Tshwane Metropolitan.	An approach based on participatory risk assessment was used to collect information on food safety in environments with low data availability. Structured interviews and focus groups were conducted.	A hygiene training program is imperative in order to minimize the presence of S. aureus on the chicken.
NIEHAUS, A. J., APALATA, T., COOVADIA, Y. M., SMITH, A. M. & MOODLEY, P. 2011. An outbreak of foodborne salmonellosis in rural KwaZulu-Natal, South Africa. *Foodborne pathogens and disease,* 8, 693-697.	Microbiological testing was available on 37 stool samples and food samples.	In order to investigate the commonality of isolates, phenotypic and genotypic techniques were used.	Salmonella Enteritis was found to be the cause of an outbreak at a school function due to contaminated food. A challenge continues to exist in rural areas when it comes to epidemiological investigation.
CAMPBELL, P. T. 2011. Assessing the knowledge, attitudes and practices of street food vendors in the city of Johannesburg regarding food hygiene and safety. University of the Western Cape.	Vendors selling cooked foods on the streets of Johannesburg who are certified. The intended sample for this study was 378 rounded to 400, but due to unforeseen circumstances, only 150 street vendors were recruited.	In-depth interviews with street food vendors were conducted to assess their knowledge and attitudes. Recorded information about food safety and hygiene practices using an observation checklist.	The findings demonstrated that street vendors generally understood the principles of ensuring safe food. Statistically, there was also a substantial difference between street food vendors who received training and those who did not.
MAYRHOFER, A. M. & HENDRIKS, S. L. 2003. Service provision for street-based traders in Pietermaritzburg, KwaZulu-Natal: comparing local	To determine the level of service required, an interview was conducted. In the study, 98 Pietermaritzburg traders and ten Kwazulu-Natal service providers were examined.	Samples surveyed in four international studies were assessed.	Service delivery establishments must have the capacity to design and deliver suitable services. It is imperative that service delivery establishments serve the informal sector.

Author and year	Study Population – –	Measuring Instruments	Summary of results
findings to lessons drawn from Africa and Asia. *Development Southern Africa,* 20, 595-604.			
VON HOLY, A. & MAKHOANE, F. 2006. Improving street food vending in South Africa: Achievements and lessons learned. *International journal of food microbiology,* 111, 89-92.	There was no defined study population. Prior studies in South Africa were reviewed by the researcher.	This study did not use any measuring instruments. Conclusions were derived from the research's previous findings.	In developing countries, improving the safety of street sold foods is a huge challenge. Conducting research on street vended foods is necessary for determining their safety and socioeconomic impact.
MARTINS, J. 2006. Socio-economic and hygiene features of street food vending in Gauteng. *South African Journal of Clinical Nutrition,* 19, 18-25.	South Africa was the location of the study, which involved 200 street food vendors and 800 customers. The number of samples collected amounted to 200.	The researcher interviewed the customers to gain insight into the reasons why they buy street foods as well as their experience of eating them. Tests on street food samples were performed in order to assess the microbiological safety of the food.	According to the survey, most vendors maintain high hygiene standards during the preparation and serving of food. The microbial count was quite low in the microbiological tests. The study also determined that street food consumption carries minimal health risks.

1.3 RATIONALE AND MOTIVATION

It has only been within the past few decades that street food vendors have been researched and recognized as an important element of urban livelihood and food provision. The informal street food vending industry has received support especially from people who work far away from home, have no time for cooking, and need readily prepared food (Proietii *et al.,* 2014: 144). According to Sun *et al.,* (2012: 159) the food vending industry has become succeeded due to low input costs and overheads. In South Africa, approximately 2 565 000 individuals worked in the informal sector in 2016 (Stats SA 2016: vi). Moreover, a large portion of the population have considered informal food vending as a source of income.

Researchers have found that in developing countries, there is a lack of hygienic water at vending stands, the disposal of wastewater and garbage in the streets, dust contacting food materials, and flies that may cause pathogens to flourish (Samapundo *et al.,* 2016: 80). According to Asiegbu *et al.,* (2016: 423), vendors often target crowded areas, such as access points to transportation and swarming sidewalks, in the Johannesburg municipality, South Africa. So, food sold on the streets is frequently prepared under unfavourable conditions and hygienic conditions. Compared to formal food vending systems, informal food vending systems do not comply with government regulations and are not protected by the government (Alimi 2016:2).

Food hygiene is a pre-requisite in the proper preparation, processing, delivery, storage, and the marketing of food (Uneke *et al.,* 2014: 10). This is necessary to avoid poisoning related to the consumption of contaminated food. Nevertheless, food hygiene is depended on the personal state of hygiene and practices of the personnel working in food vending establishments. Gordon-Davis (2011: 68) explains that equipment and utensils must be maintained hygienically, failure of which might cause food poisoning. A lot of effort is made in developing countries by health ministries to promote food safety and hygiene among street food vendors. Although these efforts have contributed to a higher level of awareness and knowledge regarding food safety and hygiene practices, they do not always translate into practice (Apanga, A 2014: 99).

According to Kok (2014: 188), studies of this kind have demonstrated that Durban's street food vendors have an adequate knowledge of food safety and hygiene principles. This study aims to determine if the vendors in WTA have enough knowledge and apply food safety and hygiene practices during the food preparation process.

The majority of street food vendors aim to reduce input costs and thereby reuse cooking vegetable oil several times to fry before discarding it (Ngozi *et al.,* 2019: 73). According to Idun-Acquah *et al.,* (2016: 8), one of the research studies shows that before vegetable oil is discarded it is used 3 – 6 times. Fernandes and Draghi (2016: 2) state that only when the oil becomes dark, foamy, and smelly is it eventually discarded. Accordingly, deep fat frying diminishes unsaturated fatty acids in oil and increases foaming, colour, viscosity, density, specific heat, and content of free fatty acids, polymers, and polar materials (Esfarjani *et al.*, 2019: 2303). Nevertheless, free radicals produced in rancid oils can damage DNA and the arteries, as well as act as carcinogens, which are substances that cause degradation (Abriana *et al.,* 2016: 8905). As a result of frequent consumption of rancid oils, you could become prematurely aged, have high levels of cholesterol, gain weight abnormally, which in the long run could ultimately cause chronic conditions such as cancer, atherosclerosis, neurological disorders, and heart diseases (Okparanta *et al.*, 2018: 71).

Laake *et al.,* (2013: 1389) conducted a study based on observation and random trials on food preparation and found that there is an unfavourable effect associated with the intake of Trans Fatty Acids (TFA). This has an influence on numerous risk factors like cardiovascular diseases – which are mainly based on comprised blood lipids, lipoproteins, and endothelial functions. The intake of TFA may possibly stimulate aspects related to risks associated with cancer including: a systematic inflammation, insulin resistance, and adiposity. However, the link between cancer risk and the intake of TFAs has not been satisfactorily established.

This is the first research of its nature in the WTA. This report will provide valuable information for Environmental Health Officers in order to formulate strategies to adapt safe street food preparation and handling practices, as well as food vending laws/policies within the eThekwini Municipality.

1.4 STUDY AIM

This research aims to determine the food safety and hygiene practices and the trans-fatty acid content of vegetable cooking oil used by the informal food vendors in the WTA. This is in order to provide guidance on the dangers associated with re-using vegetable cooking oil and precarious food handling practices.

1.5 STUDY OBJECTIVES

The specific objective of the study is to investigate the oil safety, hygiene practices and food safety knowledge of informal food vendors at the WTA in eThekwini by:

- Investigating the demographics of informal food vendors at WTA in eThekwini by determining the demographic characteristics of the informal food vendors by means of a socio-demographic questionnaire.
- Investigating the quality of used vegetable cooking oil by informal food vendors at the WTA in eThekwini by preliminary screening of vegetable cooking oil through the analysis of a 3M^{TM} oil quality test strips to check the concentration of free fatty acids, and post – screening of vegetable cooking oil through gas chromatography (GC) by analyzing trans fatty acids content.
- Investigating the hygiene practices and food safety knowledge by informal food vendors at the WTA in eThekwini by determining the food safety and hygiene practices of the informal food vendors by means of a food handlers' questionnaire.
- Observing the food and safety practices of the vendors by using an observational check list.

1.6 PLAN OF RESEARCH ACTIVITIES

Table 2 below depicts the plan of activities for the study, from inception till the delivery of the final thesis.

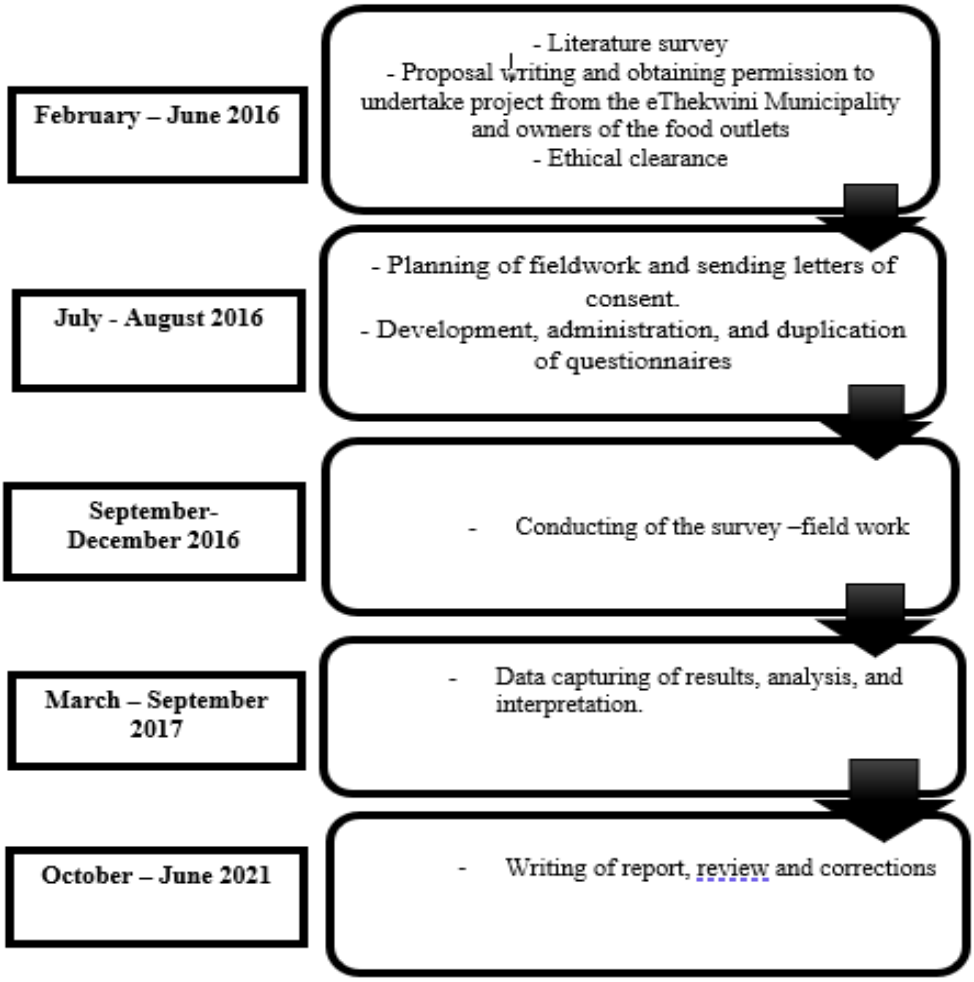


Figure 1.2: Plan of research activities

1.7 STRUCTURE OF THE DISSERTATION

The dissertation comprise of 5 chapters as described in Figure 1.3 below.

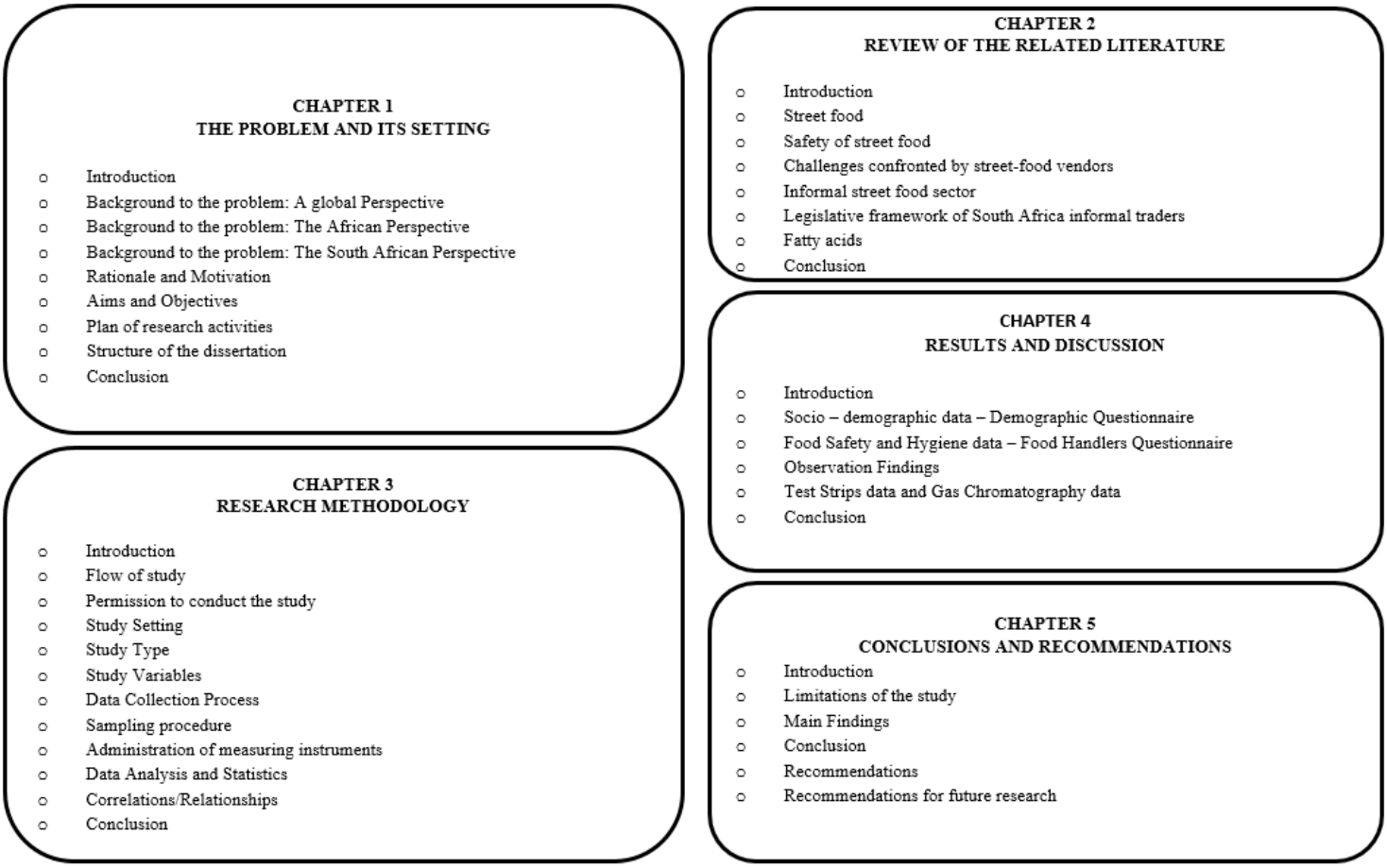


Figure 1.3: Structure of the dissertation

1.8 CONCLUSION

The intended output of this study is to determine the standard of food safety practises and quality of vegetable oil used for cooking purposes by the informal food vendors. This will be achieved through face-to-face interviews with food vendors, and by observing the food vendors at work and transcribing these observations for analysis. It has been recognised that internationally, street food vending is a concern and a vital public health issue (Rane 2010: 100). African based studies also show that the leading cause of illness and death in developing countries is foodborne diseases (Baluka *et al.,* 2015: 31). Additionally, the lifestyle of large populations in the developing world consume food bought from street vendors, with consequent health risks brought about by some practices that may be considered unhygienic in

the food handling process (Akhtar *et al.*, 2014: 348). The extent of the understanding of food safety knowledge by street vendors, and how they handle food prior to being sold to the general public, is the main motivation of this study. The study has policy and safety implications for the eThekwini Municipality. The study can also contribute to educating and training the vendors to improve knowledge and practices.

CHAPTER 2: REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

The United Nations project that by 2050 there will be 9 billion people on the planet, according to (Proietti *et al.* 2014: 144). In developing countries and in emerging, poverty stricken area, there will be a 98% increase in population, based on the same estimates. . In addition, there will be a considerable increase in urban populations, during this period, with an estimated 6.4 billion people being urban based. (World Health Organization (WHO) 2010: 15). Hence, the fast expansion of urban areas demands more food availability for commuters who live in an environment perceived as unfavourable to agricultural activities. According to Mateo-Sagasta *et al.,* (2017: 1), water, which is a critical agricultural production resource is becoming scarce s because of domestic and industrial excessive usage thus jeopardizing food supply. Poor urban commuters face a high risk of consuming inadequate and low-quality food, including street food that is often unhygienic, and this exposes them to health risks, according to (Alkon *et al.* 2013: 128). So, urbanization and the development of informal food supply systems are associated (Vorley and Lançon 2016: 4; Jonah and May 2020: 3).

In this chapter literature about informal street food vendors and the role of the informal economy on the populace at large will be reviewed. The literature will be based on the proposed street model with its tools (Hill *et al.*, 2019: 17). This model deals with street business guidelines, guidelines for food and nutrition in the street, the component of street food hygiene and the proposed street food-vending cart. Last but not least, a literature review will be conducted on frying methods and overused cooking oil.

2.2 STREET FOOD

There is relatively high awareness of the commercial and domestic food sector in South Africa, particularly when compared to other countries within the continent. According to the Competition Commission South Africa (CCSA) (2019), informal food sector still accounts for 40 to 50% of sales and annually is worth R360 billion. This industry is categorised of small-scale owner-operated enterprises who sell food in various kinds. This includes street traders, hawkers, spaza shops and vendors who are trading from the back of their bakkies (trucks), also

known as “bakkie traders”. The formal food and grocery sector employs fewer people than this sector (Wegerif 2020: 797).

Street vending is a livelihood strategy developed by people with less or limited resources. These people use street vending as a source of their livelihoods. Selling of ready meals by street vendors supports the low-income population, and is an important means of providing livelihoods for this group of people, considering their socio-economic vulnerability (Gamieldie and Van Niekerk 2017: 25). Often, these people do not have any other means of sustainance, so street vending becomes an important livelihood strategy. In developing countries and around the world, street food offers a range of commodities and nutrients, assisting in meeting nutritional needs as well as providing convenience, variety, and choice. Furthermore, street food is an affordable option due to its low-cost advantage (Nonato, Minussi *et al.,* 2016: 3).

Furthermore, street foods contribute to the socio-economic environment in various ways, including job creation, providing a salary for those who form part in production or selling, and the improvement of local economies and the preservation of the local food culture (De Cunto *et al.,* 2017: 17). Street vending, therefore, is important in alleviating poverty in places where alternative means of livelihoods are hard to come by, such as in high density residential areas in most urban centers.

Despite the benefits presented by street food trading on food security, street vending is associated with risks related to food safety. Pathogenic micro-organisms and hazardous chemicals may contaminate food during preparation and food sale due to exposure. Vending sites often do not have adequate and clean water, disposal of waste, and sanitary facilities. Also, conditions of transport play a role in the overall challenges in managing and developing street foods vending, as some means of transportation may compromise food cleanliness (Alimi 2016: 145).

According to (Letuka *et al*., 2019: 11) currently, a persisting and common problem globally that results in morbidity and significant mortality is food poisoning. It has been reported that people who consume street foods often suffer from food borne disease like cholera, diarrhoea, typhoid fever and gastroenteritis (Islam *et al.,* 2015: 481). Temperature, storage, and relative

humidity can all cause food contamination, so multiple factors contribute to the problem. Hence, it is critical to observe optimal hygiene during food handling and storage (Daou *et al.*, 2021: 416).

Figure 2.1 depicts Hill *et al.*'s street vending model, together with its associated tools.

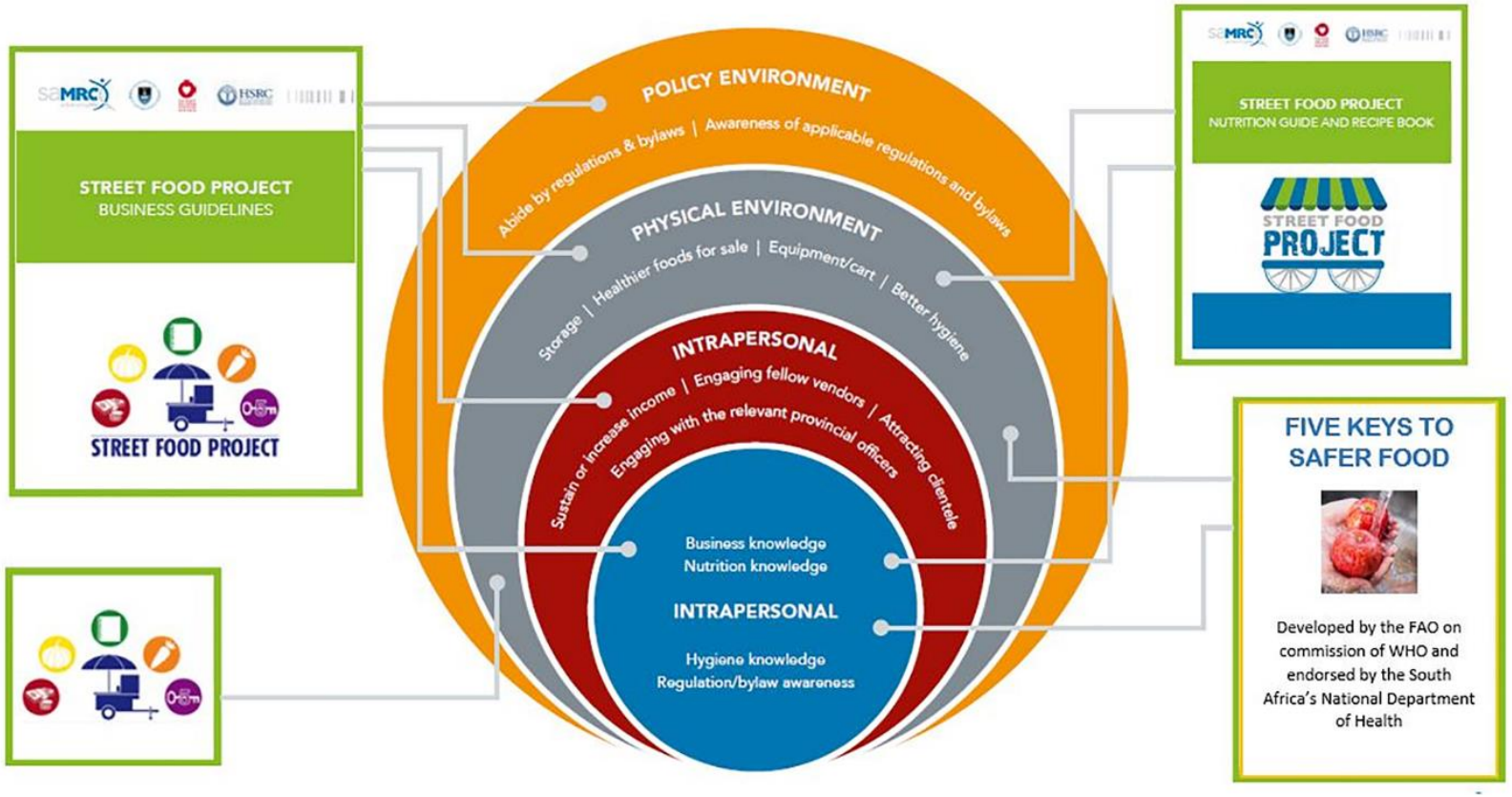


Figure 2.1: The proposed street model with its tools (Hill *et al.*, 2019: 17).

In accordance with the proposed street model (figure 2.1), business components, food and nutrition components, hygiene components, and vending cart components can be categorized. These four components, together, have an influence on most of the other elements in the socio-ecological framework, namely, intrapersonal/individual, interpersonal factors, physical environments, and policies. It is imperative that any public health endeavours are not only focused on individuals and their practices, but also on the context in which they live. The guidelines presented in this article have been simplified as much as possible in order to be applicable to those in low- and middle-income countries (Hill *et al.,* 2019).

2.3 BUSINESS COMPONENT

The data reveals that the majority of vendors are vending without any form of licensing or certification (Horn 2018: 6). Also, research showcase that the working hours of vendors are long, almost every day of the week, but in 2019 they still made less than R1 000 per week (Hill, Mchiza, Puoane and Steyn 2019: 401). The application of logbooks or inventories by vendors is limited. Moreover, vendors tend to purchase from supermarkets and similar shops instead of purchasing from wholesalers in bulk. Therefore, following the stock inventory principle is often difficult. Potential vendors considering starting a food vending business and existing vendors should be introduced to a business guideline comprised of 12 concise messages. The 12 messages are - to do research, to find start-up financing; to plan food types; to contact the relevant by-laws; to obtain a business license/certificate; the vending cart or unit/stand; to store inventory and cart; to entice clients; to promote the business; to keep logs; and to safeguard money (Hill *et al,*. 2019: 18).

According to Skinner (2017: 11), there is almost no literature and studies quantifying the contribution of informal traders and street food to affordable, accessible meals for low income households. Across 11 cities in Southern Africa, the African Food Security Urban Network (AFSUN) studied household food security (Battersby 2012: 3). A total of 6 453 households were surveyed in specific low-income neighbourhoods in the 11 cities on a range of food security issues and their food sourcing. Seventy percent of households in this survey purchased food from informal outlets. Among the households that utilized the informal food economy daily, 32% did so daily, and 59% did so at least one time per week. Crush and Fryne (2011: 792) summarized these results. Based on the data collected by the survey in the neighbourhoods and cities where it was conducted, it appears the more food insecure and low-income

households are, the greater the likelihood for them to rely on the informal sector as a food source.

Formal and informal economies are highly integrated and have a wide range of business relationships. There is considerable disagreement about the protagonist of informal activities when it comes to stimulating broader economic activity, as described below (Studies 2010: 280).

- *"The informal sector, on the one hand, is viewed as a dynamic sector that can play an important role in creating jobs as well as contributing to economic growth. Through a gradual process of formalization, informal activities may eventually yield tax revenues."*
- *"The informal sector, on the other hand, is perceived as a low-productivity occupation or as a survival strategy for poor households. Formal and informal sectors play passive roles in developing countries, and they act as temporary substitutes for social protection during period of formal sector-led growth ".*

In South Africa, it appears that both perspectives are relevant when considering how an informal economy encompasses survivalist and enterprise-related activities (Davies and Thurlow 2010: 9).Table 2.1 below shows the different types of informal activities, and a description of their employment types.

Table 2.1: Four types of informal activities and employment

Type	Description	Are distinct formal and informal goods produced?		Is there price competition between formal and informal goods?		Is there wage competition between formal and informal workers	
Informal producers	• A small firm that produces goods and services that compete with formal sector firms, for example, processed foods, textiles, clothing. • There are informal producers who generate jobs for a number of other informal workers and compete in the market to supply their goods at the lowest possible price. Through the purchase of formal sector intermediates and the sale of commodities to formal consumers under price competition, the informal sector has a significant link to the formal sector.	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
		√		√			√
Informal traders	• A product is not produced by informal traders. Typically, they buy formal sector goods and resell them to consumers at a fixed markup or margin. As a result, goods that are informally traded will typically be more expensive than those that are formally traded. Having smaller volumes and a closer proximity to the consumer gives them an advantage.	**Yes**	**No**	**No (fixed margin)**		**Yes**	**No**
			√				√
Informally employed informal sector	• Informally employed" workers employed in the formal sector on a casual basis". In other words, they have no contracts; not unionised; and no benefits. Examples include construction sector day labourers or agricultural seasonal employees working on commercial farms. The wage rates of these workers compete with those of formal sector workers.	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
			√		√	√	
Non-competitive informal activities	• These workers are part of the informal workforce employed in formal sectors. In spite of recent regulations, domestic workers may still be considered casual employees of formal sector firms (since formal sector firms do not provide domestic services).	**Yes**	**No**	**No (sold to formal sector)**		**Yes**	**No**
			√				√

(Source: Davies and Thurlow 2010: 9)

Table 2.1 lists the four types of informal activities. four types of informal producers: (1) informal producers competing against formal producers in product markets; (2) informal traders who sell formal sector products at a fixed transaction cost margin; (3) workers employed on informal contracts to produce formal sector products; and (4) informally employed workers who produce goods and services not produced by formal sectors. The table shows that formal and informal traders are distinct, but they compete in terms of the prices of their goods and the wages that they offer to their employees. It also shows that the workers themselves who are employed in the formal sector also compete with those in the informal sector in these aspects. Additionally, the table indicates that non-competitive informal activities are unlikely to face competition like those in the regular formal and informal sectors.

There is, therefore, an advantage of providing a clear framework through the classifications of informal activities and employment for determining how different policies may have different effects on specific acts within the informal and formal economies. By exploring the different channels linking formal and informal activities, for example, product market prices, labour market wages, and informal trader margins (Davies and Thurlow, 2010: 441), one could identify informal and formal transmissions channels.

2.3.1 Legislative framework for South African informal traders

Street trading in South Africa is regulated and governed by municipal bylaws and policy at the local government level, according to (Selepe 2019: 367). Municipalities are empowered to draft and implement such by-laws under the Business Amendment Act 186 of 1993 and in accordance with the Business Act 72 of 1991 (Crush *et al.*, 2017: 11). Legislation to give effect to local government laws, such as the Municipal System Act 32 of 2000, need to be in alignment with municipal by-laws and the Constitution of the Republic of South Africa Act 108 of 1996. The details of these acts and bylaws will be discussed below.

2.3.1.1 Constitution of Republic of South Africa Act 108 of 1996

(a) Bill of rights

According to the Constitution of the Republic of South Africa (1996: 5), the Bill of Rights outlines the number of rights and protections which apply to the people of South Africa. These

rights are pertinent to the lives and treatment of street vendors, just as there are to the other citizens of the country. According to section 9 of the Constitution, everyone is the same before the law, and has the right to the same protection and benefit of the law. As part of Section 22, the right to freedom of trade is described. It states that every citizen has the right to freely choose their trade, occupation, or profession, but it includes a clause that states the law has to regulate the practice of that trade, occupation, or profession. Furthermore, informal trade can also be regulated, despite the extension of freedom trade.

(b) Business Act 72 of 1991

The Business Act (1991) is a significant piece of legislation that recognises and adds value to the small business sector in South Africa, as it realises the sector as key contributing to the success of the economy as a whole. As a result of apartheid, people were barred from participating in the formal economy, which consequently led to the development of an informal economy (Gamieldien and Van Niekerk 2017: 12). This Act, therefore, aims to address this imbalance in the sector by giving the same recognition to the dual formal and informal economy in South Africa.

(c) Municipal Systems Act.

Constituents define the purpose of development duties, as well as the authority and functions of local governments. The local government is also given the power to issue by-laws to govern street trading. Section 152 of the constitution outlines the objectives of local government, which includes delivering democratic and accountable service to local populations. The Constitution also promotes social progress, enhances the economy, and encourages communities and organizations to become more involved in local government. Additionally, section 156 refers to the authority's functions within the local governments and states that a community has executive authority over certain local government matters including street trading and has the right to administer those matters. Therefore, pursuant to Section 162 of the Constitution, municipalities are tasked with making street trading bylaws which may only be enforced after having been published in the provincial official gazette and which must be available for public inspection (Constitution of the Republic of South Africa 1996: 74-80).

2.3.2 Street trading by-laws

A by-law is a public governing law that has the responsibility to regulate informal vending in a given demographic area, among other things. In addition to license conditions, payment

options, food safety, road traffic safety, and the location of street vendors, street vending laws also cover many other aspects which will be discussed in depth in the next section (Msoka and Ackson, 2017). In many countries, street trading is regulated by the municipal codes (David *et al.*, 2013: 58). In South Africa, by-laws are the responsibilities of local municipalities, and are meant to assist municipalities run their affairs in a regulated manner. Activities such as street advertising, city planning, vending, waste management, etc, are the responsibilities of local municipalities, and are regulated by by-laws. It is the responsibility of municipalities to ensure that these by-laws are enforced to ensure the smooth running of municipalities.

2.3.2.1 Permit and Fees

For informal traders to operate legally, they must obtain a permit from the municipality, a licence card, and a valid trading approval. Without these permissions, one runs the risk of operating illegally. The eThekwini by-laws on informal trading (eThekwini Municipality 2014: 15) state that informal trading permits are open for application to the general public for informal trading on municipal property, subject to the provisions of the relevant by-laws. Traders need to have a permit to be allocated lawful vending spaces, or for them to operate from designated vending sites. Vending permits are open for all citizens of the country, and importantly, can be offered to individuals or partnerships with similar interests. A fee is payable for one to obtain a vending license. In order to apply for a permit for informal trading, a form must be prescribed by the municipality. Municipalities also take certain factors into consideration when granting informal trading licenses. In addition, first-time applicants, the unemployed, physically disabled, and the black are given preference for licenses.

In order to receive a trading license or permit, vendors must pass an assessment exam led by the Health Department, taking into account the different rates for operating permits. Through the eThekwini Informal Economy Policy of 2001, the complicated costs of permits and licensing procedures are addressed. Since the existing SMME policy provides very little funding to small businesses (Skinner 2017: 432), this policy offers a comprehensive, consistent approach towards funding them.

2.3.2.2 Regulation of vending sites

The Container Policy of the eThekwini Municipality (2006: 8) states that 74% of traders within the municipality trade without licenses, and that 18% are leasing trading stalls from private individuals. Reports also indicate that 50% of the traders are behind with their monthly rentals, and only 26% operate officially with licences. It is common for local governments to have strong restrictions regarding the areas in which street vendors may operate. Street traders are prohibited from operating at places and areas where street trading is prohibited, such as in the city of Cape Town and city of Durban. Other prohibitions are trading outside of an established shop that trades in similar wares, or where trading may cause an obstruction to vehicular flow. Trading is also not permitted outside of church buildings, council buildings, or outside of residential buildings. In addition, street trading is not permitted in areas protected under the National Monument Acts, 1969 (Act No. 28 of 1969) unless written permission is granted by the Council. Vending is generally not accepted where vending stations block walkway of existing buildings, or where vending sites have already been allocated to other vendors, or outside of a state or Council Building (Khuluse 2016: 28).

2.3.2.3 Health and safety regulations

Mokoatle *et al.*, (2016: 1) note that the purpose of the municipal policies is to improve food hygiene standards and enforce compliance to minimise food-borne illnesses in the community. Furthermore, food policies are meant to serve as continuous improvements for food handling practices (WHO 2012: 1). As part of protecting the health of the community, every street vendor must practice hygiene and sanitation during the course of conducting a trade by, for example, ensuring that no fires are made in an environment that will harm people or damage property. As well as that, the environment should be safe for trading, public health regulations are followed, and there should be no garbage surrounding the trading area. Therefore, vendors are expected to abide by directives of municipal authorities where health and safety regulations have to be enforced. It is also the vendor's responsibility to ensure that the business area is always clean and hygienic. Vendors that prepare food have a responsibility to make sure the food they prepare is prepared in a hygienic environment and according to Health Department requirements.

2.4 FOOD PROVISION AND FOOD SECURITY

According to research on street vendors, many of them sell packaged snacks, sweets, sweetened beverages, and cooked food to their customers (Marutha and Chelule 2020: 5). Also, research results reveal that both vendors and consumers have poor nutrition knowledge (Mamun *et al.,* 2020: 48). Therefore, vendors can be empowered by the basic food and nutrition guidelines thus providing knowledge and enabling them to make informed decisions regarding the food they sell (Hawkes 2013: 6). Moreover, the South African food-based dietary guideline is recommended as the reference source for street food vendors (Hill *et al.,* 2019a: 18).

2.4.1 Food security In South Africa

Mbow *et al.,* (2020: 442) indicate that recent global challenges of household food and nutrition security have increased as the tough economic restrictions and impacts of climate change put new and additional stress on food systems. The Food and Agriculture Organisation (FAO) in collaboration with FAD note that the world is not on track to attain Sustainable Development Goals (SDGs) in ending hunger by 2030 (FAO 2020). Various organization reports (WHO, WFP, UNICEF, IFAD and FAO, 2018) have stressed that in 2017 nearly 821 million people globally were undernourished (Janssens *et al.,* 2020: 829). Besides, the rating scores of the Global Hunger Index (GHI) revealed that out of 119 countries 52 had scores rated as serious, alarming, and extremely alarming in terms of hunger (International Food Policy Research Institute (IFPRI), 2017). Therefore, in achieving the 2030 SDGs to end global hunger, more countries are getting to acknowledge the necessity of strengthening food and nutrition security and have put up mechanisms to monitor the attainment of the Sustainable Development goal of ending hunger amongst their people (Egal 2019: 96).

South Africa's Constitution guarantees the right to food. All citizens in South Africa have a right to adequate food and water under section 27(1) (b) of the Constitution. Also accentuated in section (27) (b) of the Constitution is the responsibility of the State in ensuring reasonable legislative efforts to ensure these rights are achieved (Nkrumah 2019: 50). Thus, to meet the right to food, the availability, accessibility, and adequate food must be available for everyone without discrimination (WHO 2018: 3). Hence, the responsibility to develop agricultural policies and programs support initiation lies with the Department of Agriculture, Forestry and Fisheries (DAFF) to ensure that South Africans can produce their food and reduce food

insecurity (Termeer *et al.*, 2018: 89). Additionally, the Food and Nutrition Security Policy holds key importance in achieving the global Sustainable Development Goals and National Development Plan. Lastly, SDGs goal two commits to eradicating hunger, achieving food security, improved nutrition, and promote sustainable agriculture by 2030 (Grosso *et al.*, 2020: i22).

Various studies indicate that that there is a combined effect between food security, unemployment, poverty, and inequality (FAO 2017; Wight *et al.*, 2014). The South African National Development Plan (NDP) stresses that the cause and consequence of poverty is food insecurity. A report by Statistics South Africa in 2017 was released looking at poverty and inequality trends in South Africa between 2006 and 2015. This report indicated that the population living below the food poverty line of R441 per person monthly in 2015 was more than a quarter (25,2%) compared to almost a third (28,4%) in 2006. South Africa experience an increase in the proportion of people living below the food poverty line between 2006 and 2009, with the proportion of people below the poverty datum line increasing from 28,4% to 33,5%. However, post this increase there was a decline in the number of people below the food poverty line to 21.4%. This was, however, followed by an increase of 3.8% to 25.2% in 2015 (Stats 2017). Due to the global recession in 2009, South Africa also noted an increase in food poverty. In addition, low-income households tend to be affected by economic shocks more than those with higher incomes, which explains the significant rise in food poverty during the economic crisis.

South Africa is food secure at the national level. This is witnessed by the GHS results that showcase that 6,8 million people experienced hunger and 10,4 million people had insufficient access to food in 2017 (Stats SA 2017). Even though there is sufficient food available for everyone through domestic food production and food imports, at household level the access to food is still a challenge as a result of high levels of income inequality. The Quarterly Labour Force Survey indicated that in the third quarter of 2017 the unemployment rate stood at 27,5%. Therefore, all the discussed factors above have a direct and indirect impact on the country's food security. Furthermore, elevated poverty levels and unemployment have a direct influence on a household's ability to access food. Significant differences in income levels result in some households struggling to access food even though food is in itself food secure.

Approximately 12,7 million households in South Africa, out of 16,2 million households, reported in 2017 that they had adequate access to food. The amount of people experiencing inadequate food access was only 2,5 million, while 0,9 million people considered their food access severely inadequate. On a provincial level, Limpopo has the highest proportion of households with adequate access to food (93,6%). Gauteng has the second highest proportion (84,0%). While the Northwest ranked highest in terms of households reporting inadequate access (although above the national average of 15,8%), Northern Cape (20,5%), Eastern Cape (20,1%), KwaZulu-Natal (18,6%), and Mpumalanga (18,6%) ranked highest in terms of households reporting insufficient access. In addition, the Northern Cape (13.0%), Mpumalanga (12.3%), and Northwest (11.6%) were the provinces in which access to food was almost twice as poor as the national average (Stats SA 2019).

Based on the population group, black African-headed households had the highest proportion of inadequate food access (17,9%), followed by coloured households (13,5%). Also, the highest proportion of households with severe inadequate access to food is headed by coloureds (8,3%). Furthermore, the highest proportions of households who reported having adequate access to food are white-headed households (96,6%) followed by Indian/Asians (93,2%) (Stats SA 2019).

2.5 FOOD SAFETY AND PERSONAL HYGIENE

Conditions that allow for the growth and transmission of food-borne pathogens and other microorganisms are generated by unhygienic practices during food preparation, distribution, and storage (Hemalata and Virupakshaiah, 2016: 1017). Also, the risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practices of food hygiene. Hence, infected food handlers and their unhygienic food handling practices attribute to many food borne diseases and outbreaks (Aklilu *et al.*, 2015: 2).

2.5.1 Personal hygiene

The consumption of canned food and buying ingredients from street and market vendors presents significant public health risks, primarily due to inadequate hygienic practices, as cited by Bereda *et al.*, (2016: 168). There are many instances where vendors do not have adequate

washing facilities, so when they return to work afterwards they are not properly bathed. It is not unusual for vendors to sleep at vending sites in order to protect their property (Muyanja *et al.,* 2011: 1551). This leads to repeated contamination of food and ingredients from unwashed hands and the material used for wrapping. Despite this, some vendors know the importance of wearing clean, proper clothing when handling food (Akabanda *et al.,* 2017: 4). Thus, some vendors wear aprons and hairnets as the result of this. After a few awareness-raising campaigns for vendors, it is widely understood that clean clothes and utensils are essential (Khairuzzaman *et al.,* 2014: 8).

Food vendors are sometimes hindered by a lack of water points and poor drainage from their workplaces in ensuring good hygiene practice. Furthermore, research indicates that vendors usually use the same buckets they use for washing for food preparation, thereby posing an additional health risk. A contamination of foods with fecal matter can result from this exercise. Further, a large number of vendors operate their establishments without obtaining a license or a health certificate. This poses another risk as it may mean that these vendors do not have adequate training in terms of food handling and preperationan (Sun *et al.,* 2012: 162).

2.5.2 Hygiene of the environment

There are serious concerns raised by studies on the danger associated with exposure to street foods in vending sites (Thi Kittirath *et al.,* 2021). To enhance their sales and display their products it is in the nature of the street food vendors to target high human traffic areas as places of food preparation, handling and selling. The common sites of food vending are such areas as major street corners, industrial construction sites, bus and train terminals, public places, and school premises. In most instances, the vending sites are either mobile or stationary, or through using an open or protected crude structure such as pushcarts, display wooden tables, aluminium trays or bowls, or chop bars (Adimasu *et al.,* 2016: 2). Either way, food is exposed through these methods, thereby causing a health risk.

Kotzekidou (2016: 20) state that refuse disposal facilities are often inadequate at food vending site, resulting in the increase of waste at these sites. This then results in an accumulation of pest infestation, leading to an enhanced risk of food contamination. This is due to the fact in many occasions city planning is not inclusive of vending sites, resulting in a an accumulation of waste as waste collection is often not as often in these sites. Municipalities often worry that if they

offer services to illegal operations, this will be interpreted as recognition of them. Due to the non-payment of vendor contributions towards maintaining public services, however, vendors are not entitled to municipal benefits due to the illegality of vending. Thus, unhygienic conditions in the area where the food is sold will worsen as a result. Poor sanitation conditions contribute to poor food storage and transportation conditions on vending sites (Okojie and Isah 2014: 2).

The raw materials for street food vendors come from formal stores in some cities. Food obtained from such regulated facilities is regarded as safer (Khairuzzaman *et al.*, 2014: 7). Unfortunately, most informal vendors do not have stalls where they can sell their goods. Therefore, these vendors normally store their goods where food is being prepared and sold, or at their homes, and then transport it to the vending sites the next trading day. This method of storage, where food is not stored hygienically and in controlled environments, often leads to food contamination.

2.5.3 Food safety

Food hygiene is about the production of food that is safe for consumption, free from micro-organisms and is of good quality for human consumption (Calloni 2013: 3410).Therefore, food hygiene is about providing food for consumption with limited risk of contracting food poisoning. To achieve this, good hygiene practices must be followed during food production, preparation, storage, and trading. In addition, food hygiene involves cleaning dishes and work surfaces with sanitary detergents, disposing of waste in a proper manner, and ensuring an environment free of pests.

Health and safety officers are most concerned with street food vendors' hygienic practices. A vending stand is rarely equipped with running water, toilets, and washing facilities. By working in partnership with stakeholders involved, such as vendors, government agencies, and private institutions, awareness programs can help to improve the safety of street foods (Alimi 2016: 146).

In many instances' vendors are willing to take part in reform programs that enable them to work in an environment that is safe and hygienic. Khairuzzaman *et al.*, (2014) conducted a survey on street vendors in Harare and Lusaka, which revealed that vendors are willing to offer

contributions towards the development of public infrastructure such as water points, refuse receptacles, and washing stations, if the municipality provides sanitation facilities and a garbage disposal system (Khairuzzaman *et al.,* 2014: 3). In order to improve vending conditions and the livelihood of vendors and their families, a conducive partnership involving all stakeholders should be encouraged.

2.5.4 Microbiological safety

The major concern worldwide is the bacterial contamination of street foods. Various studies have stated that pathogenic bacteria are associated with street foods (Eromo *et al.,* 2016; Kharel *et al.,* 2016; Niyonzima *et al.,* 2017; Jahan, Rahman, Sikder *et al.,* 2018; Abakari et al., 2018).

According to Argaw and Addis (2015: 59), globalisation and climate change have introduced new challenges to food safety, as there has seen an increase in foodborne diseases. Globalisation means the transportation of food to alien areas, whilst climate change results in the introduction of new pathogens resulting from, among others, changes in temperature and humidity. Also, human consumption patterns change as people become more accustomed to, and prefer convenient and fresh foods. , Therefore, global changes in food transportation, consumption and climate change can promote the development of microorganisms and foodborne diseases (Hamad 2012: 405).

Several hundred different viruses, bacteria, parasites, toxins, metals, and prions have been identified as contributing to foodborne diseases among humans (Ukuku and Latiful 2015: 16). Almost half of all foodbourne illnesses are caused by viruses. Bacterial agents, however, are responsible for a much larger number of foodborne illnesses that result in hospitalisation and even death (Fung, Wang and Menon 2018: 91). Thus, foodborne bacterial agents contribute to severe and fatal foodborne illnesses. Food poisoning infections are caused by Staphylococcus, Salmonella, Clostridium, Campylobacter, Listeria, Vibrio, Bacillus, and Enteropathogenic Escherichia coli, and they account for 90% of all food poisoning cases (Nyenje and Ndip 2013: 158). Various studies have reported that consumption of street foods is associated with a high amounts of coliform bacteria. Also, food is often contaminated by pathogens such as salmonella spp., Bacillus cereus, Clostridium perfringens, Staphylococcus aureus, Escherichia coli, Listeria monocytogenes, or Vibrio cholera (Cho *et al.,* 2011: 41; Anihouvi *et al.,* 2013: 2453; Manguiat and Fang 2013: 199).

A study conducted in India revealed that there was a significant incidence of *fecal coliform* contamination in street food vending sites that had no soap. Likewise, samples were taken from vendors who did not wear jewellery, and these were found to be less likely to be contaminated compared to those who did wear jewellery (Sabbithi *et al.*, 2017: 39).

2.5.5 Chemical safety

There is limited existing research in street food regarding chemical hazards. Studying chemical hazards in food deserves the same attention as microbiological contamination as it can help in the understanding of food safety. Chemical additives not approved for use in food have also been found in street foods, for example, colorants, preservatives, and pigments derived from pesticides used during primary food production (e.g. fertilizers) (Proietti, Frazzoli, and Mantovani, 2014; Al Mamun and Turin, 2016; Alimi and Workneh, 2016; Mondol and Uddin, 2017). In Bogor, Khairuzzaman *et al.* (2014) found that street food samples were chemically analyzed in order to test for colorants and pesticide residues that are not allowed for consumption, including textile dyes. In order to prevent food from becoming chemically spoiled, salt, spices, nitrates, and sugar must be used correctly. Food producers, however, may purchase cheap ingredients that could be contaminated to keep food production prices low.

Food can be contaminated with heavy metals and pesticides because of the conditions under which street food is sold. However, contaminants may occur due to inappropriate storage facilities. It is possible that chemical contamination is also influenced by the utensils used, raw materials used, and transport methods employed (Proietti *et al.*, 2014: 145).

2.6 VENDING FACILITIES

Street food vendors usually lack proper vending facilities (Hassan and Fweja 2020: 336). Therefore, it is advised that vending facilities such as a mobile cart that adhere to basic requirements, as stipulated by DoEH and the guidelines for conducting a food vending business, should form the basis in the street food vending cart design. In instances where vendors cannot afford such facilities, training on improvised vending facilities is normally given by authorities so that vendors conduct their business in hygienic and acceptable facilities.

2.6.1 Food preparation, handling, and vending

According to Alimi (2016: 143), the temperatures during street food preparation should be high enough for cooking and frying to kill vegetative cells. However, even with high temperatures there is a high possibility of survival of resistant spores of micro-organisms. However, the nature in which street foods are being prepared, handled, and vended introduces them to recontamination, cross-contamination, and transmission of pathogens and foodborne illnesses. The majority of street food is prepared in advance in bulk at different times (Mjoka and Selepe 2017: 2). The common aspect contributing to foodborne illness is the long holding time of more than six hours at room temperature, before the food is consumed. This long holding time between food preparation and consumption is reported to contribute to the multiplication of microorganisms, leading to food contamination (Ricci *et al.,* 2020: 107296). Therefore, it is advisable that food be consumed within 6 hours after preparation in instances where temperature control is not an option, as is the case with most street vendors.

The method through which food is transported also plays a role in food contamination. Food science researchers allude to the fact that transportation contributes significantly to meat spoilage and zoonic disease, especially if such food is transported under high temperatures (Campos *et al.,* 2015: 2). The method in which slaughtered animal carcasses are transported from the abattoir to retailers in the crude structure like wooden pushcarts, open plastic or aluminum trays increased the chances of cross-contamination. Alimi (2016: 143) states that the use of vehicles that are not designed for meat transportation such as taxis, buses, and motorcycles is common in Nigeria. However, these are without proper cooling storage facilities to transport meat products from the abattoir to retail stores (Chepkemoi *et al.,* 2015: 72).

In the markets and streets of Africa meat is retailed in open wooden trays that are usually difficult to wash thoroughly, therefore, prompting microorganism's contamination of meats and admission of airborne pollutants. ImathIu (2017: 59) state that the major risks factors that have been recognized in street foods is the non-regulated time and holding temperature that contributes to the disease outbreak. Another identified risk factor in street food preparation and handling entails the common use of a charcoal stoves to maintain the warm temperature of food over a long period (Muyanja *et al.,* 2011: 1551). However, this might not provide adequate temperature to inhibit the spread of pathogenic microorganisms. On the other hand, temperatures below 40° C used to reheat food could increase food contamination through

salmonella. Also, overheating at higher temperatures can result in the loss of essential nutrients and flavors in food. Meanwhile, holding of food at ground level and continuous uncovering of food for dishing exposes street food to dust contamination and flies, which has been linked to foodborne diseases such as cholera and diarrhoea (Malangu 2016: 59).

According to Marutha and Chelule (2020: 2) the major contributors to cross-contamination of street foods are vending practices and facilities that are used for supplying street food. It has been reported that during cutting and chopping of food the major contamination of street foods occurs at vending sites as a result of cross-contamination (Rane 2011:102; AlZaabi and Khan, 2017: 128). In South Africa, Johannesburg vendors were observed to be selling raw meat and poultry as well as gravy and salad, cutting and chopping with the same knife on the same surface without cleaning in between. The study further revealed that vendors chopped and prepared food with bare hands and even exchanged knives with fellow vendors without in-between cleaning thereby increasing the chance of cross-contamination (Hossen *et al.,* 2020: 14).

In various studies, the use of non-disposable plates, cups, and cutleries for serving food has been reported (Muyanja *et al.,* 2011: 1554; Alimi 2016: 144). Cold water and scrubbing towels were used to wash these utensils and were rinsed in cold water, meanwhile, others used soap solutions. Some of the vendors used the same water the whole day, while some changed water only twice in the day (Marutha and Chelule 2020: 2).These practices observed by researchers create a conducive environment for recontamination of street vended food. Moreover, the use of the same cutleries leads to cross-contamination and transmission of infectious diseases among unsuspecting consumers.

2.7 CHALLENGES CONFRONTED BY STREET-FOOD VENDORS

In developing economies, Otto, *et al.,* (2011) put forward the notion that street food vending is an important economic role player that contributes to development. In spite of this, street food vendors in Africa still face many challenges in operating their businesses. Vendors, for example, are often considered for city development plans by planning agencies and law enforcement authorities. As a result, vendors are always at risk of having their goods confiscated, or their stalls destroyed by city law enforcement agents (Njaya 2014: 97). In South Africa, however, one of the municipalities, Mbombela Municipality, has since 2015 not raided

any street market to search those trading without licence or counterfeit goods. This is a result of a lack of law enforcement since the raid requires several participants. Therefore, this has a negative impact on the municipality as it increases illegal trading especially by illegal immigrants from countries such as Mozambique, Zimbabwe, Swaziland, Nigerian and other African nationals. On the other side, it is argued in surveyed literatures that women lack pavement tenure security due to arbitrary evictions. Notably, women comprise the bulk of street traders in the country. The requirement in South Africa for these traders is to buy a trading permit at a cost of R60 a month, which negatively impact on women's income as they are mostly the primary caregivers in the country (Ngomane 2020: 381).

It is also critical for informal street food vendors to have access to infrastructure. However, reviewed literature indicates that the majority of informal street food vendors do not have access to space for storage and for shelter, they also have limited access to water, sanitation, and electricity to enable them to stimulate local economic growth. Also, if infrastructure is available it is usually in a derelict state and not maintained (Mkhize *et al.,* 2013: 56; Gamieldien and Van Niekerk 2017: 25). However, it is argued that due to high pricing this infrastructure is not affordable to most street vendors, meaning that municipalities have inadequate funds to provide and maintain adequate infrastructure for the street vendors. As such, municipalities are then overhanded as they try to enforce by-laws, as evidenced by cases of livelihood destruction noted in 2013 during the violent removal of 6000 inner city street traders in Johannesburg; and in 2012 by the closure of 600 informal businesses in Limpopo municipalities in South Africa (Monga *et al.,* 2019: 3).

2.8 IMPACT OF COVID -19 ON INFORMAL WORKERS

In 2019, the advent of Covid-19 saw a nationwide lockdown in South Africa. This lockdown had massive negative economic impacts. One of the most vulnerable groups affected by the lockdown was street vendors, who rely on the general public to conduct their business. Street vendors, like other informal workers. Informal workers do not have secure employment contracts by definition and consequently do not enjoy employee benefits, workers union protection, or social protection. Also, the agriculture and rural sector is where informality is especially widespread hence, more than 80% of self-employed are informal (FAO 2020). Some forms of informal street-food vendors are seasonal, the more economically disadvantaged, and the most likely to lose their livelihoods should there be changes in government policy, amongst

other factors. Hence, informal street vendors were particularly vulnerable to the economic shocks brought on by the Covid-19 pandemic (International Labour Organisation 2020: 2).

In the informal economy many women and men must feed their families and themselves hence, they need to earn an income. As the majority cannot depend on income replacement or savings, not working and staying at home may result in job loss and livelihood. Bhan *et al.*, (2020: 2019) report that more than 2 billion workers in 2020 were earning their livelihood in the informal economy. All those working globally account for 62%. In low-income countries, total employment represents 90% of informal employment, in middle-income countries it is at 67% and in high-income countries it stands at 18% (Etim and Daramola 2020: 1; Bonnet *et al.*, 2019: 4). Furthermore, in low -and lower-middle-income countries women are more exposed to informality and are often in more vulnerable situations than their male counterparts. In the informal sector, similar observations are applicable, where women account for almost 80% of those employed in the sector. The informal sector also comprises of unregistered small-scale units, often employing ten or fewer undeclared and low-skilled workers, comprising family members that are unpaid and are mainly women.

Poor workers in the informal economy are especially vulnerable to the definite risks associated with COVID-19. It is nearly impossible for informal workers to avoid the spread of the virus in urban areas due to overcrowded and unsanitary living conditions that make social distancing nearly impossible. Running water and lack of accessibility not only minimizes the likelihood of handwashing but forces people to line up for water. Therefore, there is a greater chances people endangering themselves and their communities where running water is scarce, especially during the Covid-19 pandemic. Informal economy workers are not properly informed about the virus, its symptoms, and preventative measures, particularly in rural areas. If these workers continue to operate, usually there is no access to personal protective equipment (PPE) and handwashing stations. Also, social distancing is difficult to adhere to by those working due to the nature of the working environment (Chirisa *et al.,* 2020: 2).

According to ILO (2020: 2) in the informal economy most workers have higher exposure to occupational health and safety risks, inappropriate protection, and greater chances of suffering from illness, accident, or death. COVID-19 forms part of these risks when employees get sick including migrants, who have limited access to medical care access and no income security through sickness or employment injury benefit. Hence, failing to access health care leads to the

virus spreading more widely with deadly consequences. On the other hand, if health care is accessible majority of workers, notably the street vendors, will be liable for out-of-pocket costs, which they can hardly afford. Consequently, that will compel them to go into debt or to the productive assets, dropping them into deeper poverty.

2.9 TRANS FATTY ACIDS AND IMPACT ON HEALTH

Street food vendors have been found to use high amounts of oil during the preparation of their food. This oil, according to research, contains high amounts of trans-fatty acids. A trans-fatty acid (TFA) is an unsaturated fatty acid that contains the least number of double bonds in its trans configuration according to MoH (2011: 3). A trans-fatty acid is made using industrial processes called industrial trans fatty acids (iTFA) from partially hydrogenated and deodorized vegetable oils and heated at extremely high temperatures. In partially hydrogenated vegetable oil, elaidic acid is the most common TFA. Ruminant trans fatty acids (rTFA), which are low levels of naturally occurring TFAs, are found in ruminant milk and meat. Such acids are normally found in, for example, cattle and sheep meat. Vaccenic acid is the most prevalent trans-isomer of ruminant TFA (Gebauer *et al.*, 2011: 344). Trans fatty acids are generally required in the food industry for commercial purposes such as producing semi-fat foods and extending shelf life of products such as margarine, crackers, deep-fried fast foods, pancakes, omelets, etc. They are also widely available in restaurants. The content of TFAs differs from one food to another. It is also difficult to ascertain the amount of trans-fatty acid use from one locality to the other (Li 2019: 3).

In the study cited by Dhaka *et al.*, (2011: 534), trans fats increase triglycerides, insulin, and low-density lipoprotein (LDL) while lowering beneficial high-density lipoproteins (HDL). The general perception of trans fatty acids (TFA) implies harmful effects on health. Fats and oils from natural sources contain a combination of monounsaturated, polyunsaturated, and saturated fatty acids (Forouhi *et al.*, 2018: 3). In a definition given by Takeuchi and Sugano (2017: 1), trans fatty acids (TFAs) are unsaturated fatty acids with a double bond in the trans configuration.

Oil is an essential part of people's daily diet. The inappropriate consumption of oil and fat has been related, on one hand, to a higher incidence of cardiovascular diseases and metabolic disorders. However, dietary fat can provide energy, fat-soluble vitamins, and many other

health-beneficial compounds, and is therefore an essential part of a healthy diet (Albahrani and Greaves 2016: 27).

In partially hydrogenated vegetable oil, TFA is produced, which is a method generally used to produce solid fats. In partially hydrogenated oils, the TFA content depends on the hydrogenation method. Several factors are involved, such as time, catalyst, temperature, and heat, as well as the types and proportions of oils and the composition of monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) (Dhaka *et al.*, 2011: 534).

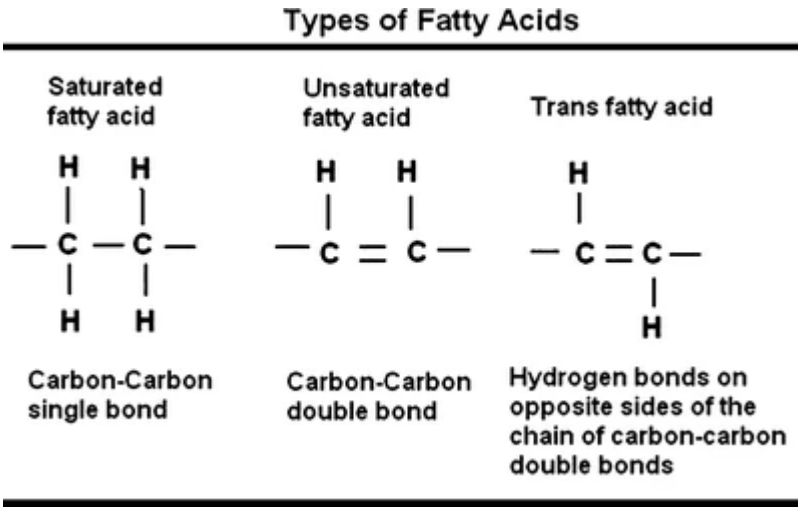


Figure 2.2: Types of fatty acids showing the trans configuration

2.9.1 Frying

One of the cheap and fast ancient food preparation methods is frying. Frying is one of the most preferred methods of food preparation because of its speed of food processing It also changes the sensory and nutritional characteristics of meat due to simultaneous heat and mass transfer, as an outcome of complex interactions between food and oil (Bordin *et al.*, 2013: 5; Ngadi and Xue 2016: 37). Frying is a result of high temperature and fast heat transfer, which makes it an efficient cooking method. The oil acts like a heat-transferring compound when food is immersed. Frying has a preserving action as the result of thermal destruction of microorganisms, enzymes, and reduction of water activity on the surface of food (Jaarin and

Kamisah 2012: 220). Moreover, the consumption of fried foodstuffs promotes the consumption of fats and oils.

In their article, Xu *et al.* (2020: 10) note that hot oil releases mass and heat simultaneously, forming a crust that preserves flavours and retains some of the juiciness of food during cooking, making chewing and digestion easier. Therefore, a food's composition, as well as its heat and mass transfer properties, such as thermal conductivity, thermal diffusivity, specific heat, and density, are important factors in determining heat transfer rate. As the oil and food are altered during the frying process, these characteristics change. Additionally, interactions between food compounds can lead to other changes.

The frying process initiates physical and chemical changes due to the condition to which food is submitted during frying. Therefore, this change depends on the food composition, and besides changing food texture it affects the development of colour, flavour, and taste (Omer *et al.,* 2014: 1).

Table 2.2 shows the main changes that occur in the composition of food as a result of the frying process.

Table 2.2: Main changes occurring in the composition of food during the frying process

Component	**Change during frying**
Fat	Increased concentration and change in the composition
Water	Significant loss
Reducing sugars	Millard reaction
Starch	Gelatinization
Proteins	Alteration of the composition
Amino acids	Formation of heterocyclic flavouring substances
Flavouring substances	Formed by oxidative and Maillard reaction
	Interaction with frying oil
Vitamins	Moderate loss
Minerals	Small loss
Antioxidants	Moderate loss

(Bordin *et al.,* 2013)

Table 2.2 summarises the chemical and physical changes during the process of frying food.

The amount of frying oil and polar compounds absorbed by food, as a result of oil degradation, determines the quality. As a result of dehydration, some water evaporates during the frying process. The starch gelatinizes, protein denatures, and some nutrients are destroyed at high temperatures, including vitamins, such as thiamin and riboflavin. This then results in the development of certain flavours, production of crispiness, and formation of pores resulting in a distinctive texture and sensory characteristics of food (Gómez *et al.,* 2020: 1). Hence, in the course of frying degraded products are formed consisting of volatile and non-volatile components (Marmesat *et al.,* 2012: 2333). Frying processes result in the loss of most volatile elements, while the non-volatile elements formed by thermal oxidation and polymerization of unsaturated fatty acids remain in the frying oil and in the finished product. Moreover, these compounds are accumulated in the frying oil and cause further degradation (Koh and Surh, 2015: 467). Also, health is affected through diet since these products are absorbed by fried food. As a result of these changes, degradation of oil quality may take place to a degree where it impossible to prepare high-quality fried products and such oil should be discarded (Debnath *et al.,* 2012: 259).

Table 2.3 shows the main groups of compounds formed during the frying process.

Type of change	Causative Agent	New compounds formed
Hydrolytic	Moisture	Free fatty acid
		Diacylglycerols
		Monoacylglycerols
Oxidative	Air	Oxidized monomers
		Oxidized dimers and polymers
		Volatile compounds (aldehydes, ketones, hydrocarbons)
		Sterol oxides
Thermal	Temperature	Dimers and non-polar polymers
		Cyclic Monomers
		Trans isomers and position isomers

(Bordin *et al.,* 2013)

More than 400 differenr heat-induced reaction products can be contained in used frying oil of which the majority can be absorbed into the fried food (Sebastian *et al.,* 2014: 420). In Table 2.3, it is shown that chemical reactions occur during the deep-fat frying process, including hydrolysis, oxidation, isomerization, and polymerization. It then generates free fatty acids, small molecular alcohols, aldehydes, ketones, acids, lactones and hydrocarbons, diglycerides and monoglycerides, cyclic and epoxy compounds, trans isomers, monomers, dimers, and oligomers (Olivero-David *et al.,* 2014: 11637). The composition of oil used for frying determines the complexity of these reactions, food structure and matrices, frying procedures, and process conditions like, for example, frying time, temperature and pressure (Karoui *et al.,* 2011: 927). Due to the high amounts of oil consumed by fried foods, quality loss in terms of frying oil can not only adversely affect their sensory properties, but also produce undesirable breakdown products that may negatively impact consumer health (Zribi *et al.,* 2014: 10357). (Gertz and Behmer, 2014: 757). Similarly, Kushairi *et al.,* (2017: 435) report that different

types of edible oils have different experiences with process-induced contaminants, particularly when they are exposed to high temperatures.

2.9.2 Selection of oil for cooking.

According to Gadiraju *et al.,* (2015: 8425), some factors determine the choice of frying oil, by vendors, namely: the cost; stability and resistance of oil and the reaction of the products to oxidation. In the past few years, the impact of the oil used and changes that occur with industrial practice have been well appraised. Due to oxidation and the exposure to temperatures as high as 200°C, highly unsaturated vegetable oils have a short frying life and result in a short shelf life of the food product. However, oils rich in saturated fatty acids (SFAs) and partially hydrogenated oils have enhanced stability profiles for prolonged frying. Palmoil, for instance, is a good frying oil but contains 45%-50% SFA. Moreover, partially hydrogenated sunflower, rapeseed, and soybean oil contains less than 20% SFA, but has more trans-fatty acid (TFA) of up to 20% which extend the shelf life of the product. On the other hand, some oil such as olive are highly resistant to oxidation. In contrast, corn oil is the most common oil used for frying away from home, especially in national chains of fast-food restaurants. Lastly, the oil absorption of the inherently low fat and low-calorie foods makes them energy-dense after frying oil (Arslan *et al.*, 2017: 706).

2.9.3 Effects of deteriorated frying fats and oils

A common belief is that repeatedly using cooking oil is harmful to your health, as described in Venkataand and Subramanyam (2016: 637). There is a common practice for poor communities in South Africa of eating highly oxidized overused fats, also called super oxidized soup (Padayachee 2006: 21). Oxidized lipids in human plasma are elevated when these oils are consumed, which may lead to deterioration of the body's natural anti-oxidants. Their effect is to reduce the immune system's ability to fight viral infections. A number of studies have found a link between cooking oil fumes and lung cancer. It is thought that this risk increases as the number of stir-fried or deep-fried meals is increased (Lee and Gany 13: 646).

As Brühl (2014: 708) explains, there are many chemical reactions occurring during frying, which result in numerous degradation products. There are various products associated with

these processes, including peroxides, aldehydes, ketones, hydroperoxides, polymers, and cyclic monomers. Despite the fact that ketones, aldehydes, and polymers can be easily eliminated, each of these compounds can still cause toxic effects.

Oxidized lipids present in fried food may be fast-tracked by increasing temperature and concentration of oxygen. Due to the variety of interfering factors, such as the type of oil, history of thermal treatment, and portion retained in the food, it is difficult to estimate the nutritional effects of these compounds Hence, it is critical that the selection of the frying oil is not based only on its characteristics of technology, but also on its nutritional features (Oke *et al.,* 2018: 6). One of the principal problems associated with intake of fried food is the increase in energy intake. The absorption and retention of oil increases the fat content of food (Hu *et al.,* 2018: 2).

2.9.4 Dietary fats and chronic diseases

The consumption of fried foods, such as French fries, fried chicken and fried eggs is common in the United States. In addition to producing trans fatty acids, the frying process increases energy density of fried foods and changes their nutrient composition (Pattanayak 2019: 5). A second effect of the process of frying is the increase in oxides cholesterol, which is caused by inhibition of the enzyme paraoxonase. It is known that excessive consumption of energy-dense foods can cause overweight, elevated blood pressure, and diabetes-related heart failure risk factors (Romieu *et al.,* 2017: 250). The consumption of fried foods has been associated with a higher risk of coronary heart disease, according to the Nurses' Health Study and the Health Professional Follow-up study In the United Sates. However, the analysis of data from 40 000 adults in the Spanish cohort of the European Prospective Investigation into Cancer and Nutrition showed no association of fried food consumption with coronary heart disease (Djoussé *et al.,* 2015: 1).

Regardless, research has found inconsistent associations between fried food intake and risk factors for heart failure. Various studies have assessed the link between fried food intake with the incident of heart failure and all concur that it is likely that fried food intake might just be an alternate of poor dietary habits and may not be informally related to coronary artery disease or heart failure risk (Cahill *et al.,* 2014; Guallar-Castillón *et al.,* 2012; Sayon-Orea *et al.,* 2013; Sayon-Orea *et al.,* 2014). However, such a hypothesis has not been well studied. In particular,

it is unclear whether fried food consumption is linked with heart failure in subjects with the highest-quality diets, as assessed by alternate healthy eating index scores (Djoussé *et al.,* 2015: 1)

Chronic non-communicable diseases (NCDs) such as coronary heart disease, strokes, hypertension, diabetes mellitus, and obesity are the major causes of mortality and morbidity in the world. A report by the WHO (2017) notes that in 2015, 17 million premature deaths (>70 years) associated with NCDs were lost to low- and middle-income countries, and 37% to cardiovascular diseases (CVDs) (Bennett *et al.,* 2018: 1072). Additionally, 17.9 million people died from cardiovascular disease in 2016, representing 31% of all global deaths. Eighty-five percent of these deaths were the result of heart attack or stroke (Buettner and Schunter 2019: 14).

Diet and nutrition play a significant role in promoting and maintaining good health because they are an important risk factor for chronic diseases, according to Petersen and Baehni (2018: 8). The United States is one of the most vulnerable countries to death and disability due to suboptimal diet quality, which caused 678,000 annual deaths of all types in 2010 (Gadiraju *et al.,* 2015: 8424). In addition to excess sodium intake, unhealthy diets are associated with an inadequate intake of fruits, nuts and seeds, whole grains, vegetables, and seafood. Studies show that consuming excessive amounts of energy-dense foods high in fat, predominantly saturated fat and refined carbohydrate can lead to weight gain and obesity, as well as an increased risk of NCDs (Steyn and Mchiza 2014: 90).

2.10 CONCLUSION

The objective of this review was to examine literature pertaining to food safety and hygiene practices of informal vendors, as well as to assess the health impacts of Trans fat intake. The literature reveals that street food is a critical role player in contributing towards the economy, job creation and income generation. Additionally, street food vending contributes to food security as it serves a large number of people with food in urban areas. But there is still a lot of work that needs to be done to improve the environmental conditions of the vending sites where food is prepared and served. Also, infrastructure and water accessibility need attention so that hygiene and food safety is enhanced. Furthermore, more training needs to be conducted on food safety, hygiene, and basic nutrition, so that healthy living is promoted through this sector.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents the research methods used in the study. The study aimed to assess food hygiene, food safety practices, and trans-fatty acid content of used vegetable cooking oils from various informal food vendors at Warwick Triangle Avenue (WTA) in Durban. Additionally, this study sought to determine food safety and hygiene practices of informal food vendors, and also to observe and report on food and safety practices of the vendors. Lastly, the study aimed at determining the socio-demographic characteristics of the informal food vendors and to investigate the quality of used vegetable cooking oil they use. The components used to collect data in this study included the following:

- Food handler's questionnaire.
- Observation sheets to observe hygiene practices of food handlers during food preparation.
- Socio-demographic questionnaire to establish the profile of the informal food vendors.
- Recording the quality of the vegetable oil used to prepare food items, using 3M^{TM} oil quality test strips.
- Collection of used cooking oil samples for lab analysis.

The instruments that were used in the study are comparable to those used in a study by Campbell (2011) in assessing the knowledge, attitude, and practices of street food vendors in the City of Johannesburg regarding food hygiene and safety.

The study population, data collection procedures, sampling, and instruments used will be deliberated upon in this Chapter. The data capturing process and methods of data collection will be discussed. The ethics and legalities of the study will also be disclosed. The flow of the study is shown in Figure 3.1 below**.**

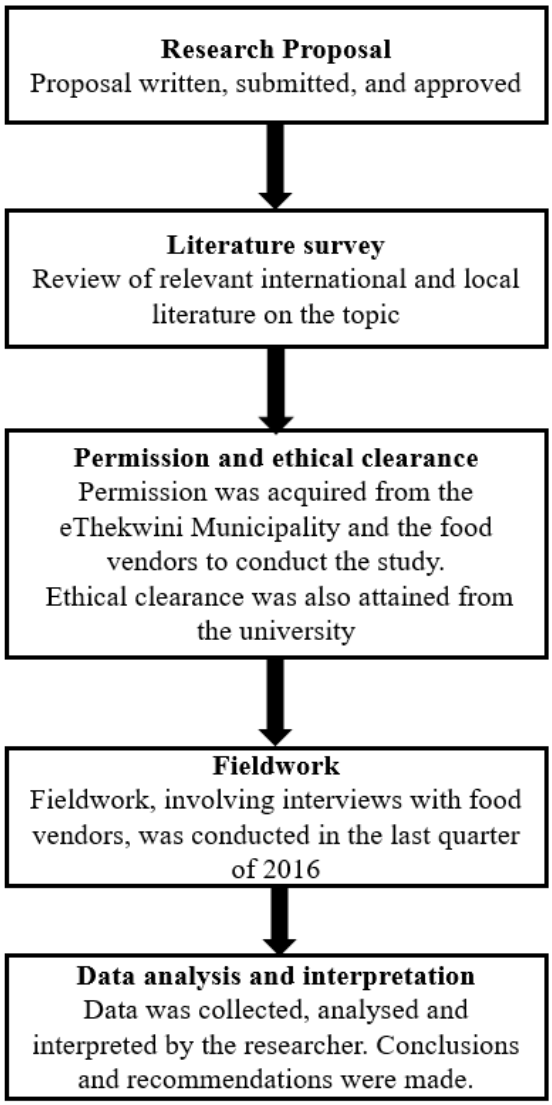


Figure 3.1: The research project process

3.2 PERMISSION TO CONDUCT THIS STUDY

Approval from the eThekwini municipality was attained to conduct this study amongst the informal food vendors selling food in the WTA region (Refer to Annexure-A for the letter of permission). The Faculty of Applied Sciences Research Committee (FRC) approved the research proposal in 2016. Ethical clearance was granted (Ethics number IREC 77/16) by the Institutional Research Ethics Committee (IREC) at DUT, in line with the Human Science Research Council (HSRC) guidelines (Refer to Annexure-C).

The researcher informed the vendors of the nature of the research face-to-face interviews on-site before a request was solicited from the vendors for participating in the study. During the

visit, the objective es of the study as well as the data collection process were discussed in detail with all participants. The information letter and consent form (Annexure D) was issued to the owner/employee to sign after the permission had been granted. Participating individuals in this study contributed positively to the results and conclusions made in this study.

3.3 PARTICIPATION AND CONFIDENTIALITY

All participants were informed that participation in the study was voluntary and that they could withdraw from the study at any time or refuse to participate without penalties. The information obtained was kept confidential and no names were used during the study this is in line with Protection of Personal Information Act (POPIA) section 14 (Adams *et al.* 2021: 4). Participants were also informed that there were no direct benefits for participating in the study other than possible self-knowledge improvement.

All personal information of participants are stored in the Department of Food and Nutrition Consumer Science in a locked cupboard and electronic data password protected. The storage period will be five years (from 2020), and after this period the data will be disposed of by shredding and electronic data deleted. Only the researcher and supervisors will have access to the information. Lastly, participants were assured that neither their jobs nor their level of services will be affected by their participation or refusal to participate in the study.

3.4 STUDY SETTING

Durban, or the joint eThekwini Municipality is located on the east coast of South Africa and is also known as the port city. Durban is the third-largest city in the country and Kwazulu-Natal the largest province. The population size of the eThekwini Municipality is nearly 3.4 million people (Census 2011). The city economic sectors are listed as follows: manufacturing (23.0%), financials and business services (22.0%), community services (19.0%) and wholesale, and retail (15%.0). In terms of the level of education, those with a Grade seven and above are reported at 64.0%. Thirty percent of the economically active population of the municipality are reported to be unemployed (Stats SA 2020).

WTA is made up of nine diverse market areas which are:

- The Bovine Head Market
- Early Morning Market
- Morning Market
- Music Bridge
- Berea Station
- Brook Street
- Mpepho and Lime Market
- Bead Market
- Victoria Street Market

The Bovine Head Meat Market is dominated by plated ready to eat food and fresh produce vendors. The suppliers of this market are local butcheries, formal shops, and the early market. It is estimated that input costs per trader are R560 000 per annum and R50 000 monthly. The estimated turnover is R720 000 per annum and R65 000 per month per trader with a profit income of R13 000 per month. The rental per annum per market is around R33 552 and is R69.90 per table per month (Conley 2015: 1).

3.5 STUDY TYPE

This study was of a descriptive nature with an analytical component. The data collection exercise was of a quantitative nature, using a socio-demographic questionnaire (Annexure E) and a food handler's questionnaire (Annexure F). A detailed observation sheet (Annexure G) and a sheet for recording the results of 3M™ oil quality test strips (Annexure H) were also used. Used cooking oil samples were collected in small glass bottles for lab analysis.

3.6 STUDY VARIABLES

The variables of the study were as follows:

- **Study area:** Informal food vendors in and around WTA.
- **Sampling strategy:** All the informal street food vendors who consented to participate, and were involved in preparation, distribution, or selling food that has been cooked in oil

- **Study setting:** Informal street food vendors in the WTA in Durban that prepare food using cooking oil participated in the study since the objectives were to investigate the hygiene practices and food safety knowledge for both shallow frying and deep frying informal food vendors, and the trans-fatty acid content of used vegetable cooking oil used by deep frying informal food vendors at WTA.
- **Human resources:** Participants and researchers.
- **Assessments instruments:** Socio-demographic and food handlers' questionnaire, observation sheet, and 3M^{TM} oil quality test strips recording sheet for recording the strips results.

The Data Collection Process

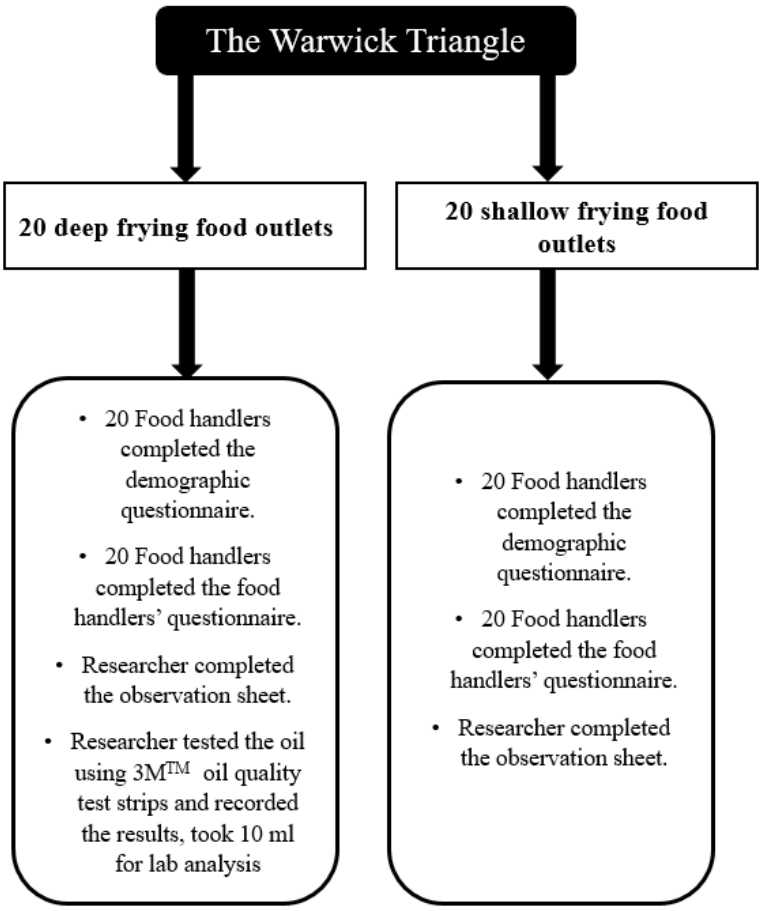


Figure 3. 2: Data collection process

3.7 SAMPLING PROCEDURE

The criteria applied in this study included 40 informal food vendors in WTA, in order:

- To be expressive and sufficient to draw effective conclusions
- To offer an appropriate reflection of the study population and
- To accommodate for non-responses.

All 40 targeted vendors participated in the study, and quota sampling was used. Quota sampling is a procedure that ensures that a certain characteristic of a population sample will be represented to the exact extent that the investigator desires (Sharma 2017). The entire population in quota sampling was divided into relevant groups according to their relevancy to the topic of interest. According to Sharma (2017: 751) when it is impossible to attain a probability sample, but you are still trying to create a sample that is representative of the population being studied, quota sampling is particularly useful. Therefore, the purpose of quota sampling was to improve the representation of the particular strata within the population and to ensure that the strata were not overrepresented. Hence, the use of a quota sample, which led to the stratification of a sample, allowed easy comparison of these groups. Moreover, the targeted population fulfilled the resolution of this study and followed the specific inclusion and exclusion criteria of the study. In this study, the qualifying criteria are all informal food vendors that were deep-frying and shallow-frying their food during preparation within the WTA. Therefore, all vendors who were not using cooking vegetable oil for frying were excluded from the study.

A total number of 40 informal food vending outlets, scattered in the WTA, participated in the study. Before the commencement of the study, the researcher walked through the WTA and discovered that not all vendors were deep-frying food and that some were shallow-frying. The vendors were divided into two groups: 20 deep-frying and 20 shallow-frying. There were several different employees in each store, depending on how busy the outlet was. Because of the nature of the study, there were limitations, and these will be discussed in Chapter 5.

The following inclusion criteria were used:

- All the informal street food vendors in the WTA in Durban that prepare food using cooking oil.

- All the employees of the identified informal street food vendors on the WTA in Durban.

The exclusion criteria were as follows:

- Formal food vendors around WTA in Durban
- All the informal street food vendors in the WTA in Durban not using cooking oil in food preparation.

3.8 ADMINISTRATION OF MEASURING INSTRUMENTS

The questionnaires used in the survey were developed as per the procedure reported by Meaker (2008) in KwaZulu-Natal in the formal and informal urban areas of Pietermaritzburg. The study by Meaker was similar to this study and the questionnaires were translated to isiZulu by Meaker. The researcher was granted permission to administer the questionnaire to the respondents by Meaker (Annexure-B). Three modes of data collection were utilized to ascertain hygiene practices, food safety knowledge, and trans-fatty acid content of used cooking vegetable oil by informal food vendors in the WTA. The three modes consisted of the following:

3.8.1 Face to face interviews with owners and food handlers.

Interviews were carried out utilising two different types of questionnaires. Each participant completed a socio-demographic questionnaire. This questionnaire included questions on gender, age, level of education, menu availability, who developed the menu, and the choice of the menu used. The second questionnaire was the food handling and practices' questionnaire and was completed by the fieldworker while questioning the food handlers. This questionnaire covered education level, work experience, training and hygiene knowledge, wastage, food holding and serving, personal hygiene, purchasing and receiving, and lastly storage.

The researcher and fieldworkers conducted interviews in Zulu since the area was dominated by Zulu speaking people. The interviews were carried out inside the vending outlets and all questionnaires took approximately 45 minutes to 1 hour to complete depending on how busy it was at that time. A total number of 40 food handlers participated during September and October

2016 when the study was conducted, and all 40 vendors completed all three aspects of the study. The researcher was present all the time to increase the validity of the exercise, and to offer additional support to the fieldworkers. The face to face aspect of the data collection and interviewing process is shown in Figure 3.3.

Figure 3. 3: Fieldworker conducting the interview

3.8.2 Observation sheet to observe food handlers during food preparation, cleanliness, and use of cooking oil.

After the completion of the two questionnaires, the researcher completed an observation sheet for each outlet. This observation sheet was designed mainly to focus on food service management and to monitor the following procedures: General management of food outlets, storage, food preparation, holding and serving, wastage, usage of oil, and hygiene practices.

Completing the observation sheet took ±20 minutes per food outlet due to the intensity of the checklist. The observation sheet had 73 questions and each was answered by ticking or circling a "Yes" or "No" or "N/A" where appropriate. The observation sheet was only completed once.

Ultimately, the observation checklist plays an important role because it can validate or repudiate what was said by the participants in the questionnaires (Manterola and Otzen 2017: 73). Part of the fieldwork exercise is shown in Figure 3.4.

Figure 3. 4: Researcher Observation

3.8.3 Recording and sampling of oil

In each vending outlet, the food handler confirmed the method of food preparation. For all deep-frying vendors (n=20), the oil was tested on-site and pre-screened using 3M™ oil quality test strips. Recordings were done on the free fatty acids (FFA) recording sheet that was formulated by the researcher refer to figure 3.6 below. The test strip was dipped into hot oil till all blue bands were submerged. It was then allowed to develop for five seconds, then removed from the oil sample, and then removed after 30 seconds. The strip was exposed to light. The change in colour of the strip was compared to an evaluation guide in the presence of the vendors and oil quality level recorded. The evaluation guide had four stages, stage one "okay" the oil is suitable for consumption; stage two "probably okay" probably suitable; stage three "probably

not okay' probably not be safe; stage four "bad oil" not safe. An example of the tested oil is shown in Figure 3.5.

Figure 3. 5: Oil Sample

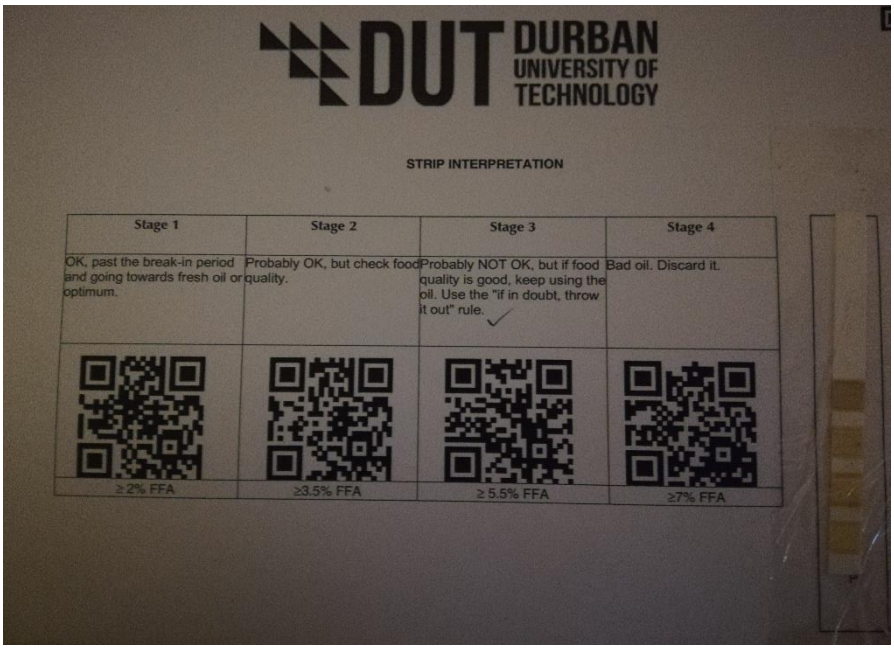


Figure 3. 6: Pre-Screening sample

Thereafter the researcher took a sample for Gas Chromatography (GC) analysis for post-screening to check the amount of tran's fatty acids. A 30ml clear PVC dropper bottle was used to collect the oil sample for the fulfilment of GC analysis. The bottles were directly stored in a cooler bag immediately after sampling. Later upon arrival on campus these were transferred to a refrigerator. This procedure is supported by a study conducted in Nigerian markets wherein the oil samples were kept in refrigerators resulting in greater nutritional quality upon prolonged storage (Bukola *et al.*, 2015: 13). Oil pre-screening and post-screening did not take place in shallow frying informal food vendors due to the quantity of oil they were using for cooking, it was too small for sample collection.

3.8.4 Gas chromatography parameters

A Shimadzu 2014 Gas chromatography was used with an injector temperature of 200 ºC to analyse the oil. A ZBFFAP Column was used with a column temperature which was varied as follows: 180 ºC @2 ºC to 200 ºC @ 2 ºC to 250 ºC (30mins). The Flame Ionisation Detector was used and kept at a temperature of 250 ºC with a split ratio of 10.

3.8.5 Quantitative analysis of the content of used oil

A sample of 0.1g of used oil was added into a 40 mL vial. This was followed by the addition of 5 mL of BF_3-Methanol. The sample was heated in a steam bath for 10 minutes then it was cooled to room temperature. The mixture was transferred to a separating funnel where 10 mL of hexane was added to extract complex from the derivatisation agent with used oil. The mixture was washed with 2 x 10mL of saturated sodium chloride solution. The aqueous layer was drained and discarded. The organic layer was transferred into a clean vial and dried with anhydrous sodium sulphate. The organic solvent was concentrated and analysed using gas chromatography. Figure 3.7 depicts the post-screening samples used in this procedure.

Figure 3. 7: Post-screening samples

Fatty acids in oil remain one of the major constituents as a result the physical, chemical, and physiological properties of cooking oils depend mainly on their fatty acids composition. The simplest procedure to determine fatty acids is by methylation where they are quantitatively detected as methyl esters.

The gas chromatographic system uses three fatty acid standards namely methyl palmate, methyl stearate as well as methyl oleate. These three fatty acids are the main components of cooking oil. Thus, quantitative analysis of these three fatty acids was used to probe the quality as well as their stability during cooking, presumably, they would have de graded due to temperature exposure. These fatty acids were therefore quantified from all cooking oil samples obtained from vendors. The cooking oil samples were added to a derivative Boron trifluoride-methanol. The methanolic BF_3 is commonly used as a methylation reagent as well as in methanolysis of lipids and cooking oils. Ackman (1998) remarks on official methods employing boron trifluoride in the preparation of methyl esters of the fatty acids of fish oils. The schematic diagram for this derivatisation process is shown in figure 3.8 below.

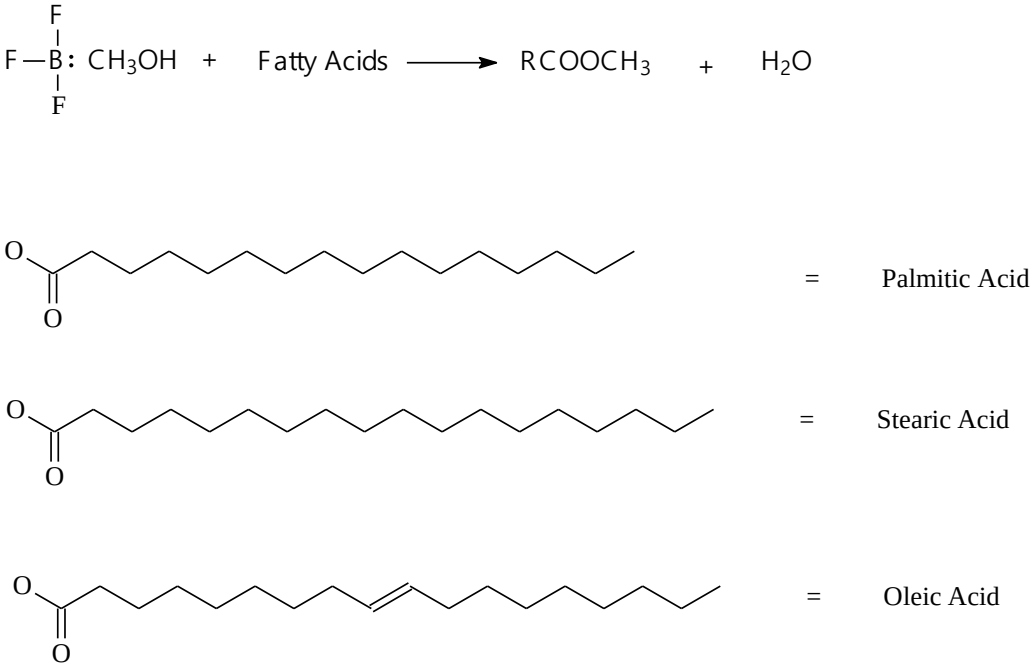


Figure 3. 8: Mechanism methylation of fatty acid in cooking oils

3.9 DATA ANALYSIS AND STATISTICS

The researcher ensured that the socio-demographic questionnaire, food handlers questionnaire, observational checklist, and free fatty acid sheets were completed thoroughly to avoid gaps before leaving the vendors' outlets. The completed socio-demographic questionnaire, food handler's questionnaire, observational checklist, and free fatty acid sheet were captured on an excel spreadsheet by the researcher and transferred to the statistical software known as the Statistical Package for the Social Science (SPSS) version 22.0 for descriptive analysis. Graphs and tables were used to present the results and comparisons drawn between deep-frying and shallow-frying vending sites results.

3.10 CONCLUSION

In this chapter, an overview of the research methodology used to ascertain food hygiene practices, food safety knowledge, and trans-fatty acid content of used vegetable oil by informal food vendors at WTA in Durban has been broadly discussed. The study type, sampling methods, and inclusion and exclusion criteria were also discussed. All the suitable instruments used in the study and the data collection process have been outlined. Results obtained from the

socio-demographic and food handlers' questionnaire, observational checklist, as well as oil test and gas chromatography results will be presented in the next chapter. Lastly, results will be discussed and elaborated with the support of findings from other studies.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 INTRODUCTION

Study results are presented in this chapter. A total number of 40 informal street food vendors participated in the study and were subdivided into two groups. The first group of 20 made use of deep-frying food preparation methods and the second group of 20 used shallow frying as a food preparation method. All the information from the socio-demographic questionnaires, food handlers' questionnaires, observational checklists, free fatty acid check sheets and oil testing (gas chromatography) analysis will be summarized and illustrated in tables and graphs. A distinction between the results of vendors who are deep frying and shallow frying will be drawn. The difference between what was said by the food handlers and what the researcher observed will also be discussed.

4.2 DEMOGRAPHIC DATA – VENDORS

The socio-demographic results display the study population in percentages grouped in the following categories:

- Personal information
- Level of Education
- Business Experience
- The variety of the menu

The socio-demographic characteristics of the deep frying and shallow frying participants are shown in Table 4.1.

Table 4.1: Socio-demographic profile of the food vendors (Deep frying vs Shallow frying)

	Deep frying		**Shallow frying**	
Variables	**N**umber (n=20)	Percentages	Number (n=20)	Percentages
Gender				
Male	2	10.0		
Female	18	90.0	20	100.0
Total	**20**	**100.0**	**20**	**100.0**
Age of Respondent				

<30 years	6	30.0	5	25.0
≥30 years	14	70.0	15	75.0
Total	**20**	**100.0**	**20**	**100.0**
Highest level of education				
No education	0	0.0	4.0	20.0
Std 1/ Grade 1-3	1	5.0	0	0.0
Std 2-5 / Grade 4-7	1	5.0	4	20.0
Std 6-9/ Grade 8-11	10	50.0	5	25.0
Matric/ Std 10/ Grade 12	8	40.0	7	35.0
Apprenticeship	0	0.0	0	0.0
Post – matric diploma / Technikon	0	0.0	0	0.0
Total	**20**	**100.0**	**20**	**100.0**
Do you have previous experience in food service?				
Yes	7	35.0	8	40.0
No	13	65.0	12	60.0
Total	**20**	**100.0**	**20**	**100.0**
Do you have a menu?				
Yes	5	25.0	0	0.0
No	15	75.0	20	100.0
Total	**20**	**100.0**	**20**	**100.0**
Who developed the menu?				
The owner	20	100.0	N/A	N/A
The nutritionist or dietician	0	0.0	0	0.0
Food Preparation staff	0	0.0	0	0.0
Other	0	0.0	0	0.0
Total	**20**	**100.0**	**20**	**100.0**
What is this menu used for?				
Economical	13	65.0	N/A	N/A
Locally accepted foods	5	25.0	N/A	N/A
Locally available foods	0	0.0	N/A	N/a
Favourite foods	2	10.0	N/A	N/A
Other	0	0.0	0	0.0
Total	**20**	**100**	**20**	**100**

Table 4.1 indicates that the majority (90.0%; n=18) of the deep-frying respondents were females. Thirty percent (n=6) were below the age of 30, the majority (70.0%; n=14) were 30 years and above. However, only 40.0% (n=8) had matric as the highest level of education, Fifty percent (n=10) achieved a Std 6-9/ Grade 8-11 qualification and 5.0% (n=1) had Std 2-5/ Grade 4-7. Most respondents had no previous experience in food preparation (65.0%, n=13). Twenty-five percent (n=5) of the respondents had a menu. A total of 65.0% (n=13) sold fried food because it was economical for the consumer and 25.0% (n=5) sold fried food because it was locally accepted food. Lastly, 10.0% (n=2) sold fried food because it was a consumer favourite.

Hundred percent (n=20) of the shallow-frying respondents were females and 25.0% (n=5) were below the age of 30 whereas 75.0% (n=15) were 30 years and above. However, only 30.0% (n=7) had matric as the highest level of education, 25.0% (n=5) achieved a Std 6-9/ Grade 8-11 qualification and 20.0% (n=4) had Std 2-5/ Grade 4-7. A total of 20% (n=4) had no education at all. Most respondents had no previous experience in food preparation (60%, n=12). None of the respondents 100.0% (n=20) had a menu that they cooked from.

4.3 FOOD HANDLERS (FH'S)

The food-handlers' socio-demographic results show the study population in percentages grouped in the following categories: number of employees working in the shallow frying (SF) and deep-frying (DF) outlets.

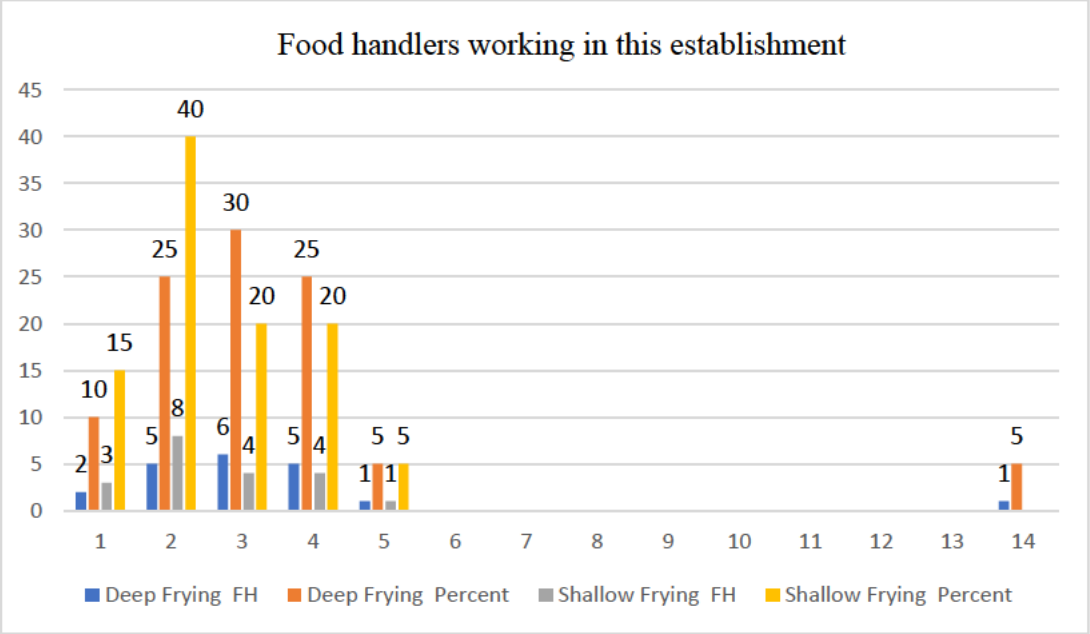
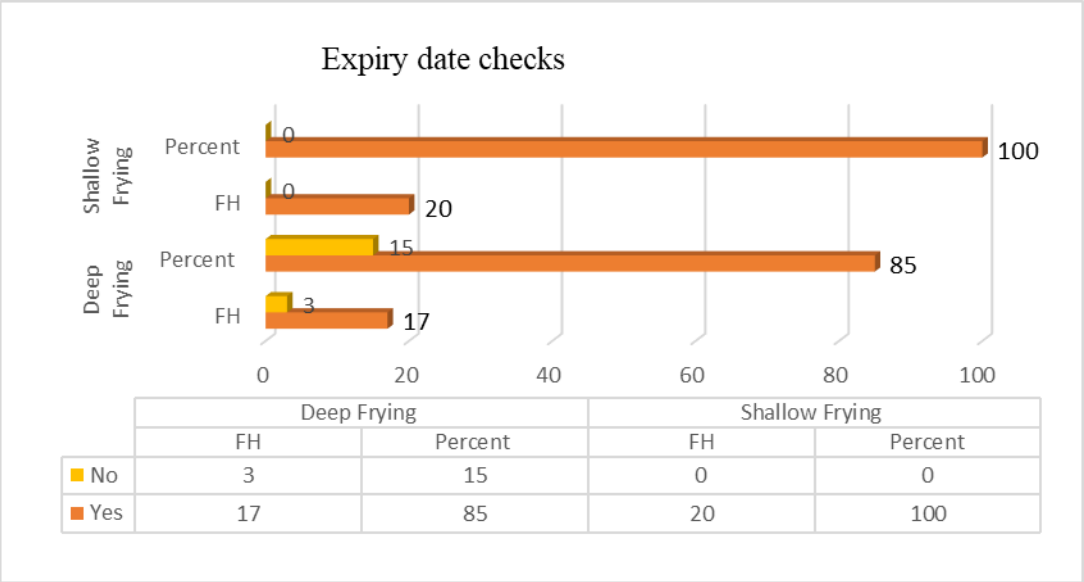


Figure 4. 1: Number of FH's (Deep frying vs Shallow frying)

The results displayed in Figure 4.1 indicate that 5.0% (n=1) of the DF establishments had 14 employees, 5.0% (n=1) had 5 employees and (30.0%, n=6) had maximum of 3 employees. As for the SF vendors, the results indicate that 5.0% (n=1), of the establishments had 5 employees, 40.0% (n=8) had 2 employees. Fifty-five percent (n=11) of the vendors had 4 or fewer employees.

4.3.1 Food storage

This section deals with the knowledge the vendors had with regards to the importance of adhering to expiry dates of foods and ingredients.



	Deep Frying		Shallow Frying	
	FH	Percent	FH	Percent
No	3	15	0	0
Yes	17	85	20	100

Figure 4. 2: Expiry date evaluation by (Deep frying vs Shallow-frying) FH's.

The results illustrated in Figure 4.2 indicate that the majority (85.0%; n=17) of the DF vendors did check the expiry date on the food received/bought. In contrast, all (100.0%; n=20) of the SF vendors indicated that they do check the expiry date on food bought for preparation.

4.3.2 Food preparation

This section presents the results on the entire process of food preparation environment and the adequacy of utensils used during the operation of the vending site.

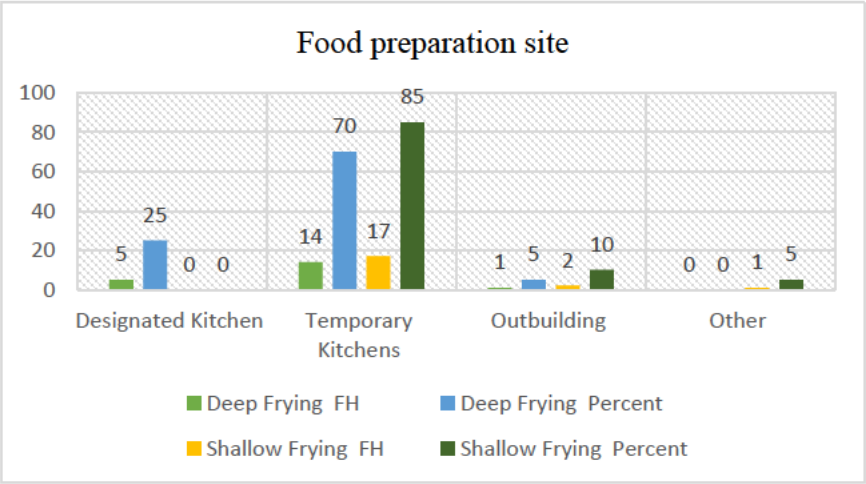


Figure 4. 3: Food preparation site (Deep frying vs Shallow frying)

As illustrated in Figure 4.3, the type of preparation site of vendors that prepare DF and SF food. The majority (70.0%; n=14) of DF food handlers prepared food in a temporary kitchen, 5.0% (n=1) prepared food in an outbuilding, and 25.0% (n=5) in a designated kitchen. Most of the food handlers (85.0%; n=17) prepared food in temporary kitchens and 10.0% (n=2) prepared food in an outbuilding.

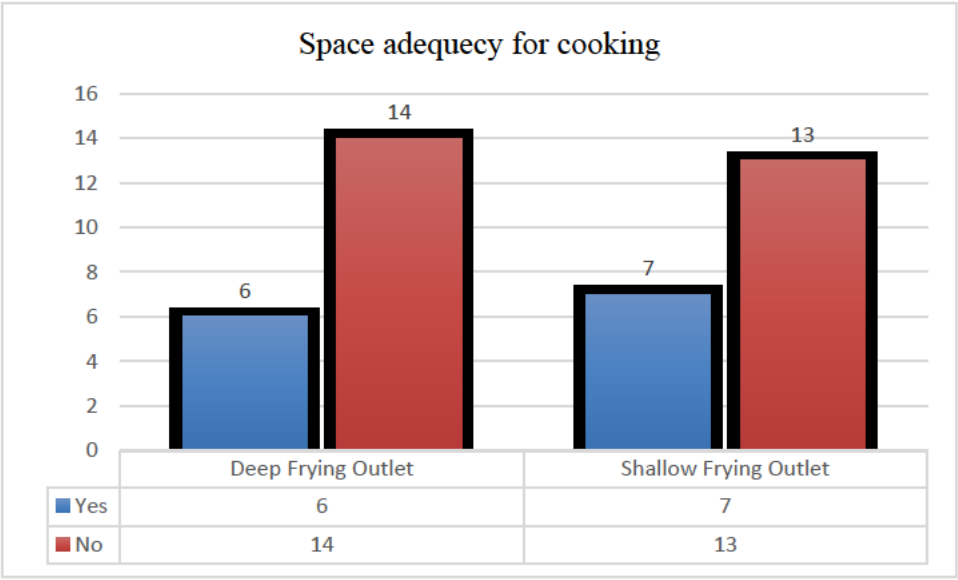


Figure 4. 4: Space adequacy for cooking (Deep frying vs shallow frying)

Adequate cooking spaces was not present in 70.0% (n=14) of DF vendors and 65.0% (n=13) of SF vendors (Refer to Figure 4.4).

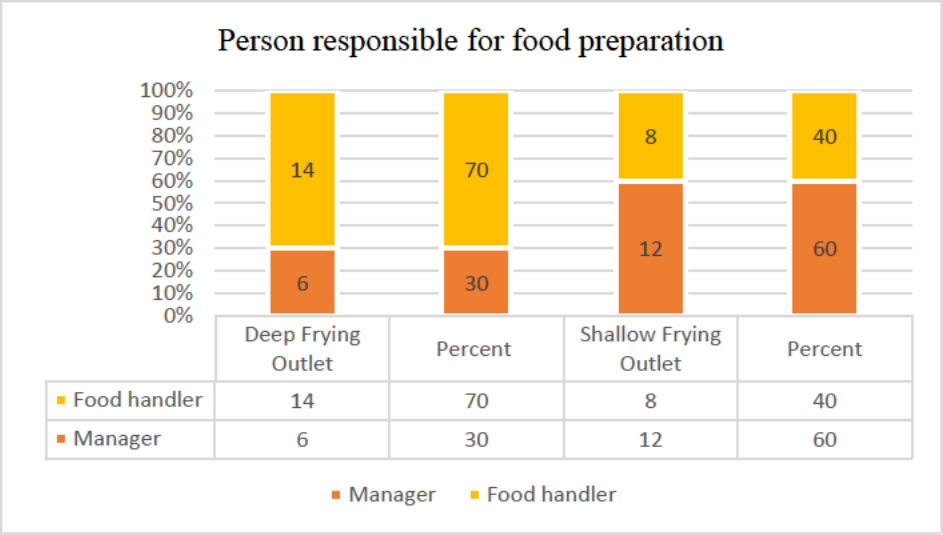


Figure 4.5: Person responsible for food preparation (Deep frying vs Shallow frying)

It is illustrated in Figure 4.5 that the food prepared in a majority (70.0%; n=14) of DF vending sites was done by food handlers and 30.0% (n=6) is prepared by owners. The food is prepared by owners in 60.0% (n=12) of SF vending sites and 40.0% (n=8) is prepared by food handlers.

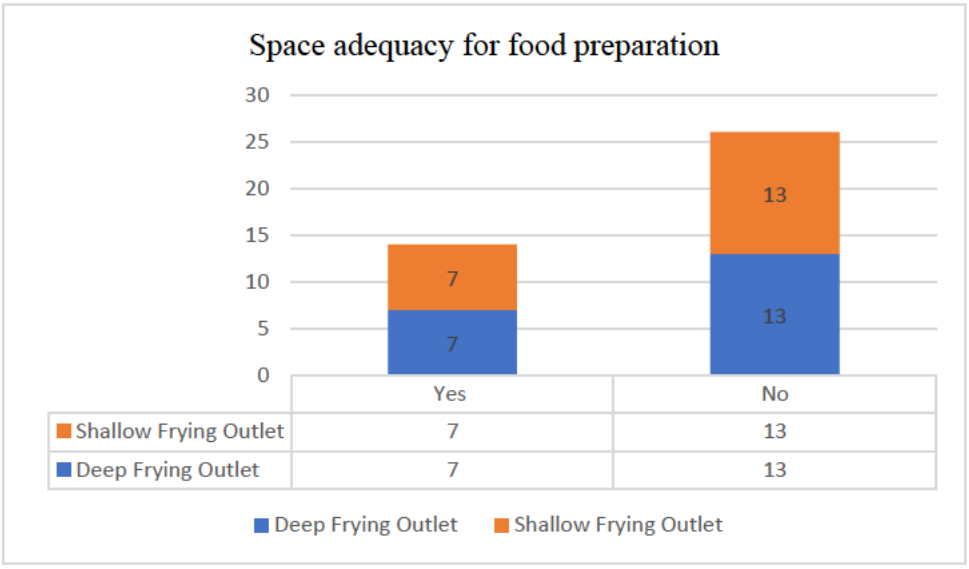


Figure 4. 6: Space adequacy for food preparation prior cooking (Deep frying vs Shallow frying)

Figure 4.6 illustrates that the majority (65.0%; n=13) of both DF and SF vendors did not have enough space for food preparation.

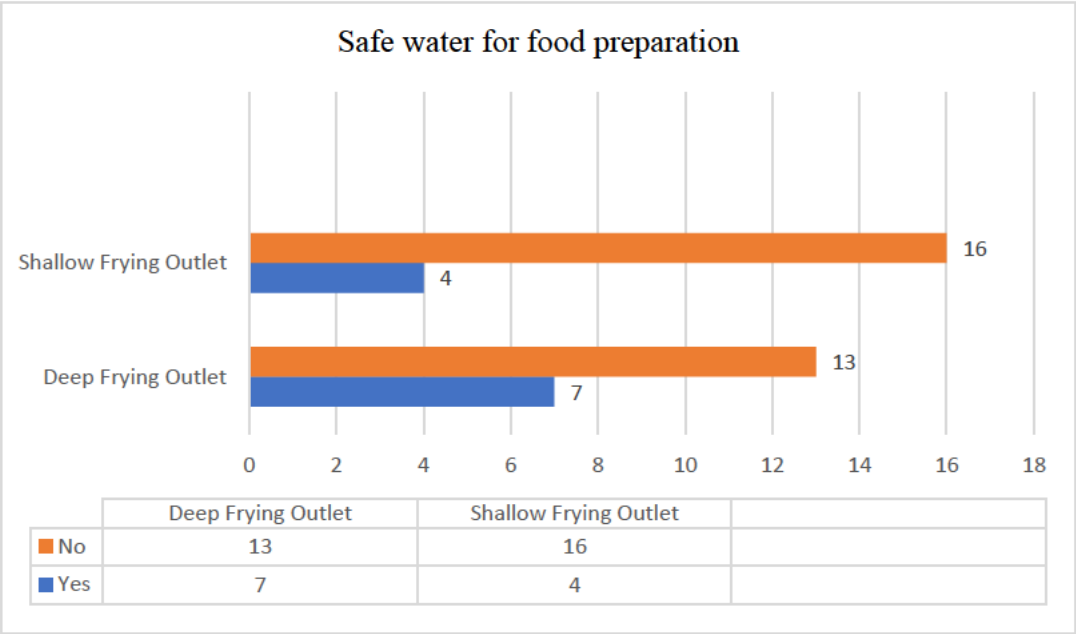


Figure 4.7: Safe Water for food preparation (Deep frying vs Shallow frying)

It is further illustrated in Figure 4.7 that 65.0% (n=13) DF and 80.0% (n=16) of the SF vendors did not have access to safe water for food preparation.

Table 4.2: Available food preparation utensils and recipe utilization (Deep frying vs Shallow drying)

	Deep frying		Shallow frying	
Variables	Number (n=20)	Percentages	Number (n=20)	Percentages
Are there enough food preparation utensils?				
Knives				
Yes	15	75.0	12	60.0
Chopping Boards				
Yes	11	55.0	9	45.0
Measuring equipment				
Yes	4	20.0	9	45.0
Serving spoons				
Yes	12	60.0	11	55.0
Mixing tools				
Yes	8	40.0	11	55.0
Are all recipes available?				
Yes	0	0.0	0	0.0
Are the recipes used?				
Yes	2	10.0	0	0.0
Where were these recipes obtained?				
No Recipe	18	90.0	20	100.0
Owner	1	5.0	0	0.0
The Food Handler	1	5.0	0	0.0

Table 4.2 illustrates that out of 20 DF vending sites the majority (75.0%; n=15) had enough knives, 55.0% (n=11) had access to chopping boards, 20.0% (n=4) had measuring equipment available and 60.0% (n=12) had serving spoons.

Out of the 20 SF vending sites, 60.0% (n=12) had enough knives with chopping boards available. For vending sites, only 45.0% (n=9) had measuring equipment available, and 55.0%, (n=11) had serving spoons.

4.3.3 Food holding

The following section presents the information on how and how long the food is kept before and after food preparation before it is sold.

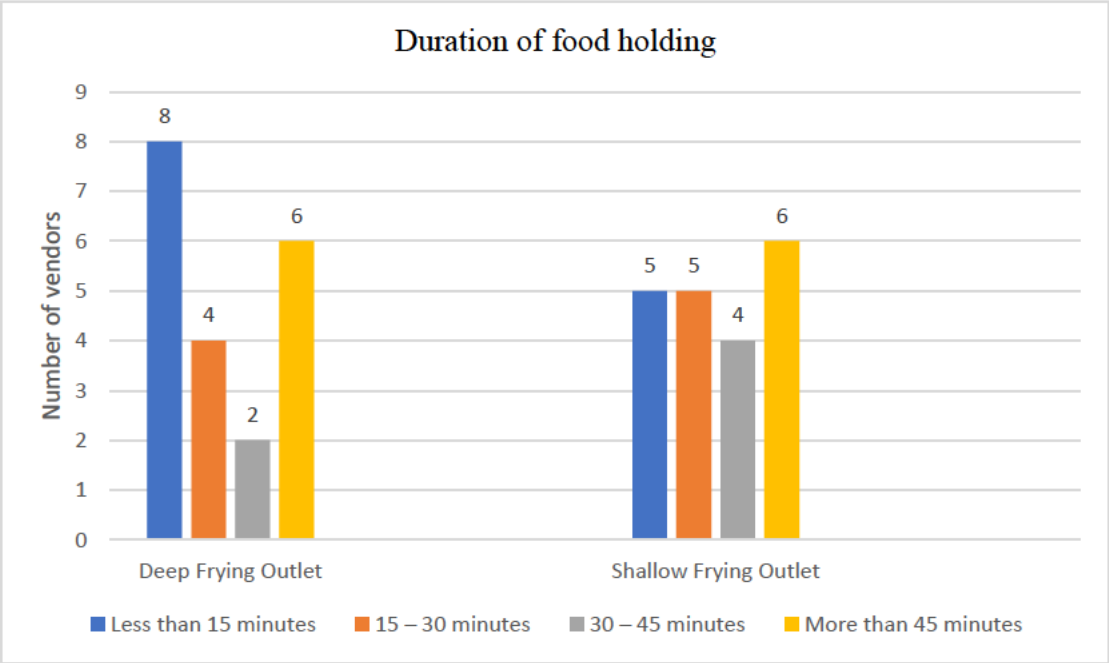


Figure 4.8: Duration of food holding (Deep frying vs Shallow frying)

Figure 4.8 illustrates that most of the DF vendors (40.0%; n=8) kept food for less than 15 minutes and 30.0% (n=6) kept the food for more than 45 minutes. A small number of vendors (10.0%; n=2) kept the food from 30 to 45 minutes, while 20.0% (n=4) kept the food from 15 to 30 minutes.

Less than a third SF vendors (30.0%; n=6) kept food for more than 45 minutes and 25.0% (n=5) kept the food for less than 15 minutes, and 25.0% (n=5) kept the food between 15 – 30 minutes. A small number of vendors (20.0%; n=4) kept the food for 30 – 45 minutes.

4.3.4 Serving

The following section presents the space availability results for food serving and the satisfaction of customers when it comes to portion size.

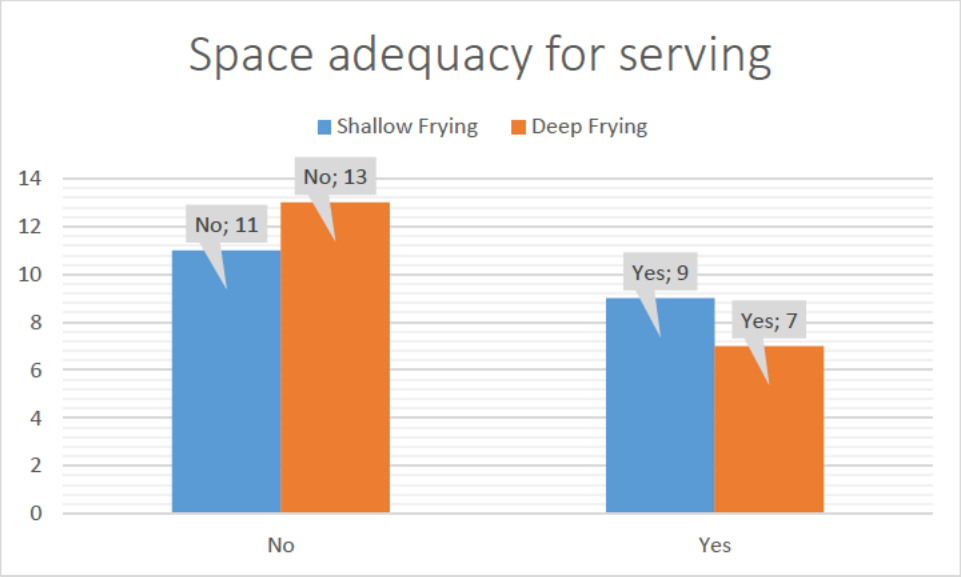


Figure 4.9: Space adequacy for serving (Deep frying vs Shallow frying)

It is illustrated in Figure 4.9 that only 55.0% (n=11) DF vendors had enough space for serving food, whereas only 45.0% (n=9) SF vendors had space for food serving.

4.3.5 Waste

This section deals with what happens to the leftover food and how much food is not sold on the day of preparation. Furthermore, it deals with the accessibility of waste resources and the removal of waste.

Table 4.2: Waste (Deep frying vs Shallow frying)

	Deep frying		Shallow frying	
Variables	**Number (n=20)**	**Percentages**	**Number (n=20)**	**Percentages**
Status of unsold prepared food				
Thrown away	2	10.0	2	10.0
Given to a Friend	4	20.0	1	5.0
Taken home	6	30.0	11	55.0
Kept for the next day	1	5.0	0	0.0
Food Handlers eat it	4	20.0	0	0.0
Other	3	15.0	6	30.0
Total	20	100.0	20	100.0
Quantity of unsold prepared food waste				
None	7	35.0	11	55.0
Less than a quarter	11	55.0	4	20.0
Half	0	0.0	3	15.0
More than half	2	10.0	2	10.0
Total	20	100.0	20	100.0
Reheating and selling of food the day after preparation				
Yes	1	5.0	2	10.0
No	19	95.0	18	90.0
Total	20	100.0	20	100.0
If yes how is it reheated?				
Not served	19	95.0	18	90.0
On the stove	1	5.0	2	10.00
Total	20	100.0	20	100.0
Availability of designated rubbish area				
Yes	19	95.0	19	95.0
No	1	5.0	1	5.0
Total	20	100.0	20	100.0
Area of location				
In the kitchen food preparation	1	5.0	0	0.0
In the serving area	2	10.0	0	0.0
Outside the food shop	13	65.0	1	5.0
Other	3	15.0	18	90.0
Total	19	95.0	19	95.0
Frequency of removal/cleaning				
Once a day	9	45.0	1	5.0
Twice a day	6	30.0	0	0.0
Other	4	20.0	18	90.0
Total	19	95.0	19	95.0
Does the rubbish bins have tightly fitting lids?				
Yes	10	50.0	6	30.0
No	9	45.0	13	65.0
Total	19	95.0	19	95.0

Table 4.3 shows that if the food is not sold out 10.0% (n=2) of the DF vendors threw the left-overs away, whereas 20.0% (n=4) gave it away. The majority (30.0%; n=6) of the vendors took it home, and the only one (5.0%) kept the food for the next day, while 20.0% (n=4) of the FH's ate the left overs. Similar to the DF, the SF vendors 10.0% (n=2) threw away the leftovers, but only 5.0% (n=1) of SF vendors gave the food away. Fifty-five percent of the SF vendors (n=11),

took the food home, while (55.0%; n=11) of SF vendors threw away less than a quarter of the left-overs. Ten percent (n=2) of the SF vendors threw away more than half of the left-over food. Twenty percent (n=4) of the SF vendors threw away less than a quarter of the food waste, and only 15.0% (n=3) threw away more than half of the food waste. Similar to the DF, 10.0% (n=2) of the SF vendors threw away more than half of the leftovers. Leftover food was reheated and served by 5.0% (n=1) of DF vendors. A similar trend was noticed for DF vendors where 10.0% (n=2) reheated and served the food the following day. Five percent (n=1) of DF vendors and 10.0% (n=2) of SF vendors who served the food the following day, used the stove.

Designated rubbish areas were available to 95.0% (n=19) to both DF and SF vendors. Of the 95.0% (n=19) of the DF vendors who had access to rubbish areas, 5.0% (n=1) had these areas situated in the kitchen, 10.0% (n=2) in the serving area, 65.0% (n=13) outside the food shop, and 15.0% (n=3) used the municipality dumping points. Of the 95.0% (n=19) of the SF vendors who had access to rubbish areas, 5.0% (n=1) accessed them outside the food shop and the rest (90.0%; n=18) used municipal dumping points. Cleaning or removal of rubbish by DF vendors took place once a day in 45.0% (n=9) of the cases, and twice a day in 6.0% (n=30) for the rest of the cases. Cleaning or removal of rubbish took place once a day in 5% (n=1) SF of the vending sites. Only 50.0% (n=10) of DF vendors and 30.0% (n=6) of SF vendors had rubbish bins with tightly fitting lids.

4.3.6 Training and food safety

This section deals with results on food safety training received by the vendors interviewed as part of this research.

Table 4.3: Food preparation and food safety training (Deep frying vs Shallow frying)

	Deep frying		**Shallow frying**	
Variables	Number (n=20)	Percentages	Number (n=20)	Percentages
Menu planning				
Yes	5	25.0	12	60.0
Food preparation				
Yes	5	25.0	13	65.0
Prevention of food contamination				
Yes	7	35.0	13	65.0
Prevention of cross-contamination of food				
Yes	7	35.0	13	65.0
Illness in the workplace				
Yes	8	40.0	10	50.0

	Deep frying		Shallow frying	
Injury in the workplace				
Yes	7	35.0	10	50.0
First Aid				
Yes	4	20.0	10	50.0
Personal hygiene				
Yes	10	50.0	13	65.0
Hand washing				
Yes	14	70.0	13	65.0

Table 4.4 shows that 25.0% (n=5) of the DF vendors and 60.0% (n=12) of the SF vendors received training about menu planning. Food preparation training was received by 25.0% (n=5) of the DF vendors and 65.0% (n=13) of the SF vendors. Training on prevention of food contamination and cross-contamination was received by 35.0% (n=7) of the DF vendors. Illness in the workplace training was received by 40.0% (n=8) of the DF vendors and 50.0% (n=10). A similar trend was noticed for injury in the workplace and first aid training. As for DF vendors, injury in the workplace training was received by 35.0% (n=7) of the vendors. First aid training was received by 20.0% (n=4) of DF vendors and personal hygiene training by 50.0% (n=10) of DF vendors, and hand washing training by 70.0% (n=14) DF vendors. The SF vendors who received training for personal hygiene and handwashing was 65.0% (n=13).

Table 4.4: Training providers (Deep frying vs Shallow frying)

	Deep Frying		Shallow Frying	
Variables	**Number (n=20)**	**Percentages**	**Number (n=20)**	**Percentages**
Department of Education				
Yes	0	0.0	0	0.0
Total	20	100.0	20	100.0
Department of Health				
Yes	0	0	12	60.0
Total	20	100.0	20	100.0
Food handler				
Yes	7	35.0	0	0.0
Total	20	100.0	20	100.0
Previous Employer				
Yes	4	20.0	0	0.0
Total	20	100.0	20	100.0
Other				
Yes	5	25.0	1	5.0
Total	20	100.0	20	100.0

In addition, Table 4.5 shows that 60.0% (n=12) of the SF vendors received the training by the Department of Health. Thirty-five percent (n=7) of the DF vendors' training was provided by food handlers and 20.0% (n=4) by previous employers.

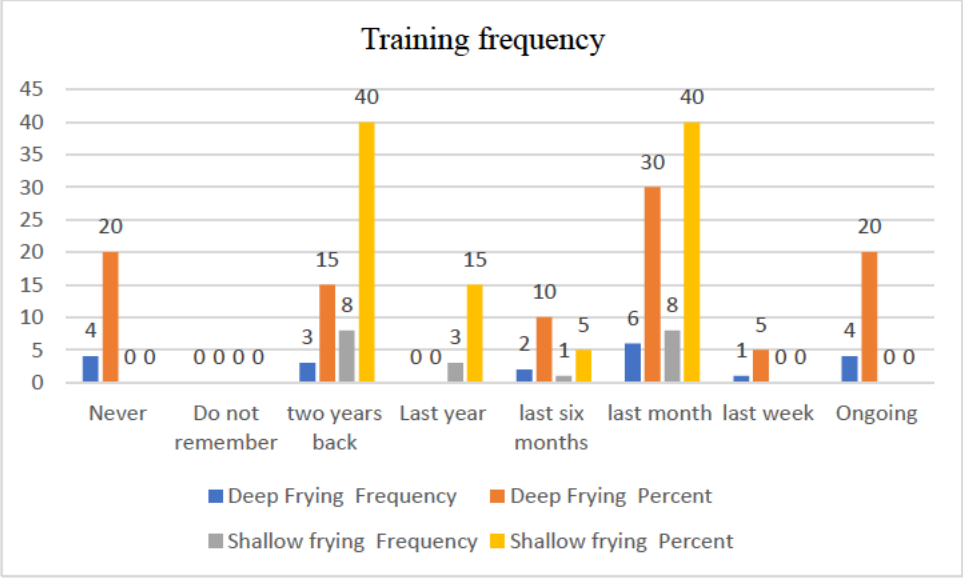


Figure 4. 10: Training frequency (Deep frying vs Shallow Frying)

An assessment was then made as to the frequency of training the food vendors received. Figure 4.10 demonstrates that 15.0% (n=3) of DF vendors received training two years ago, with the rest in the last year, and 20.0% (n=4) said the training is ongoing. Shallow frying vendors who received training two years ago and last month were both 40.0% (n=8); 15.0% (n=3) received training the previous year and 5.0% (n=1) received training in the last six months.

Table 2.3: During the frying process main group of compounds formed

	Deep Frying		Shallow Frying	
Variables	Number (n=20)	Percentages	Number (n=20)	Percentages
Is there soap available for hand washing				
Yes	12	60.0	20	100.0
No	8	40.0	0	0.0
Total	20	100.0	20	100.0
Is there hot water available for hand washing?				
Yes	1	5.0	0	0.0
No	19	95.0	20	100.0
Total	20	100.0	20	100.0
Is there cold water available for hand washing?				
Yes	4	20.0	2	10.0
No	16	80.0	18	90.0
Total	20	100.0	20	100.0

The frequency at which utensils were cleaned was also measured. Table 4.6 shows that only 60.0% (n=12) of DF vendors had soap for hand washing and all SF vendors (100.0%; n=20) had soap for hand washing purposes. Hot water was only available in 5.0% (n=1) of DF vendors, cold water was available in 20.0% (n=4) of the DF vendors and in 10% (n=4) of the SF vendors.

Table 4.5: Frequency of utensils cleaning (Deep frying vs Shallow frying)

	Deep frying		**Shallow frying**	
Variables	**Number (n=20)**	**Percentages**	**Number (n=20)**	**Percentages**
During preparation				
Yes	2	10.0	5	25.0
No	18	90.0	15	75.0
Total	20	100.0	20	100.0
After the food is ready				
Yes	17	85.0	18	90.0
No	3	15.0	2	10.0
Total	20	100.0	20	100.0
After the work is finished				
Yes	16	80.0	19	95.0
No	4	20.0	1	5.0
Total	20	100.0	20	100.0

Table 4.7 illustrates how frequently the vendors clean their utensils. Only 10.0% (n=2) of the DF vendors indicated that they clean their utensils during food preparation compared to 25.0% (n=5) of the SF vendors. Statistics also show that most vendors cleaned the cooking utensils after the food is ready, i.e., 85.0% (n=17) of the DF vendors and 90.0% (n=18) of the SF vendors. Thereafter, 80.0% (n=16) of the DF vendors indicated that they cleaned their utensils at the end of the working day, compared to 95.0% (n=19) of the SF.

Table 4.6: Frequency of stove cleaning (Deep frying vs Shallow frying)

	Deep frying		Shallow frying	
Variables	Number (n=20)	Percentages	Number (n=20)	Percentages
During preparation				
Yes	0	0.0	0	0.0
No	20	100.0	20	100.0
Total	20	100.0	20	100.0
After the food is ready				
Yes	12	60.0	15	75.0
No	8	40.0	5	25.0
Total	20	100.0	20	100.0
After the work is finished				
Yes	8	40.0	12	60.0
No	12	60.0	8	40.0
Total	20	100.0	20	100.0

In terms of the frequency of stove cleaning, Table 4.8 reveals that the stove was cleaned only after the food was ready by 60.0% (n=12) of the DF vendors and by 75.0% (n=15) of the SF vendors. Forty percent (n=8) of the DF vendors and 60% (n=12) of the SF vendors only cleaned the stove after the day's work was finished.

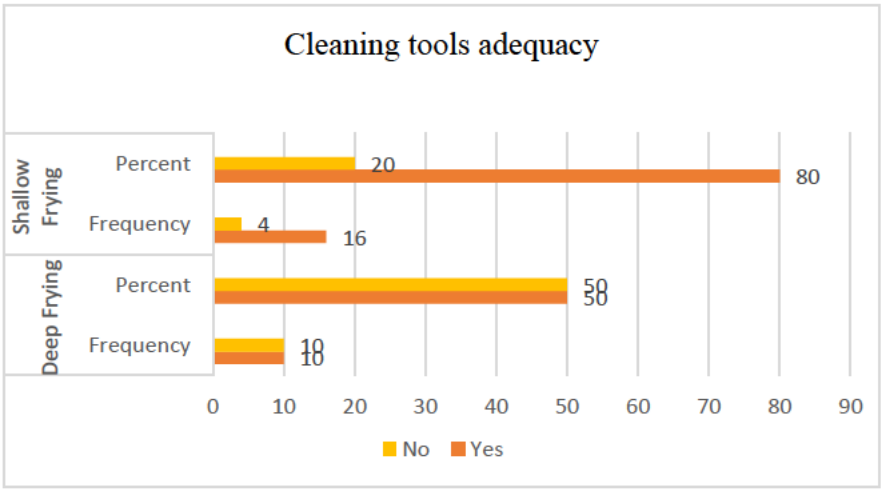


Figure 4.11: Cleaning material adequacy (Deep frying vs shallow frying)

Figure 4.11 illustrate that 50.0% (n=10) of the DF vendors and 80.0% (n=16) of the SF vendors had enough cleaning material for their utensils.

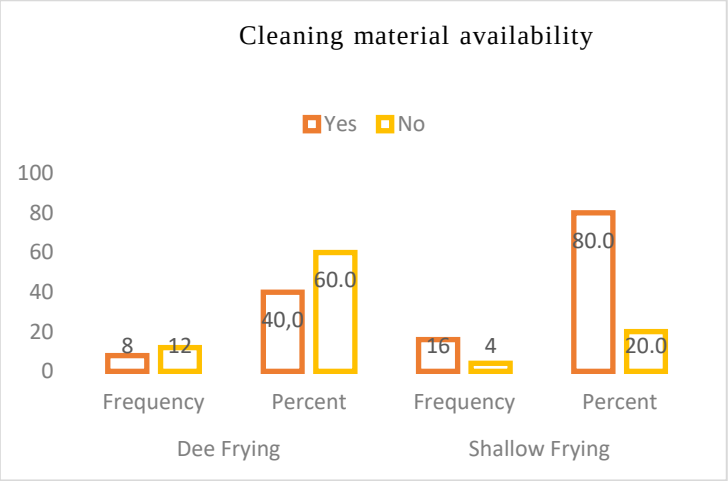


Figure 4. 12: 4.12 Cleaning material availability (Deep frying vs shallow frying)

It is demonstrated in Figure 4.12 that only 40.0% (n=8) of the DF vendors had cleaning material and the majority (80.0%, n=16) of the SF vendors had cleaning material at their disposal.

Table 4.7: Preparation areas cleaned cleaning frequency (Deep frying vs Shallow frying

	Deep Frying		**Shallow Frying**	
Variables	**Number (n=20)**	**Percentages**	**Number (n=20)**	**Percentages**
During preparation				
Yes	2	10.0	3	15.0
No	18	90.0	17	85.0
Total	20	100.0	20	100.0
After the food is ready				
Yes	8	40.0	20	100.0
No	12	60.0	0	0.0
Total	20	100.0	20	100.0
After the work is finished				
Yes	11	55.0	10	50.0
No	9	45.0	10	50.0
Total	20	100.0	20	100.0
Are the work areas ever sanitised?				
Yes	7	35.0	17	85.0
No	13	65.0	3	15.0
Total	20	100.0	20	100.0

Regarding the preparation and cleaning of cooking areas, Table 4.9 reveals that 10.0% (n=2) of the DF vendors and 15.0% (n=3) of the SF vendors clean the preparation area during food preparation. After the food was ready the preparation area was cleaned by 40.0% (n=8) of the DF vendors and 100.0% (n=20) of the SF vendors. After the work was finished the area was cleaned by 55.0% (n=11) of the DF vendors and 50.0% (n=10) of the SF vendors. The work area was sanitised by 35.0% (n=7) of the DF vendors, and 85.0% of the SF vendors.

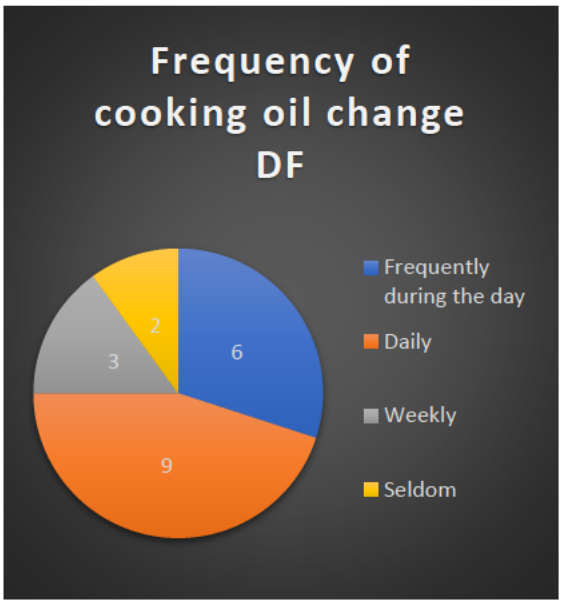


Figure 4.13: Oil replacement Deep frying

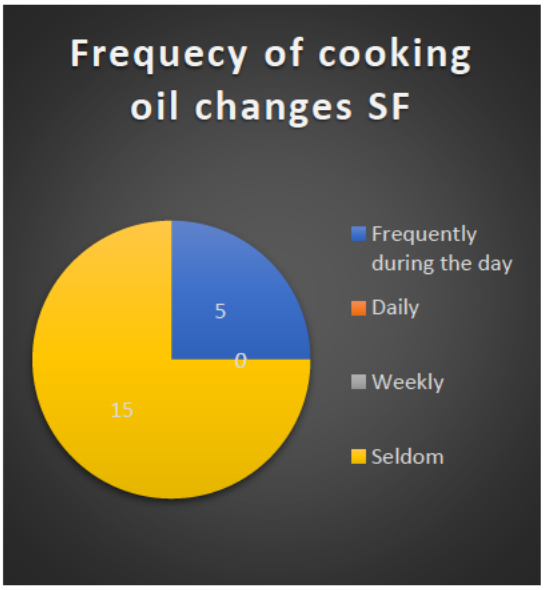


Figure 4. 14: Oil replacement Shallow frying

Figure 4.13 illustrates that 45.0% (n=9) of the DF vendors changed oil daily, while 30.0% (n=6) changed the oil frequently, with 15.0% (n=3) changing the oil weekly and 10.0% (n=2) changing it seldom.

On the other hand, Figure 4.14 illustrates that 25.0% (n=5) of the SF vendors changed the oil frequently during the day and 75.0% (n=15) seldom changed the oil.

4.4 OBSERVATION FINDINGS

This section reports on what the researcher and the fieldworkers observed during the fieldwork. The observations regarding various variables of the study are reported for both the SF and DF food handlers.

Table 4.8: Menu availability and receiving of goods

	Deep frying	Shallow frying
Variables	**Number %(n=20)**	**Number %(n=20)**
Evidence of monitoring procedures		
No	95.0 (19)	100.0 (20)
Evidence of policies and procedures		
No	90.0 (18)	100.0 (20)
Service-learning agreement between Municipality & the vendors		
No	100.0 (20)	100.0 (20)
Delivery date is written onto the product		
No	100.0 (20)	100.0 (20)
Delivery temperature checked		
No	100.0 (20)	100.0 (20)

Table 4.9: Storage and stock

	Deep frying	Shallow frying
Variables	**Number %(n=20)**	**Number %(n=20)**
Perishable food stored in a cold room/fridge/freezer		
No	65.0 (13)	100.0 (20)
Non-perishable foods stored in a separate room		
No	100.0 (20)	100.0 (20)
Cleaning items stored with food		
No	90.0 (18)	100.0 (20)
Storage areas kept locked		
No	85.0 (17)	100.0 (20)
Adequate light in the storage area		
No	90.0 (18)	100.0 (20)
Adequate space in the storage area		
No	55.0 (11)	100.0 (20)
Food stored in the original packaging		
No	40.0 (8)	80.0 (16)
Products clearly labelled		
No	100.0 (20)	100.0 (20)
Expiry dates on food items		
No	100.0 (20)	50.0 (10)
Products are transferred to storage containers, and the expiry dates recorded		
No	100.0 (20)	100.0 (20)
Food that is past the expiry date is used		
No	100.0 (20)	100.0 (20)
All containers covered		
No	70.0 (14)	30.0 (6)
Any of the food old or stale		
No	100.0 (20)	95.0 (19)

The storage areas are clean		
No	70.0 (14)	95.0 (19)
The storage areas neatly arranged		
No	85.0 (17)	95.0 (19)
Food stored directly on the floor		
No	60.0 (12)	75.0 (15)
Refrigerated storage available		
No	80.0 (16)	100.0 (20)
If yes, is the refrigerated storage in working order?		
No	85.0 (17)	70.0 (14)
Stock sheet kept		
No	100.0 (20)	95.0 (19)
The old stock of food used before the new stock (FIFO)?		
No	100.0 (20)	15.0 (3)
Any evidence pest (rodents/insects) infestation?		
No	45.0 (9)	20.0 (4)
Unpleasant odours in the storage area		
No	65.0 (13)	40.0 (8)

Table 4.10: Food preparation and recipe

	Deep frying	**Shallow frying**
Variables	**Number %(n=20)**	**Number %(n=20)**
Adequate space for food preparation		
No	35.0 (7)	60.0 (12)
Adequate space for serving /portioning		
No	30.0 (6)	45.0 (9)
Recipe availability		
No	95.0 (19)	100.0 (20)
Recipe standardization		
No	100.0 (20)	100.0 (20)
Adequate food preparation utensils		
No	30.0 (6)	45.0 (9)
Internal temperature of the food checked		
No	100.0 (20)	100.0 (20)
Easy access to water for cooking		
No	50.0 (10)	70.0 (14)

Tables 4.10-4.12 show the observation made with regards to the availability of menus, receiving of raw ingredients, storage methods, stock management, food preparation, and recipe availability and standardisation. The observation took one hour at each tuck shop. It was observed that there was no evidence of monitoring of policies and procedures for all SF vending sites (100.0%; n=20) and for the majority (95.0%; n=19) of the DF sites. Likewise, records were not available for goods delivered to the vending sites of both the SF and DF sites. Space adequacy and storage was a challenge due to the nature of the business and the operating environment of vending sites. As a result, unpleasant odour was observed in the majority of DF vending sites. It is crucial to highlight that expiry dates of food items were adhered to, even though they are not visible the majority of the vendors only purchased what they needed and replaced it when it was finished daily. The majority of the DF vendors (95.0%; n=19) and all (100.0%; n=20) SF vendors operated without a recipe and the internal temperature of the food was not checked in any of the vending sites. For some vendors water for cooking was not easily accessible.

Table 4. 11: Oil discarding

	Deep frying
Variables	**Number %(n=20)**
Is it poured down the storm water drain	
No	85.0 (17)
Is it poured down sewer/ waste water drains	
No	100.0 (20)
Is it poured on the ground	
No	100.0 (20)
The oil is collected & removed by used oil contractors	
No	75.0 (15)
Poured in a plastic container when it is hard to discard	
No	80.0 (16)
Nothing left to discard	
No	95.0 (19)
Taken home	
No	75.0 (15)

Table 4.12: Holding of food before serving and adequacy of utensils

	Deep frying	Shallow frying
Variables	**Number %(n=20)**	**Number %(n=20)**
Food served immediately following cooking		
No	55.0 (11)	50.0 (10)
Is the food kept warm during this time?		
No	100.0 (20)	100.0 (20)
If yes is the internal temperature checked?		
No	100.0 (20)	100.0 (20)
Are there adequate food serving utensils?		
No	25.0 (5)	35.0 (7)
Are there adequate eating utensils		
No	25.0 (5)	45.0 (9)
Portion sizes are standardized		
Yes	20.0 (4)	50.0 (10)

Table 4. 13: The waste management

	Deep frying	Shallow frying
Variables	**Number %(n=20)**	**Number %(n=20)**
Is all the prepared /cooked food served		
No	15.0 (3)	20.0 (4)
Is there a designated rubbish bin?		
No	100.0 (20)	85.0 (17)
Are the dust bin in covered?		
No	60.0 (12)	100.0 (20)
Are the dust bin cleaned?		
No	40.0 (8)	100.0 (20)
Is there waste lying outside the dustbin?		
No	60.0 (12)	85.0 (17)

Tables 4.13-4.15 show the observation made with regards to oil discarding, holding of food before serving, adequacy of utensils, and waste management. It was observed that when DF vendors are done using the oil 15.0% (n=3) poured it down the storm water drain. One of the DF vendors (5.0%) fried food at high heat until there was no oil left in the pot. Food was not served immediately after preparation by 55.0% (n=11) of the DF vendors and by 50.0% (n=10) of the SF vendors, and at the same time the food was not kept warm, and neither was the internal temperature monitored. Waste bins for SF vending sites were mostly (100.0%, n=20) not

covered and in the majority of these cases (85.0%, n=17), waste was found lying outside the bins.

Table 4.14: Food handler's hygiene and handwashing procedures

	Deep frying	**Shallow frying**
Variables	**Number %(n=20)**	**Number %(n=20)**
Kitchen utensils clean		
No	40.0 (8)	65.0 (13)
Kitchen equipment clean		
No	50.0 (10)	70.0 (14)
Correct cleaning chemicals available		
No	100.0 (20)	100.0 (20)
Adequate cleaning chemicals		
No	100.0 (20)	100.0 (20)
Work areas clean		
No	50.0 (10)	60.0 (12)
Area cleaned frequently during food preparation		
No	65.0 (13)	65.0 (13)
Area sanitized following food preparation		
No	100.0 (0)	100.0 (0)
Water available for cleaning		
No	30.0 (6)	85.0 (17)
Food handlers wash their hands regularly		
No	50.0 (10)	35.0 (7)
Water available for the customers handlers to wash their hands		
No	50.0 (10)	35.0 (7)
Soap available for hand washing		
No	55.0 (11)	20.0 (4)
Food handlers' overalls/clothes clean		
No	35.0 (7)	1.0 (5)
Servers wash their hands before serving		
No	90.0 (18)	50.0 (10)
Cooked food kept separately form raw food items		
No	20.0 (4)	40.0 (8)

The results of observing hygienic practices in vending sites (Table 4.16) reveal that correct cleaning chemicals were not available in all the SF and DF vending sites (100.0%) such as detergent for clothes and sanitizers and dishwashing liquid. All the DF and SF vending sites were not sanitized during food preparation, and 65.0% (n=13) of the areas were not cleaned

during food preparation. It was observed that the majority of the DF food handlers did not wash their hands before serving (90.0%; n=18), as 50.0% (n=10) of the DF vending sites did not have water available for food handlers to wash their hands. Fifty percent of the consumers did not wash their hands before eating either.

4.5 COOKING OIL TEST USING 3M™

This section of the research deals with the results of oil pre-screening using 3M™ oil quality test strips as well as post-screening results using Gas Chromatography. Therefore, the statistics available below showcase the results obtained from DF and FH's only, because the test strips can only be functional when used in the deep frying method.

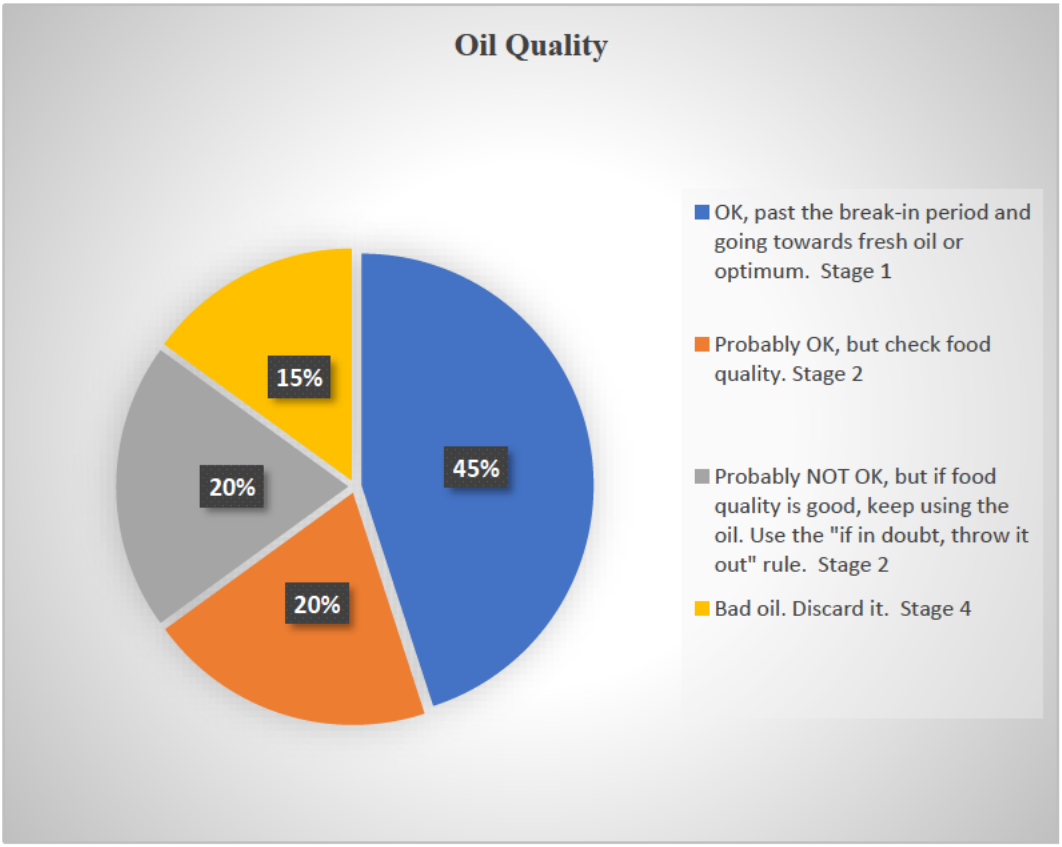


Figure 4. 15: 3MTM oil quality test strips results (Deep frying) (n=20)

Figure 4.15 demonstrates that 45.0% (n=9) of the DF vendors' cooking oil was suitable for cooking, 20.0% (n=4) was probably suitable and 20.0% (n=4) was probably not safe depending on the quality of food and 15.0% (n=3) was not safe and had to be discarded.

4.6 QUANTITATIVE ANALYSIS OF THE COMPONENTS OF COOKING OIL USING GAS CHROMATOGRAPHY

Gas chromatographic techniques required that a calibration standard be created from approved standards. The chromatograms of three methylated fatty acids are given in Figure 4.16. These chromatograms revealed that under specified chromatographic conditions as given above in the methodology section, they were all detected below a retention time of 3 minutes. The external standard method was used with the calibration curve obtained from plotting the different concentrations of these standards against their area of each peak. Results of the quantity of each fatty acid in oil are given in Table 4.18.

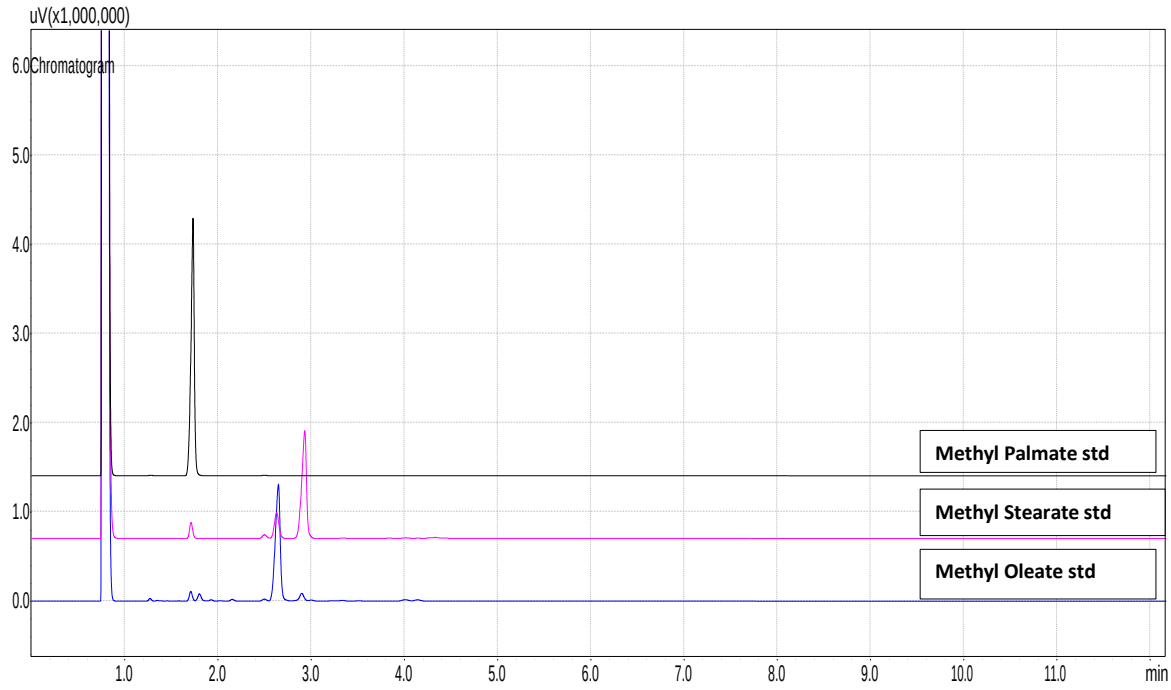


Figure 4. 16: Gas chromatographic peaks for the studied fatty acids at their corresponding retention time

The table that clearly gives a comparison of the concentration of each fatty acid that was determined using gas chromatography and results of the test trips are given in Table 4.17, this was done to evaluate the quality of used oils by comparing data from the strip with the concentration of fatty acids. It was found that the samples that were obtained from Bovine head market were in bad state, however, the concentration of palmitic, stearic and oleic acids ranged from 5.92 to 32.79 %. Interestingly, those from Victoria Street Market, Mixed trading strip and Berea Station, that had passed the test strip test had the concentration of palmitic,

stearic and oleic acids ranged from 4.62 to 16.6 %. This data suggested that the concentration of fatty acid could not be used as measure of the quality of fatty acid. Previous studies on the content of fatty acid are presented in table 4.15 below from different places. This table was compared with the studied three fatty acid and were found to be within the studied range.

Table 4. 15: Concentration of fatty acids from different cooking oil samples

Sampling Sites	Sample	Concentration of Fatty Acid (%)			Strip Interpretation			
		Palmitic Acid	Stearic Acid	Oleic Acid	OK, past the break-in period and going towards fresh oil or optimum. Stage 1	Probably OK, but check food quality. Stage 2	Probably NOT OK, but if food quality is good, keep using the oil. Use the "if in doubt, throw it out" rule. Stage 2	Bad oil. Discard it. Stage 4
Victoria Street Market	**A1**	4.62	7.68	10.42	**1**			
Victoria Street Market	**A2**	5.13	6.45	13.75	**1**			
Victoria Street Market	**A3**	6.33	8.57	9.87	**1**			
Early Morning Market	**A4**	11.66	8.01	7.17		**1**		
Early Morning Market	**A5**	14.42	6.65	11.77		**1**		
Bovine head market	**A6**	6.1	6.54	16.74			**1**	
Mixed trading strip	**A7**	16.6	7.94	7.94	**1**			
Bovine head market	**A8**	6.83	14.23	31.22				**1**
Mixed trading strip	**A9**	12.52	8.95	10.05	**1**			
Music Bridge	**A10**	18.03	8.57	29.91			1	
Music Bridge	**A11**	15.38	4.46	26.78			**1**	
Bovine head market	**A12**	5.92	7.86	27.62				**1**
Berea Station	**A13**	5.67	7.11	32.79	**1**			
Berea Station	**A14**	5.34	6.88	15.4	**1**			
Berea Station	**A15**	4.1	6.31	15.54	**1**			

Sampling Sites	Sample	Concentration of Fatty Acid (%)			Strip Interpretation			
		Palmitic Acid	Stearic Acid	Oleic Acid	OK, past the break-in period and going towards fresh oil or optimum. Stage 1	Probably OK, but check food quality. Stage 2	Probably NOT OK, but if food quality is good, keep using the oil. Use the "if in doubt, throw it out" rule. Stage 2	Bad oil. Discard it. Stage 4
Brook Street	**A16**	4.13	6.19	14.43			**1**	
Brook Street	**A17**	4.63	7.44	11.65		**1**		
Victoria Street Market	**A18**	8.82	6.27	17.28	**1**			
Bovine head market	**A19**	12.92	6.55	24.44				**1**
Fresh produce	**A20**	8.82	8.23	15.26		**1**		

Table 4.16 : Previous study on the content of fatty acid

Concentration of fatty Acids (%)			
Palmitic Acid	**Stearic Acid**	**Oleic Acid**	**Reference**
4.1-18.03	6.31-8.57	15.54-29.91	This study
6.24	2.35	13.8	(Dorni *et al.*, 2018)
6.2	28.0	2.8	(Orsavova *et al.*, 2015)
7.54	4.88	16.43	(Ivanova *et al.*, 2016)
5.60	3.08	22.75	(Kollathova *et al.*, 2019)
3.7	2	nd	(Kostik *et al.*, 2013)
9.2	2.8	34.7	(Aung *et al.*, 2018)

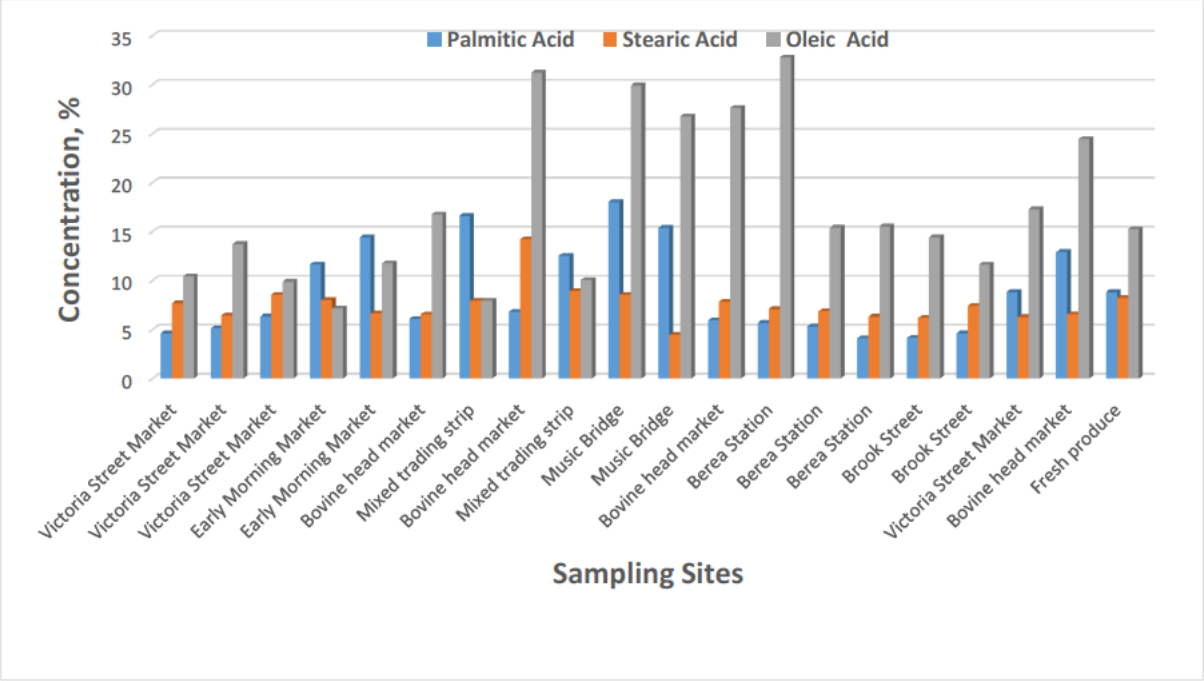


Figure 4.17: Concentration of fatty acids from different sampling sites

4.7 DISCUSSION OF RESULTS

A total number of 40 informal vending traders qualified to participate in this study. Altogether, there were 20 Deep frying vendors and 20 Shallow frying vendors. Upon analysis of the results, it was revealed that most informal food traders were females (90.0%; DF) and (100.0%; SF) and this was in line with findings of the study conducted on hygiene, safety, and food practices of food vendors at the University of Technology (UOT) in Durban where most vendors (66.8%) were females (Khuluse 2016: 95). Martin's (2006: 21) study on hygiene features of street vending in Gauteng also found that most (90.5%) of the vendors were females. However, it was inconsistent with a study conducted in Brazil on food safety rules compliance among Brazilian food truck vendors by Auad *et al.,* (2018: 180) where the majority (58.0%) of food vendors were male.

The educational profile of informal food vendors in this study was much lower compared to other countries and other studies since DF and SF combined vendors (37.5%; n=15) had matric/ Std 10/ Grade 12. These findings were not consistent with a study conducted in Durban (73.3%) Gauteng (48.0%), South Africa (60.0%), Nigeria (90.0%), and Zimbabwe (70.0%) where the vast majority of vendors had secondary education (Khuluse 2016: 95; Martins 2006: 21; Aluko *et al.,* 2014: 167; Mayrhofer and Hendriks 2003: 598). Thirty five percent of the DF vendors and 40.0% of the SF vendors had previous experience in food services. These findings were similar to a study by Campbell (2011: 41) conducted in Johannesburg where 47.0% of vendors had three years or more of vending experience.

In the study on the identification and management of toxicological hazards of street foods in developing countries, Proietti *et al.,* (2014: 144) state that food prepared for sale and exposed for sale may become contaminated by pathogenic micro-organisms as well as hazardous chemicals. Vending stands are often not adequate and clean water, waste disposal, and sanitary facilities are often not available in the whole vending area. Poor storage facilities and transport conditions also contribute to the overall difficulties in managing and improving street food safety. This suggests that the water used by the vendors is generally unsafe. Furthermore, the practice of storing water in containers may result in contamination from the containers and the food handlers, especially considering the incidence of contaminated hands reflected by the hand swab (Gadaga *et al.,* 2008: 831). Positively, in this study, an average of 80.0% of the DF

and SF vendors had soap available for handwashing. However, water availability for handwashing was a problem, with only 20.0%, of the DF and 10.0% of the SF vendors using cold water for hand washing. According to Oguttu *et al.,* (2014: 91) in a study investigating the food value chain of ready-to-eat chicken and the associated risk for staphylococcal food poisoning in the Tshwane Metropole, South Africa 84.8% of the vendors indicated that they brought soap from home, while three vendors indicated that their customers used soap available at their toilets and 12.6% indicated that soap was not available at the vending site for customers to wash their hands. The previous studies mentioned have identified the point of service as the most critical step for potential contamination of street food (Liu *et al.,* 2014; Proietti, Frazzoli, & Mantovani 2014).

The study shows that informal food vendors stored food separately from cleaning products and food product were kept in the original packaging. This was in line with a food safety and hygiene study practice of vendors during the chain of street food production in Brazil, it was revealed that 91.0% of the vendors stored food items separately without debris, thus avoiding cross-contamination between raw and cooked products. Also, 93.0% of the vendors stored food separately from the cleaning products to prevent contamination (Cortese *et al.,* 2016: 91).

Observations from this study regarding food safety and hygiene practices during peak hours are similar with findings of Khuluse (2016: 97) where FH's did not wash hands as regularly as expected in the kitchen and working surface were not sanitized before and after food preparation. Also consistent to the study by Sun *et al.,* (2012: 163) the researcher discovered that despite valuable positive feedback given on the food safety and hygiene knowledge questionnaires, food handlers did not practice hygiene standards during peak hours; their main focus was on getting food out as soon as possible thus making more money at the end of the day.

The study further revealed that fatty acids are mostly analysed using gas chromatograph (g.c) in the form of methyl ester derivatives. The mass spectra of these derivates contain ions, the double bonds cannot be determined in the aliphatic position by this technique. The carbon chain of the common fatty acids especially of plants and animals varied from (C_{16} to C_{22}); with zero to six double bonds of the *cis* configuration. In this work, the determined fatty acids (methyl palmate, methyl stearate and methyl oleate) carbon atom chain is between $C_{17} – C_{19}$.

The analysis of fatty acids before and after use was evaluated using gas chromatography. The results are listed in Figure 4.16. From these results, it is evident that the temperature and cooking or frying time have a high impact on the investigated edible oils. The analysed multiple samples taken from DF vendors of WTA (Durban) show that there is considerable variability that exists between the samples even for those samples from one source. Constant heating and reuse of these oils affect the acid value as well as the viscosity, and these properties are functional in degradation during storage of biodiesel (Monyem *et al.*, 2000: 373), and an alike behaviour is expected for the cooking oil. In addition, the level of saturation of the fats or oils during frying or cooking was observed.

Study results further revealed that a value of 4.62% for methyl palmate (sample A_1) was obtained implying an increase in viscosity, acid value as well as the saturation process. The highest saturation point was observed for samples A_{11} and A_{12}. This effect implies an increase from C_{17}: 1 (monosaturated) fatty acid to C_{17}: 2 (diunsaturated) fatty acid chains. The obtained results for methyl oleate show more stability as compared to methyl palmate and methyl stearate. This effect is due to the number of carbon atoms that provide high resistance towards heat, cooking, or frying of the oil. The results obtained for methyl palmate, methyl stearate, and methyl oleate at sample A_7 (16.6, 15.8, and 31.9%) respectively, imply that the cooking oil was utilized several times. These values differed tremendously from those of unused oils at 4.0, 6.9, and 34.5 %, respectively.

All in all, results from this study show a positive association between the intake of trans-isomers of fatty acid and the risk of coronary heart disease (CHD) is observed. Additionally, the results obtained indicate that fats and oils experience different degrees of proportionality in saturation during frying or cooking use, with the magnitude of these changes varying from sample to sample. A high degree of composition is observed in the used frying oil samples. The results indicate high consistency (or repeatability) of used cooking or frying oil from the sampling points of WTA.

4.8 CONCLUSION

The results of the study revealed that to improve food safety and hygiene practices, basic infrastructure with proper storage and washing facilities should be in place. The observational findings of this study showed that only 30.0% of DF and 5.0% of SF vendors had clean storage.

This is consistent with the literature that the knowledge attained from hygiene training was not excellently practised by food handlers. There were shocking results observed in DF vendors where oil was used until the level of oxidation. This is consistent with pre-sampling results where 15.0% of the DF vendors were using bad oil and it had to be discarded. As such, it is recommended that the training of informal food vendors should be revisited and that there should be a clear framework and policy on the training of food handlers. Furthermore, frequent audits from the municipality should be conducted to mitigate any food safety hazards and to improve the working conditions of the informal food vendors.

CHAPTER 5: CONCLUSION

5.1 INTRODUCTION

The previous chapter, chapter four presented the research findings. Therefore, chapter five outlines the obtained conclusions in this study. The chapter also, draw a comparison of this study with the available literature. Lastly, the conclusion will be set with established recommendations on the analysis of this study.

The research aim was to determine the food safety and hygiene practices and the trans fatty acid content of vegetable cooking oil used by the informal food vendors in WTA. This was to inform the dangers associated with re-using vegetable cooking oil and precarious food handling practices. There is correspondence between data obtained in this study and the objectives of the study outlined in the first Chapter.

The findings will provide valuable information for environmental health officers in the improvement of strategic plans towards adapting safe street food preparation and handling practices, preparation, and food vending laws/ policies within the eThekwini Municipality.

5.2 LIMITATION OF THE STUDY

These were the following limitations that the study was confronted with:

- The first limitation was the exclusion of cafeterias around WTA and Durban University Campuses, some students use public transport and they are frequent users of WTA but they buy food from cafeterias.
- Some vendors thought that the researcher was from law enforcement, they refused to participate stating that they are scared to participate because they might be in trouble with their bosses.
- Collected data from the food handlers are subject to self-reporting, there is a possibility of prejudice being demonstrated because no validation could be attained from the participants

during the study. Also, it was difficult to go back and take another oil sample from the same vendor because they did not vend in the same spot.

- Due to the nature of the environment, some vendors were vending in the pedestrian pathway, so commuters were walking through while the researcher was observing.
- The completion of an observation sheet has limitations because the participants perform well when they noticed that they are being monitored.

5.3 MAIN FINDINGS

Food vendors in this study were mostly females aged above the age of 30. The majority of DF vendors had grade 8 to 11 and SF vendors had grade 12 as the highest qualification. Vending sites mostly had more than one food handler with no previous experience in foodservice. Food vending sites were mostly temporary kitchens hence, space adequacy for cooking was not enough. As a result, the safe water supply was very limited. Deep frying food vendors were found to lack knowledge of food preparation and food safety training. The oil was changed daily by the majority of DF vendors and seldom by the SF vendors. The researcher observed that there was no evidence of monitoring procedures, policies, and service-learning agreements between municipality and vendors. The sanitation and hygiene condition of the storage area was alarming.

5.3.1 Socio-Demographic

In this study, the socio-demographic variables assessed were gender, literacy level, socio-economic status, length of service, and cultural background. The unemployment rate in Durban increased from 21.8% in 2018 by 4.3% in 2019 making it 26.1% (Stats SA, 2019). Hence, people resort to informal food trading to make a living. This study revealed that most vendors had secondary education even though not all of them completed grade 12. Regarding experience, the majority of the participants had no prior experience.

Vending became more prevalent amongst women because historically this industry was not well coordinated and not much capital was required. Hence, this industry is dominated by

women in South Africa which is like other countries. This study attests to that, majority of participants were females.

5.3.2 Food safety and hygiene practices (FH's)

This questionnaire is one of the pillars of this study, both DF and SF participants had the same questions, and this was to ascertain if all are aligned with food safety and hygiene practices. In DF outlets food was prepared more by food handlers and in SF mostly by owner/ managers. All the parties were well informed with checking expiry dates and not selling leftovers the following day. The majority of the vendors were preparing food in a temporary kitchen, had no adequate space for cooking, and a shortage of water access.

As much as the food preparation utensils were enough not all were correct tools. There was one chopping board for raw and cooked food which might result in cross-contamination. Some vendors use normal tablespoons as serving spoons. The majority of vendors did not have recipes that also led to the majority not having a menu. There was a huge gap in food safety training between DF and SF vendors, SF vendors were more trained than DF vendors. Vendors confirmed that they received food safety training, but the training providers were their colleagues and owners. This is in line with the observation that was conducted, that there are no single vendors who produced a permit and training documents.

Food holding varied because of the nature of the business, competition and where the vending site is situated. As result, it was a determining factor as well the busier the vendor the greater chance for oil replacement. Waste disposal was accessible to most vendors. There was a huge gap in food safety training between DF and SF vendors, SF vendors were more trained than DF vendors.

5.3.3 Observational findings

The following observations were made during the study:

- It was observed that the majority of vendors, in general, did not follow food safety procedures and policies as a result there was no evidence of service-learning agreements with the municipality on site.
- During receiving there was no monitoring control with regards to temperature. Whenever the vendors ran out of meat, they bought from one of the surrounding retailers, in this process, the meat was not in temperature-controlled storage it was just in the original packaging. Therefore, storage for the cold chain was not regarded as a critical factor by the vendors. During preparation and food holding the temperature was not monitored. Food was prepared in advance before serving, reheat the food and serve.
- A bucket system was observed for washing hands and it was a storage for cleaning cloths. So, food handlers together with consumers would come and wash hands in that same bucket they use for cleaning surfaces. Furthermore, they would rinse the cloth in the same water then wipe their hands.
- There was a frequent exchange of money between the food handlers and the consumers. Immediately after receiving money food was served with hands not being washed.
- All the vending sites had no proper storage, which is lockable, sectionalise for different use, with lighting, and free from rodents. The majority of the vendors at the end of the business day, packed up and went home with everything and set up in the morning again. Few were leasing storage underneath the bridge in WTA.

5.3.4 Trans Fatty Acids findings

- It was found that the samples that were obtained from Bovine head market were in bad state, however, the concentration of palmitic, stearic and oleic acids ranged from 5.92 to 32.79 %.
- Interestingly, those from Victoria Street Market, Mixed trading strip and Berea Station, which had passed the test strip test had the concentration of palmitic, stearic and oleic acids ranged from 4.62 to 16.6 %.
- This result suggested that the concentration of fatty acid could not be used as measure of the quality of fatty acid

5.4 CONCLUSION

Undoubtedly informal street food trading has a positive impact on the livelihood of its target market and vendors. This sector can boost the economy by providing employment and generating income for the informal traders. However, there are key areas that must be addressed that may affect this industry negatively such as food safety, hygiene, and sanitation holistically. This may be made possible by adequate food safety training and proper functioning of basic infrastructure with all the requirements to prepare and serve safe nutritious food.

5.5 RECOMMENDATIONS TO THE FOOD VENDORS

- A basic food safety and hygiene practices certificate is highly recommended. The municipality must be the facilitator, when vendors are applying for a permit, they must complete a workshop on food safety and hygiene practices.
- Proper consultation with the municipality on how they can improve easy access to safe and hygienic water to vendors and the cost implications to the vendors.
- Deep-frying vendors need to enrol in an oil recycling program, identify drop-off spots of overused cooking oil for the collection so that it can be used in the chemical and biofuel industry.
- The municipality should develop a process for unannounced audits to very basic food safety and hygiene compliance by the food vendors.
- All food vendors must have vending site identification numbers visible to the consumers, in case there's a foodborne outbreak to make it easy for traceability.
- Mobile kitchens are highly recommended for food vendors as they have proper storage, refrigeration, and cooking facility.

5.6 Recommendation for future research

- More research on informal street food vendors from other municipalities is critical, to make a comparison of results and engage the Department of Health and other relevant stakeholders in shaping the future of street food vending in the right direction.

- Further research on the role of street food vending as a livelihood strategy, eradicating hunger and promoting urban food security.
- More research on types of cooking oil used by informal street food vendors and their impact on the food composition and how they affect the health of the commuters.
- For future studies, the researcher would like to recommend that, before participating in the study the vendors produce the permit from the municipality first so that the consistency in findings can be monitored.

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Annexure A – Permission letter from Municipality

No. M.1/1/2

Researcher- Name: Mthokozisi Kubushe
Institution- Name: Durban University of Technology
Institution- Address: CNR: Steve Biko Rd & Botanic Rd
Durban
4001
Research Subject: Trans fatty acid content in used vegetable cooking oil and food safety hygiene practices of informal food vendors in Warwick Triangle Durban

Director : Health
Box 2443
DURBAN
4000

Dear Sir/Madam

RESEARCH SITE : ETHEKWINI MUNICIPALITY HEALTH DEPARTMENT

I, the undersigned, hereby wish to apply for permission to attend the eThekwini Health Department to undertake research on Council property.

I understand that any permission granted to me will be subject to:

(a) there being no additional cost to the Council; and
(b) the exigencies of the eThekwini Health Department, and provided that no interference with its programme will ensue.

In consideration of the facilities given and to be given to me by the eThekwini City Council, as aforesaid, I hereby indemnify the said Council and its officers and hold it and them harmless against and hereby waive, renounce and abandon any claim for damages or compensation arising from injury or loss which I may sustain whilst on Council property or transport or on the way to or from any Council property or place of research or which I may sustain in any way whatsoever whilst conducting research.

I further indemnify the eThekwini Council and its officers against any claim whatsoever which may in any way result from the facilities afforded to me and be brought against the said Council or its officers.

Date: 26/09/2016

Researcher's Signature

Witness:

Mthokozisi Kubushe
Researchers Name (in capital letters)

Permanent Address:
01 Pinedale Close, Newlands West
Durban, 4037

Period From: January 2016 to Current

ETHEKWINI MUNICIPALITY

Health Unit

ACKNOWLEDGEMENT OF RESEARCH CONDITIONS:

I MTHOKOZISI RUBUSHE **undertake to comply to**

EThekwini Municipality Health Unit's conditions for the study, as stipulated in the permission letter.

Name and signature of principal investigator:

Name: MTHOKOZISI Signature: Date 26/09/2015

Name and signature of other researchers:

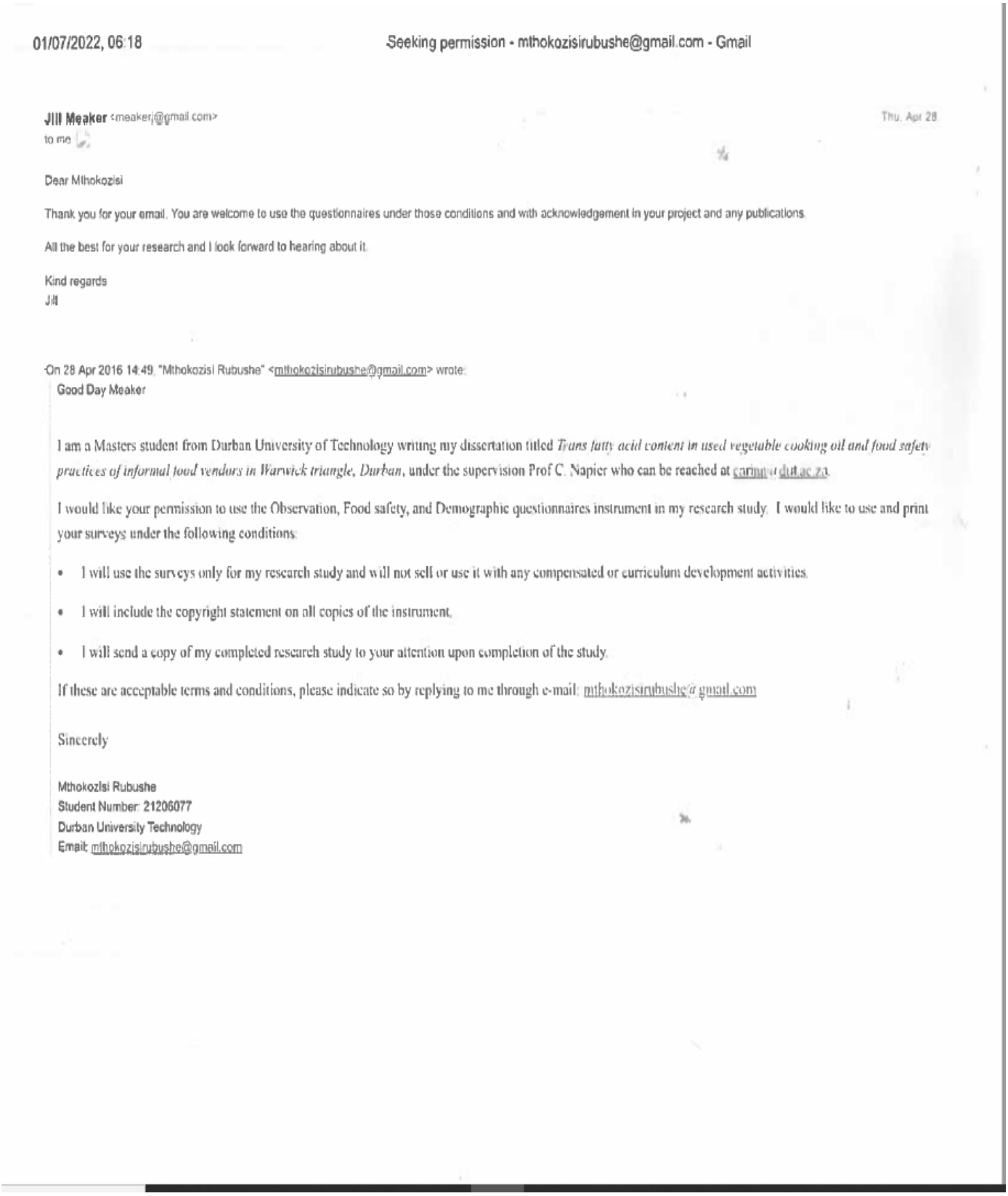
Name: _____ Signature: _____ Date: _____

Name: _____ Signature: _____ Date: _____

Name: _____ Signature: _____ Date: _____

Name: _____ Signature: _____ Date: _____

Annexure B – Permission to use questionnaires



01/07/2022, 06:18 Seeking permission - mthokozisirubushe@gmail.com - Gmail

Jill Meaker <meakerj@gmail.com> Thu, Apr 28
to me

Dear Mthokozisi

Thank you for your email. You are welcome to use the questionnaires under those conditions and with acknowledgement in your project and any publications.

All the best for your research and I look forward to hearing about it.

Kind regards
Jill

On 28 Apr 2016 14:49, "Mthokozisi Rubushe" <mthokozisirubushe@gmail.com> wrote:

Good Day Meaker

I am a Masters student from Durban University of Technology writing my dissertation titled *Trans fatty acid content in used vegetable cooking oil and food safety practices of informal food vendors in Warwick triangle, Durban*, under the supervision Prof C. Napier who can be reached at carinn@dut.ac.za.

I would like your permission to use the Observation, Food safety, and Demographic questionnaires instrument in my research study. I would like to use and print your surveys under the following conditions:

- I will use the surveys only for my research study and will not sell or use it with any compensated or curriculum development activities.
- I will include the copyright statement on all copies of the instrument.
- I will send a copy of my completed research study to your attention upon completion of the study.

If these are acceptable terms and conditions, please indicate so by replying to me through e-mail: mthokozisirubushe@gmail.com

Sincerely

Mthokozisi Rubushe
Student Number: 21206077
Durban University Technology
Email: mthokozisirubushe@gmail.com

Annexure C – IREC approval

DUT
DURBAN
UNIVERSITY OF
TECHNOLOGY

Institutional Research Ethics Committee
Faculty of Health Sciences
Room MS 49, Mansfield School Site
Gate 8, Ritson Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2900
Fax: 031 373 2407
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

29 September 2016

IREC Reference Number: **REC 77/16**

Mr M Rubushe
01 Pinedale Close
Newlands West
Durban
4037

Dear Mr Rubushe

Trans fatty acid content in used vegetable cooking oil and food safety hygiene practices of informal food vendors in Warwick Triangle, Durban

The Institutional Research Ethics Committee acknowledges receipt of your gatekeeper permission letter.

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

Yours Sincerely,

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY

2016 -09- 29

INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

Annexure D – Information letter and consent form

LETTER OF INFORMATION

Dear Warwick Triangle Avenue, Food Vendors

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

The title of my study is "Tran's fatty acid content in used vegetable cooking oil and food safety practices of informal food vendors in Warwick triangle, Durban"

Principal Investigator/s/researcher: I Mthokozisi Rubushe, (B. Tech: Consumer Sciences Food and Nutrition) will be the main researcher and I am supervised by Professor Carin Napier (D Tech Food Service Management).

In developing countries the industry of informal food vending plays an important role both economically and in meeting the demands of the population. It also contributes significantly to household food spending within the cities and towns. Furthermore, it affords income to countless household headed by women. However, violation and hazards of proper practices can emerge easily at every step of street foods production. The main sources that contribute to contamination are as follows the place of preparation, utensils of cooking and serving, raw material, time and temperature of cooked foods and personal hygiene of vendors.

We also know that one of the prevalent methods of creating pleasurable flavours and attractive appearance in food preparation is frying. It is also regarded as convenient method of cooking, as it just necessitates the immersing of food item in hot oil for few minutes only. However, the oil that is used frequently for frying of food is very closely related to the health issues.

The research aim is to determine the food safety practices and the Trans fatty acid content of vegetable cooking oil used by the informal food vendors in Warwick triangle in order to provide guidance on the dangers associated with re-using vegetable cooking oil and precarious food handling practices.

What will it involve?

- The study forms part of the eThekwini community upliftment project of WAT.
- Ethical clearance was obtained from eThekwini and DUT.
- I will need you to sign a consent form to indicate that you agree to participate in the study after I explained all the procedures to you.
- If you agree you will be asked to participate in the completion of 4 questionnaires in an interview situation it could take up to 1 hour.

  The questionnaires will include:
- Food safety questionnaire
- Observational checklist
- Demographic questionnaire
- Checklist of 3M^{TM} oil quality test strip.

- We will also take oil samples to check the content of Trans fatty acids of the cooking oil.
- Participation is voluntary and you can withdraw at any time with no penalty**.**

You will not feel any discomfort. All samples and analysis will be done at the lab. The results of the study will be shared with eThekwini municipality and WAT community after the study has been concluded but your name will not be mentioned, with the hope that interventions can be planned in the community for any identified problems. If you have any personal nutrition questions or concerns we are prepared to come back to you after the data collection to assist you.

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.
- It won't cost you anything to participate in this study.
- You will be given a participant number so no names will be used in the study**.**

Research-related Injury:

No injuries are expected in this study

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

Your participation will be greatly appreciated and thank you for allowing us to explain this study to you.

Kind regards

Mthokozisi Rubushe

Persons to Contact in the Event of Any Problems or Queries:
Supervisor: Prof. Carin Napier
Researcher: Mthokozisi Rubushe 0735353903
Supervisor contact: 031 373 2326 carinn@dut.ac.za
The Institutional Research Ethics administrator: 031 373 2900.
Complaints can be reported to the DVC: TIP, Prof S. Moyo 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 / 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**

_____	_____	_____
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

Annexure E – Socio Demographic

DEMOGRAPHIC QUESTIONNAIRE

Information to be obtained from informal food vendor that works in WAT in Durban

INTERVIEW DATE:_____/_____/_____
DD/MM/YY

INTERVIEWER'S NAME:

Please tick the respondent's answers.

SECTION 1 – GENERAL
:

NO.	QUESTIONS	ANSWERS
4.	Gender	a) Male b) Female
5.	Age of respondent	a) < 30 b) 30 and above
6.	What is your highest level of education?	a) No education b) Std 1/Grade 1-3 c) Std 2-5 Grade 4-7 d) Std 6-9 Grade 8-11 e) Matric/Std 10/ Grade 12 f) Apprenticeship g) Post – matric diploma/Technikon h) University
7.	Do you have previous experience in food service?	a) Yes b) No
8.	Do you have a menu	a) Yes b) No
9.	What menu is used? Who developed the menu?	a) The owner b) A nutritionist or dietitian c) Nonethe food preparation staff d) Other: ……

10.	Why is this menu used?	a) Economical b) Locally accepted foods c) Locally available foods d) Favourite foods e) Other (please specify) ……

Thank you for your participation

Annexure F – Food handlers

FOOD HANDLERS QUESTIONNAIRE/ *IMIBUZO EBHEKENE NABAPHEKI*

Vendor/ Umthengisi #	

The aim of the questionnaire is to investigate the daily food hygiene and safety practices among food handlers.

Inhloso yalemibuzo elandelayo ukuthola inqubo yenhlanzeko Kanye nokuphepha kokudla okukhiqizwa abapheki balesikole.

NB: Please complete the answers in the blocks provided on your right hand side or indicate with a cross **X** for either a **yes** or **No** answer.

Isexwayiso: *Sicela ukuba ubhale izimpendulo zakho ebhokisini elingasokudla noma ufake isiphambano **X** uma uthi **yebo** noma **Cha***

GENERAL/ OKUJWAYELEKILE:

1. How many cooks/ food handlers are working at this establishment?

Bangaki abapheki abasebenza kuleli khishi?

Number/ Inombolo	

2. How long have you been a cook/ food handler for? Record the number of years and months.

Usunesikhathi esingakanani usebenza njengompheki? Bhala iminyaka nezinyanga

Years/Iminyaka	
Months/Izinyanga	

3. Do you have previous experience in food service?

Unalo ulwazi ngaphambilini lokusebenza ngokudla?

Yes/*Yebo*	
No/*Cha*	

4. Is there a menu?

Likhona yini iphepha elibhalwe ukudla ngokulandelana kwakho?

Yes/*Yebo*	
No/*Cha*	

FOOD STORAGE/ *INDAWO YOKUGCINA UKUDLA*

5. Are the expiry dates checked on the foods?

Niyakuqikelela ukubheka imibhalo emaphaketheni okudla eshoyo ukuthi ngabe ukudla konakele yini?

Yes/*Yebo*	
No/*Cha*	

6. If the expiry date on the food packaging is 20 August2014, what does this mean?

(take a sample and show it to the cook / food handler)

Uma usuku lokonakala ephakethenil okudla lingumhlaka 20 August 2014, kusho ukuthini?

(thatha isampula utshengise umpheki)

……

……

FOOD PREPARATION/ *UKULUNGISA UKUDLA*

7. Where is the food prepared?

Ukudla kulungiselwa kuphi?

Designated kitchen/*Endlini yokuphekela*	1
Temporary kitchen/ *Ikhishi lesikhashana*	2
Outbuilding/ *Endlini engaphandle*	3
Other (please specify)/ *Okunye (sicela uchaze)*	4

8. Who prepares the food?

Ubaniolungisaukudla?

The Manager/*Umphathi*	1
The food handler/*Umphathi kudla*	2
Other (please specify)/ *Okunye(chaza)*	3

9. Is there adequate space for food preparation?

Kungabe indawo yokulungisela kudla ivuleke ngokwanele?

Yes/*Yebo*	
No/*Cha*	

10. Is there adequate space for cooking?

Kungabe indawo yokuphekela ivuleke ngokwanele?

Yes/*Yebo*	
No/*Cha*	

11. Is there enough water for food preparation?

Kungabe amanzi okulungisa ukudla akhona ngokwanele?

Yes/*Yebo*	
No/*Cha*	

12. Are there enough food preparation utensils? (Answer all options)

Zanele yini izitsha zokulungisa ukudla? (phendula yonke imibuzo)

Knives/ *Imimese*	Yes/*Yebo*	No/*Cha*
Chopping Boards/*Amabhodi okuqobela*	Yes/*Yebo*	No/*Cha*
Measuring equipment/*Izitsha zokukala*	Yes/*Yebo*	No/*Cha*
Serving spoons/*Izipuni zokudla*	Yes/*Yebo*	No/*Cha*
Mixing tools/*amathuluzi okuhlanganisa*	Yes/*Yebo*	No/*Cha*

13. Are recipes available?

Ikhona yini indlela yokupheka ukudla ebhalwe phansi?kusho amarecipe

Yes/Yebo	Go to Q 14/ *Qonda kumbuzo 14*	
No/Cha	Go to Q 16/ *Qonda kumbuzo 16*	

14. Are the recipes used?

Ziyasetshenziswa yini lezindlela zokupheka kusho amarecipe??

Yes/Yebo	Go to Q 15/ *Qonda kumbuzo 15*	
No/Cha	Go to Q 16/ *Qonda kumbuzo 16*	

15. Where were these recipes obtained?

Kungabe lama recipe athathwakephi?

The manager/ *Umphathi*	1
The food handler/*Umpheki*	2

Department of Health/ *Umnyango wezempilo*	3
Department of Education/ *Umnyango wezemfundo*	4
Other (please specify)/ *Okunye (Chaza)*	5

FOOD HOLDING/*UKUGCINWA KOKUDLA OSEKUPHEKIWE*

16. How long is the food held after cooking and before serving? (Select one).
Kubekwaisikhathiesingakananiukudlaemvakokuphekwanangaphambikokuphakwa? Khethaokukodwa.

Less than 15 minutes/*ngaphansi kwemizuzuengu 15*	1
15-30 minutes/ *imizuzuengu 15 kuyakwewu 30*	2
30-45 minutes/*imizuzu ewu 30 kuya kwe wu 45*	3
More than 45 *minutes/ngaphezul ukwemizuzu engu 45*	4

17. How is the food kept warm?
Kugcinwa kanjani kufudumele ukudla?

……

……

SERVING

18. Is there adequate space for serving / portioning?
Indawo yokuphakela ukudla ngabe yanele yini?

Yes/Yebo	
No/Cha	

19. In your opinion are the students happy with the portion sizes of their food?
Ngokombonowakhokungabeabafundibayanelisekaisikalisokudla?

Yes/*Yebo*	
No/*Cha*	

WASTE/ *UKUDLA OKUMOSHEKILE*

20. What happens to the food that is prepared but the students do not finish? i.e. left overs. (Mark all relevant options).
Kwenzakalani ngokudla okungathengiswanga kubafundi ngosuku? (khetha konke okufanele)

Thrown away/ *kuyalahlwa*	1
Given to a friend/ *kunikezwa umngani*	2

Taken home/*kuthathwa kuyiswe emakhaya*	3
Kept for the next day/*kugcinelwa usuku olulandelayo*	4
Food handlers eat it/*abapheki bayakudla*	5
Other ([please specify)/*okunye (chaza)*	6

21. How much left over food do you throw away after every day that was not served or sold? (Select one)
Kungakanani ukudla okulahlwayo ngosuku okunga dayiswangwa? (Ketha okukodwa)

None/*akukho*	1
Less than a quarter/*okungaphansi kwekota*	2
Half/ *uhalf*	3
More than half/ *okungaphezulu kwa half*	4
Don't know/ *awazi*	5

22. Is left over food reheated and served the following day?
Kungabe ukudla okusalile ngosuku oledlule kuyafudumezwa kuphinde kudayiswa?

Yes/*Yebo*	
No/*Cha*	

23. If yes, how is it reheated?
Uma impendulo kuwu yebo, kufudumezwa kanjani?

On the stove/ *estofini*	1
In the microwave/*kwi microwave*	2
In the food warmer/*kwimfudumezi*	3
Other (please specify)/ *okunye (chaza)*	4

24. Is there a designated rubbish area?
Ikhona indawo yokulahla udoti?

Yes/*Yebo*	
No/*Cha*	

25. If yes, where is it situated?
Uma ikhona, ikuphi nendawo?

In the kitchen food preparation area/ *lakulungiswa khona ukudla ekhishini*	1
In the serving area,*lakuphakelwa khona*	2
Outside the food shop/*ngaphandle kwesitolo*	3
Other (please specify)/*okunye (chaza)*	4

26. How often is it removed /cleaned?
Ususwa kangaki noma uhlanzwa kangaki?

Once a day (morning / afternoon)/ *Kanye ngosuku (ekuseni/ntambama)*	1
Twice a day (midday & afternoon)/ *kabili ngosuku(emini na ntambama)*	2
Once a week/*Kanye ngesonto*	3
Other (please specify) */okunye (chaza)*	4

27. Does the rubbish bins have tightly fitting lids?

Kungabe imigqomo inazo yini izivalo zawo eziqinile?

Yes/*yebo*	1
No/*cha*	2
Some/*eminye*	3

TRAINING & FOOD SAFETY/*UKUQEQESHA NOKUPHEPHA KOKUDLA*

28. Have you received any training about food safety and hygiene?
Ngabe kukhona yini ukuqeqesha ngokuphepha nangokuhlanzeka kokudla?

Yes/*Yebo*	
No/*cha*	

29. Have you received training regarding the following? (Answer all options)
Usuke wathola yini ukuqeqeshwa mayelana nezinto ezilandelayo?

Menu planning/ *ngohlelo olulandelayo lokuphekwa*	Yes/yebo	No/cha
Food preparation/ *ukulungisa ukudla*	Yes/yebo	No/cha

Prevention of food contamination/*ukuvikela ukudla emagciwaneni*	Yes/yebo	No/cha
Prevention of cross-contamination of food/*ngokuvikela ukushintshana kwamagciwane ekudleni*	Yes/yebo	No/cha
Illness in the workplace/*ukugula endaweni yokusebenza*	Yes/yebo	No/cha
Injury in the workplace/*ukulimala endaweni yokusebenza*	Yes/yebo	No/cha
First aid/*ngosizo lokuqala*	Yes/yebo	No/cha
Personal hygiene/*ngokuhlanzeka komuntu*	Yes/yebo	No/cha
Hand washing/*ngokugeza izandla*	Yes/yebo	No/cha
Other (please specify)/*okunye (chaza)*	Yes/yebo	No/cha

30. If you have received training, whom did you receive the training from? (Answer all options)
Uma usuke waqeqeswa, wawuqeqeshwa ubani? Phendula yonke imibuzo

Department of Education/ *Umnyango wezemfundo*	Yes/Yebo	No/Cha
Department of Health/*umnyango wezempilo*	Yes/Yebo	No/Cha
Food handler/ *omunye umpheki*	Yes/Yebo	No/Cha
Previous employer/*umsebenzi odlule*	Yes/Yebo	No/Cha
Other (please specify)/ *okunye(chaza)*	Yes/Yebo	No/Cha

31. When last was training conducted? (Select one)
Ukuqeqeshwa kwakugcine nini? Khetha okukodwa

Ongoing/*kusaqhubeka*	1
Last week/*ngesonto eledlule*	2
Last month/*ngenyanga edlule*	3
Last term/*ngethemu eledlule*	4

Last year/*ngonyaka owedlule*	5
Never/ *akukaze kwenzeke*	6

32. How frequently is training conducted? (Select one)

Ngabe ukuqeqeshwa kwenziwa kangaki? Khetha okukodwa

Ongoing/*kusaqhubeka*	1
Last week/*ngesonto eledlule*	2
Last month/*ngenyanga edlule*	3
Last term/*ngethemu eledlule*	4
Last year/*ngonyaka owedlule*	5
Never/ *akukaze kwenzeke*	6

33. Is there soap available for hand washing?
Ikhona insipho yokuwasha izandla?

Yes/yebo	
No/cha	

34. Is there running tap water available for hand washing? (Answer all options)
Kungabe akhona yini amanzi ompompi okugeza izandla?

Hot	Yes/yebo	No/cha
Cold	Yes/yebo	No/cha
None	Yes/yebo	No/cha

35. How frequently are utensils washed? (Mark all relevant options)
Zigezwa kangaki izitsha? Khetha konke okulungelekile

During preparation/ *uma kulungiswa ukudla*	1
After the food is ready/ *uma ukudla sekulungile*	2
After the work is finished/*uma sekuqedwe ukusetshenzwa*	3

36. How frequently is the stove cleaned? (Mark all relevant options)
Istofu sihlanzwa kangaki? Khetha konke okulungelekile

During preparation/ *uma kulungiswa ukudla*	1

After the food is ready/ *uma ukudla sekulungile*	2
After the work is finished/*uma sekuqedwe ukusetshenzwa*	3

37. Are the correct cleaning chemicals available to clean the kitchen?
Kungabe imithi yokuhlanza ikhishi okuyiyo ikhona yini?

Yes/*yebo*	
No/*cha*	

38. Are there enough cleaning tools to clean the kitchen e.g. broom, mop, cloths, sponge, etc?
Anele yini amathuluzi okuhlanza ikhishi njengemishanelo, imophu, izindwangu zezitsha, izimpontshi, njalo njalo?

Yes/*yebo*	
No/*cha*	

39. How often is the preparation area cleaned? (Mark all relevant options)
Ihlanzwa kangaki indawo yokulungisela ukudla? Khetha konke okulungelekile

During preparation/ *ngenkathi kulungiswa ukudla*	1
After the food is ready/*emva kokuba ukudla kulungile*	2
After the work is finished/ *uma sekuphele umsebenzi*	3

40. Are the work areas ever sanitised?
Iyasetshenziswa yini imithi yokubulala amagciwane?

Yes/*yebo*	
No/*cha*	

41. If yes, how often? (Select one)
Uma kuyebo, kangaki? Khetha okukodwa

Frequently/ *njalo*	1
Daily/ *njalo ngosuku*	2
Weekly/ *njalo ngesonto*	3
Seldom/ *akujwayelekile*	4

42. How often is frying oil changed from the deep fat fryer?
Kungabe ashintshwa kangaki amafutha okushisa emshinini wokushisa?

Frequently during the day/ *njalo ngosuku*	1
Daily/ *nsuku zonke*	2
Weekly/ *ngamasonto*	3
Seldom/ *akujwayelekile*	4

Thank you for your participation / Siyabonga ukungenelela kwakho ucwaning

Annexure G – Observation Sheet

OBSERVATION CHECKLIST

OBSERVATION	YES	NO	N/A	COMMENTS
GENERAL / MANAGEMENT				
1. Is there a menu?				
2. Is there evidence of monitoring procedures?				
3. Is there evidence of policies and procedures? (ask)				
4. Is there service learning agreement between Municipality & the vendors?				
RECEIVING				
5. Is the delivery date written onto the product?				
6. Are the delivery temperatures checked?				
7. If yes how?				
STORAGE				
8. Is the perishable food stored in a cold room/fridge/freezer?				
9. Is the non-perishable foods stored in a separate room?				
10. Are cleaning items stored with food?				
11. Are the storage areas kept locked?				
12. Are there adequate light in the storage areas?				
13. Are there adequate space in the storage areas?				
14. Is the food stored in original packaging?				
15. Are the products clearly labeled?				
16. Are there expiry dates on food items?				
17. Have some food passed the expiry dates?				
18. If products are transferred to storage containers, is the expiry date recorded?				
19. Are any foods that are past their expiry date used?				
20. Are all containers covered?				
21. Is any of the food old or stale?				
22. Is there any evidence of decay in the fresh produce?				
23. Are the storage areas clean?				
24. Are the storage areas neatly arranged?				
25. Is any food stored directly on the floor?				
26. Is refrigerated storage available				
27. If yes, is the refrigerated storage in working order?				
28. Is the stock sheet kept? (ask)				
29. Is the old stock of food used before the new stock (FIFO)? (ask)				
30. Is there any evidence pest (rodents/insects) infestation?				
31. Are there any unpleasant odours in the storage area?				
FOOD PREPARATION				
32. Is there adequate space for foodpreparation?				

33. Is there adequate space for serving / portioning?				
34. Are recipes available?				
35. Are the recipes standardized?				
36. Are there adequate food preparation utensils?				
37. What fuel source is used for cooking? (e.g. wood, gas, electricity)				
38. Is the internal temperature of the food checked?				
39. Is there easy availability to water for cooking?				
OIL				
How do you discard your used oil -				
40. Is it poured down the storm water drain				
41. Is it poured down sewer/waste water drains?				
42. Is it poured on the ground?				
43. Is the oil collected & removed by used oil contractors?				
44. Where do you get your frying oil from?				
HOLDING				
45. Is the food served immediately following cooking?				
46. How long is the food held between cooking and serving?				
47. Is the food kept warm at this time?				
48. If yes, how is the food kept warm?				
49. If yes, is the internal temperature checked?				
SERVING				
50. Are there adequate food serving utensils?				
51. Are there adequate eating utensils?				
52. Are the portion sizes standardized?				
WASTE				
53. Is all the prepared / cooked food served?				
54. If not, is the left-over food stored properly				
55. Is the internal temperature of reheated food checked? (ask)				
56. Is there a designated rubbish bin?				
57. Are the dust bins covered?				
58. Are the dust bins clean?				
59. Is there waste lying outside the dustbins?				
HYGIENE				
60. Are the kitchens utensils clean?				
61. Is the kitchen equipment clean?				
62. Are there correct cleaning chemicals available?				
63. Are there adequate cleaning supplies e.g. cloths, scourers, etc?				
64.Are the work areas clean?				
65. Is the area cleaned frequently during preparation?				
66. Is the area sanitized following food preparation?				
67. Is there water available for cleaning?				
68. Do the food handlers wash their hands regularly				
69. Is there water available for the food handlers to wash their hands?				
70. Is there soap available for hand washing?				
71. Are the food handler's overalls/ clothes clean?				
72. Do the servers wash their hands before serving?				
73. Is cooked food kept separately from raw food items?				

Do you have any questions/comments/suggestions?

Annexure H – Results of 3M™ oil quality test strips

Vendor #	

Strips interpretation

Stage 1	Stage 2	Stage 3 2	Stage 4
OK, past the break-in period and going towards fresh oil or optimum.	Probably OK, but check food quality.	Probably NOT OK, but if food quality is good, keep using the oil. Use the "if in doubt, throw it out" rule.	Bad oil. Discard it.
≥ 2% FFA	≥3.5% FFA	≥ 5.5% FFA	≥7% FFA

Annexure I – Language editing certificate

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To whom it may concern

Dissertation written by Mr. Mtholoziși Rubushe

This serves to confirm that I edited the abovementioned student's dissertation entitled '*TRANS FATTY ACID CONTENT IN USED VEGETABLE COOKING OIL AND FOOD SAFETY PRACTICES OF INFORMAL FOOD VENDORS IN WARWICK TRIANGLE AVENUE, DURBAN*'.

I am a qualified reviewer and editor.

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Warm regards,

Dr S. Dlamini