A study of the hygiene and safety of foods sold by street food vendors operating within the Warwick triangle of Durban

By

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Declaration

I, Ronelle Crocker 20152631 hereby declare that this dissertation is as a result of my own work and has not been submitted to any other University.

Ronelle Crocker **Date**

Dedication

To my daughter, Kayla Kok. No matter the circumstances, giving up is never an option.

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ABSTRACT

It is often assumed that street food is unsafe because of the unsanitary environment that it is prepared and sold in. The aim of this study is to investigate the food handling practices and food premises of vendors and to determine the microbial safety of food sold within the study area.

In carrying out the aim of this study, the researcher studied the food handling practice and operation of food vendors. In order to determine the safety of foods, microbiological tests were conducted to determine the microbial load, as well as the presence and acceptable limits of food pathogens. Quantitative data were collected by the administration of a questionnaire, observation checklist and microbiological testing. All vendors situated in the study area participated in the response of the questionnaire and checklist, but only 26 full meals were collected and tested separately for microbial analysis as a mean of meat and salad. Questionnaires were used to determine the nature of operation and food samples were tested to determine the microbiological safety of foods. All food samples were collected aseptically, stored in cooler boxes and transported to the Durban University of Technology where microbiological tests were conducted. Quantitative microbial analysis was conducted on *Salmonella spp., E. coli, and Listeria monocytogenes,* and quantitative analysis was conducted on total plate count, aerobic and non-aerobic spore formers and *Staphylococcus aureus*. Statistical Package for Social Science (SPSS) version 24.0 was used to analyse the generated data to determine the mean and percentages of the results in all categories.

The results of this study indicate that the street food vendors within the Warwick Triangle have poor food safety knowledge and poor food handling practices which are evident in the microbial quality of the food sold. These results provided the municipality with adequate reasons to increase their efforts at improving the knowledge of food handlers within the municipality and thus increase the safety of street foods sold.

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LIST OF ABBREVIATIONS

ASF	Aerobic spore formers
ANSF	Anaerobic spore formers
CDC	Centre for Disease Control and Prevention
Cfu/g	Coliforming unit per gram
DMA	Durban Metropolitan Area
DoH	Department of Health
DUT	Durban University of Technology
KZN	KwaZulu Natal
FAO	Food and Agriculture Organisation
SFV	Street Food Vendors
SPSS	Statistical Package for Social Science
STDEV	Standard deviation
TPC	Total plate count
UK	United Kingdom
WIEGO	Women in informal Employment: Globalising and Organising
WHO	World Health Organisation

CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

For many years, several studies relating to street foods have been carried out around the world. The Food and Agriculture Organisation (FAO) held the first global consultation on street foods in Yogyakarta, Indonesia in 1988, (FAO, 1995). Studies by FAO (1995) have recorded poor knowledge and practices in food handling based on the assessment of microbiological contamination of food sold by vendors. This study was conducted to determine the safety of foods, as well as the hygiene practices of food vendors operating within the Warwick Triangle, Durban. The safety of food will be determined by the assessment of pathogen contamination of food sold by street food vendors.

1.2 PROBLEM STATEMENT

Many people assume that because of the character of the street trade, contamination is inevitable. Even though this theory exists many people depend on this source of food as daily nutrition. Khuluse (2015:4) confirms that irrespective of the fact that unhygienic conditions at food stalls are clearly visible, customers continue to buy and consume food from these food vendors. It is imperative that a study of the hygiene know how and practices of vendors is conducted in order to clarify this assumption. There are major concerns related to food safety such as the illegal occupation of space, sanitation problems, traffic congestion and social problems. These concerns also form part of the daily challenges of street food vendors. Dependent on the level of hygiene in a street setting, these foods may contain microbial pathogens such as *Salmonella and E-coli* which may cause serious illness. Campbell (2011:8) confirms that poor and personal environmental hygiene play a significant role in food contamination and eventually result in food-borne diseases. Previous research conducted which assessed the quality of different street foods in many countries has proven that street foods were the cause of food-borne illnesses (Omemu and Aderoju 2008:396). An article written by Augustine (2018) has identified blocked sewers, improper waste disposal and traffic congestion as a major challenge in the street food industry. The researcher thus finds it necessary to examine the challenges faced by

street food vendors, identify the hygiene practices of food vendors, as well as the safety of foods sold in the Warwick Triangle. There is no evidence of studies of this nature which have been conducted within the study area.

1.3 RESEARCH OBJECTIVES

The specific objectives of this study are to investigate the hygiene practices and safety of food prepared by street food vendors who operate within the Warwick Triangle by:

- Determining the conditions of food premises and hygiene practices used by street food vendors operating in the Warwick Triangle.
- Investigating the challenges facing street food vending operations within the Warwick Triangle.
- Determining the microbial safety of prepared food sold by vendors in the study area.

1.4 RATIONALE OF THE STUDY

Today, most municipalities are widely aware of the significance of street food vending, as well as the positive role it plays within the economy. A major concern, however, remains as to whether these foods prepared and sold on the street are safe for consumption. Street foods are made and sold in congested public areas, which experience sanitation and social problems. This study will focus on the safety of street foods and will indicate the effects that issues such as sanitation have on the final product sold. The question then remains as to whether these foods are microbiologically safe. The aim of this study is thus to investigate the vendors food handling practices, conditions of food premises, challenges that vendors face and finally to determine the microbial safety of street food sold within the study area

1.5 RESEARCH METHODOLOGY

Quantitative research methods were applied in this study. The researcher was able to gather information and data in a short space of time at the convenience of the participants. This also allowed the researcher to observe the operational activity of the participants. Three methods were used to obtain data in this study, namely a questionnaire, an observational checklist and microbial testing.

1.5.1 THEORY SEARCH

A literature review was carried out using available texts comprising relevant books, dissertations, official publications, papers, periodicals and reports relating to the nature and operation of the street food trade and the safety of street food.

1.5.2 TARGET PERCENTAGE SAMPLE

The study was conducted within the Warwick Triangle in Durban, South Africa. A physical count of 30 vendors was conducted by the researcher. Consent to conduct the study has been granted by all vendors. All participants signed a consent form which can be seen on pages 113 and 114 (Appendix 1). On the day of sample collection for microbial testing, only 26 vendors were in operation; therefore the researcher was only able to collect 26 samples for microbial testing. The study comprised vendors who sell prepared meals and not already prepared and packaged goods like, fruit, snacks, and cool drinks. A structured questionnaire and observation checklist were targeted at vendors, and a sample size of 100% was sought and returned.

Lopez-Campos, Martinez-Suarez, Aguado-Urda, and Lopez Alonso (2012:13) explain that,

> The detection and enumeration of pathogens in food and on surfaces that come into contact with food are an important component of any integrated program to ensure the safety of foods.

For the purpose of this study, the bacterial pathogens tested include *Listeria monocytogenes Salmonella* spp., *Staphylococcus aureus*, and *Escherichia coli* as they may be linked with foods or food handling practices and may cause consumer illness or disease (Food and Drug Administration 2015). A sample size of 30 (100%) was sought but a return rate of 26 (87%) was achieved.

Ethical clearance was not obtained for this study as it was not required by the Durban University of technology institutional committee.

1.5.3 DATA COLLECTION AND ANALYSIS

The results of this study were organised thematically and were combined with relevant responses from the observation checklists. The survey questionnaires and observation checklists administered to the vendors were intended to be compartmentalised and organised into sets of information to the relevant themes of the study.

1.5.3.1 RESEARCH THEMES

The nature and operation of street food vending emerged from the study through various themes. These themes surfaced in dominant components in determining the safety of street foods sold within the study area and are discussed as follows:

The nature and operation of street food vending is a key theme in determining the nature and operation of street food vendors, as well as hygiene knowledge. Within this theme, favourable and unfavourable conditions of food premises are addressed as well as challenges experienced by street food vendors.

Food hygiene regulations refer to the regulations linked to the preparation of food for the public.

Microbial safety refers to the assessment for quality and safety of foods by the enumeration and detection of pathogenic bacteria.

1.5.4 LIMITATIONS OF THE STUDY

It is important to note that this study was concentrated on the street food vendors within the Warwick Triangle, Durban. The focused area of the study was on vendors who sold ready to eat (cooked) foods. While many other vendors sell food that is not ready to eat, but rather fresh fruit, vegetables, snacks and drinks. These vendors did not form part of the sample and were not included in the study. The need to obtain consent to conduct the study on the vendors and the food has influenced the study.

1.6 DEFINITION OF TERMS

Certificate of Acceptability is a certificate issued to owners of food premises on which food is to be handled as per the regulatory requirements of the Health Act 63 of 1977. Certificates are issued to owners of premises on which food will be handled once an Environmental Health Practitioner has inspected the premises and found them to be compliant to prepare food in terms of the Regulations published under the Health Act of 1977 (Campbell 2011: 14).

Food Safety is the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (World Health Organisation, 2001).

Food hygiene legislation refers to the specific laws and regulations that are concerned with food which is intended for sale for human consumption (Gordon-Davis 2011: 5).

Hygiene is a quality of living that is expressed in clean surroundings of the home, business or industry. It is a way of life and is something which should be an instinctive part of every person, and it is promoted by knowledge (Gordon-Davis 2011: 3).

Pathogenic bacteria are bacteria which can cause illness. (Gordon-Davis 2011: 29).

Safe food refers to food which is free from any type of contamination (World Health Organisation, 2001).

Street foods are foods and beverages prepared and/or sold by vendors in streets and other public places for immediate consumption or consumption at a later time without further processing or preparation (von Holy and Makhoane 2006:89).

A street vendor is a person who offers goods to the public without having a permanent built-up structure from which to sell (Bhowmik 2005:2256).

1.7 OVERVIEW OF CHAPTERS

The study is divided into seven chapters. The chapters are organised as follows:

Chapter One: **OVERVIEW OF THE STUDY**

The introductory chapter provides an overview of the study with a background to some of the concerns raised in this study. It explains the reasoning behind the study, as well as the aims, objectives and limitations of the study.

Chapter Two: **LITERATURE REVIEW**

This chapter presents a theoretical background to the study. It includes a review of relevant literature on the nature and operation of street food vending, as well as the challenges experienced by vendors across the world. The conditions of food premises and the microbial safety of food is also discussed in this chapter. It also gives a brief explanation of the different pathogenic bacteria tested in this study.

Chapter Three: **AN OPERATIONAL PERSPECTIVE OF WARWICK JUNCTION AND ITS MANY MARKETS**

This chapter provides an outlook of the study area. It explains in detail the operational aspects of the markets situated in Warwick Triangle and gives a better perspective on the study area. These markets are all merged by different walkways and bridges, offering a beautiful sensory overload to people who pass by.

Chapter Four: **RESEARCH METHODOLOGY**

This chapter describes the research methodology and design used to execute this study. The purpose of this chapter is to give insight into the methods used in this study in order for the results and findings to be evaluated.

Chapter Five: **PRESENTATION AND DISCUSSION OF PRIMARY DATA**

This chapter will present and discuss the primary data acquired from this study. Data acquired by means of questionnaires and observation checklists are presented in the form of tables and graphs. Discussions regarding the hygienic practices and infrastructure used by vendors are included.

Chapter Six: **PRESENTATION AND DISCUSSION OF DATA ACQUIRED FROM MICROBIAL TESTS**

This chapter presents the data acquired from the microbial tests conducted in this study. Data are presented in tables, and the researcher discusses possible reasons surrounding the findings of pathogenic bacteria in this study.

Chapter Seven: **CONCLUSIONS AND RECOMMENDATIONS**

This final chapter is a discussion of conclusions drawn up by the researcher regarding the findings from the study. The researcher then provides recommendations that may be implemented by the vendors and relevant authorities.

1.8 SUMMARY

Street food vending has become an essential and useful service all over the world. The socio-economic dynamics and changes in people's lifestyles have a major influence on their purchases from street food vendors (Khuluse 2015:12), therefore ensuring food safety has become crucial.

This study is crucial in order to express the education, approaches and behaviour of street food vendors in a municipal setting, concerning food hygiene and safety.

> Through such research, gaps in food safety/hygiene knowledge amongst street food vendors can be identified in order to underpin the development of more specifically targeted and effective training programmes for such groups (Campbell 2011:5).

This chapter has provided an outline for the study by introducing the practices and challenges that street food vendors encounter during operation. Street food vendors provide a service to the public at large, and a need for enhancement of this service has been identified. This chapter also presented a background to the study and provided the aim and objectives of the study. This dissertation comprises seven comprehensive chapters. The subsequent chapter will delve into existing literature which is relevant to the street food trade.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is a review of literature, covering the nature of street food vending, the important role that street food vendors play within the economy, their food hygiene knowledge, as well as the challenges these vendors face on a daily basis. The conditions of food premises and hygiene practices of food handlers are also discussed in detail. Findings of previous research relating to microbial food safety are reviewed and discussed in this chapter.

Street foods are defined by von Holy and Makhoane (2006:89) as "foods and beverages prepared and/or sold by vendors in streets and other public places for immediate consumption or consumption at a later time without further processing or preparation." Street food vending provides a great variety of meals, which are a good nutrition source for many people (von Holy and Makhoane, 2006:90). The consumption of food on the street was developed during Roman times, where it became a custom for people to consume quick meals while standing (Bellia, Pilato and Seraphin 2016:2). Street foods can be found in nearly every corner of the world and have been on sale for thousands of years (FAO 2012).

Street foods have evolved from simple bread and sausages during the Roman times (Bellia *et al.* 2016:2) to being described by Krishnendu Ray (associate professor and department chair of the New York University food studies programme) as haute cuisine (Wist 2017). The street food sector has experienced a massive increase over the years owing to socioeconomic differences in many countries. Population development and growth are expected to increase in the next few years and, consequently so will the street food trade (World Health Organisation 1996:2). Over the years as people have migrated to cities, many of them had to become street vendors and often have had to fight for the right to sell food on the street (Wist 2017).

While street food is valued and enjoyed for its convenience, it is also important for upholding the nutritional condition of the population (World Health Organisation

1996:2). Street food vendors are required to provide wholesome, nutritious and safe meals to the public (Kwiri, Winini, Tongonya, Gwala, Mpofu, Mujuru, S.Gwala, Makarichi, and Muredzi 2014:217). Apart from its many benefits street foods have been reported to be infected with pathogens and have also been associated with outbreaks of food-borne diseases (Cho, Cheung, Lee, Ko, Kim, Hwang, Kim, Lim, and Ha 2010:41). It is widely recognised that street-food vendors are most often disadvantaged, uninformed and have little understanding of the importance of safe food handling (World Health Organisation 1996:2).

There have been increasing concerns regarding food safety (Henson 2003:1). In developed countries, even though foods are considered to be safe, many studies have shown that food-borne illnesses are widespread and that there is an increase in the frequency of food-borne pathogens (Henson 2003:1). “In many cases, high rates of foodborne illness is usually coupled with low levels of economic development and limited ability to control the safety of the food supply” (Henson 2003:1). There is also a significant relationship between issues of food safety, and influences such as hygiene and the conditions of infrastructure (Treinekens and Zuurbier 2008:107).

The street food industry is greatly inspired by the rapid blooming of the informal sector. This has given rise to several street food vending sites which are unlawful (Kwiri *et al.* 2014: 216). Street food vending is a mass feeding phenomenon that is a very popular and distinctive part of a broad informal sector (Tinker 1997:3). This sector is growing rapidly in trying to meet the changing demands of people requiring cheaper food in such a harsh economy. Tinker (2003:331) explains that “from the earliest times women and men have prepared food to sustain traders during their travels.” Women and men all over the world, who make a living selling food on the street, are breadwinners and therefore need to provide an income for their families. Tinker (2003:331) reports that the number of street vendors increases with modernisation yet early municipal and international regulations have attempted to remove the sector denouncing the food as contaminated and the vendors as troublesome.

It is estimated that 2.5 billion people consume street food around the world on a daily basis (FAO 2012). Due to the financial advantages and accessibility of street food, it is consumed daily by many people around the world, even in cities like New York where tourists are attracted to street foods like hot dogs (Bellia, Pilato and Seraphin

2016:2). A study conducted in Ghana found that nearly the entire population consumed street food (FAO 2012). In Bangkok, 67% of households only cooked once a day and depended on street foods for the other two meals every day (Chung, Ritoper and Takemoto 2010) cited by (FAO 2012). The people of Bangkok found street food to be easily accessible and more economical than cooking at home. A more recent study found that street food vendors in Bangkok are seen to be a nuisance to pedestrians, and government officials intend to implement stricter regulations as they are aware that it is almost impossible to have them removed completely (Wist 2017) because they are a source of livelihood, as well as a tourist attraction (Tripathi 2017). In Britain, however, a British Street Food Award has been introduced as the British council has realised that street food markets are an easy and affordable means of reviving an area (Hudson 2018).

The types of food sold differ according to the social standing of consumers and the cultures and traditions of the people in different cities. According to a study done by Steyn and Labadarios, (2011:462), there has been a significant increase in street food vending in South Africa and this industry has employed up to 25% of the working population in the country. Steyn *et al.* (2011:462) show that a great portion of the South African population consume street food and fewer people buy or consume food from fast food outlets. Consequently, food security of street food is indeed a cause for concern.

The objectives of this chapter are:

- To discuss the evolution and expansion of the street food industry;
- To evaluate food hygiene practices of street food vendors as well as challenges faced by street food vendors;
- To discuss the regulatory basis for the preparation and trade of street food; and
- To profile street food vendors within the study area of this research and determine the conditions of the food premises from which they operate.

2.2 THE ROLE OF STREET FOOD VENDORS WITHIN THE ECONOMY

The features of street food vending are significant. “Vendors who manufacture and/or sell street foods are small-scale operatives or micro-entrepreneurs who form a part of the so-called informal sector” (Draper (1996:4). This sets it apart from the formal food sector in a number of ways. Since most of the population in developing countries have not been absorbed into the formal labour market, many people have entered the informal sector creating employment for themselves.

Drawing from a definition quoted by Bhowmik (2005:2256) a street vendor is defined as “a person who offers goods to the public without having a permanent built-up structure from which to sell.” Companion (2012:149) explains that street vending is an essential component of the informal economic regions in many developing countries. It allows vendors to generate income with very little financial investment and does not require large amounts of capital. The growing poverty and time limits to survive in evolving countries indicate that the phenomenon of street food will continue to increase (Githaiga 2012:4). The informal sector consists of unregistered businesses. They are usually small and most often run from homes, or informal structures on street pavements (Skinner, 2006:127).

According to Campbell (2011:1), the street food industry in most cities plays a crucial role in providing meals for the population. There has been a rapid growth within the informal sector in several countries, including South Africa. It has been established that the informal economy makes a significant contribution to the creation of employment. In the year 1996, a survey revealed approximately 20 000 street traders operated in the Durban Metropolitan Area (DMA) (EThekwini Unicity Municipality 2001:3). In South Africa, street vending is the main employer in the informal sector, and this has a significant influence on the economy (von Holy and Makhoane 2006:89). Khuluse (2015:24) cited a report prepared by Guliwe (2013:1) which similarly explains that the informal sector provides over three million employment opportunities to the South African economy

A study conducted in Greece by Matalas and Yannakoulia (2000:15) found that the majority of street food vendors are low skilled people who have entered the country illegally and have seen an opportunity in street food vending. Bhowmik (2005:2258) found that in Sri Lanka, the street food vendors make a higher income than that of

other street vendors. In Nairobi, street food affords most vendors a reasonable income (Githaiga 2012:4).

Vending of food on street level in many countries is the result of many factors such as:

- deterioration of living conditions in rural areas;
- movement from rural to urban areas;
- an increase in urban development which has led to vast congestion in cities;
- long travelling distances between places of work and home;
- unemployment; and
- the scarcity or total absence of establishments which provide affordable food close to places of work (Tinker 1997; Maxwell, 2000;) cited by (Madueke, Awe and Jonah 2014:197.)

The Food and Agriculture Organisation (2001) indicates that the rate of employment within the informal sector is significantly higher than that within the formal sector and street foods play a vital part in this sector. It is further acknowledged by Muzaffar, Huq and Mallik (2009:81) that street foods make a substantial contribution to the socio-economic role by creating employment mostly for women and by serving food at affordable prices. This contribution is gradually being recognised on a global level. A survey conducted by the World Health Organisation (WHO) has indicated that street foods are an important food supply of at least 74% of the countries in Africa (Ekanem 1998:211).

Martins (2006:18) states that in South Africa, the contribution of these Small Medium Enterprises is particularly significant in view of the fact that the non-agricultural formal sectors downsized by almost a million jobs between 1990 and 2000, which resulted in many unemployed people starting their own informal trading to make a living.

Many vendors started up businesses that required a minimal capital investment, such as in street food vending (Martins 2006:18). Kumar and Singh (2009:7) explain that street vendors are usually associated with a meagre and insecure income. They infringe on the use of public land and are a source of chaos. A street vendor’s income is often affected by natural forces, appropriation of goods and vending space.

2.3 STREET FOOD AND TOURISM

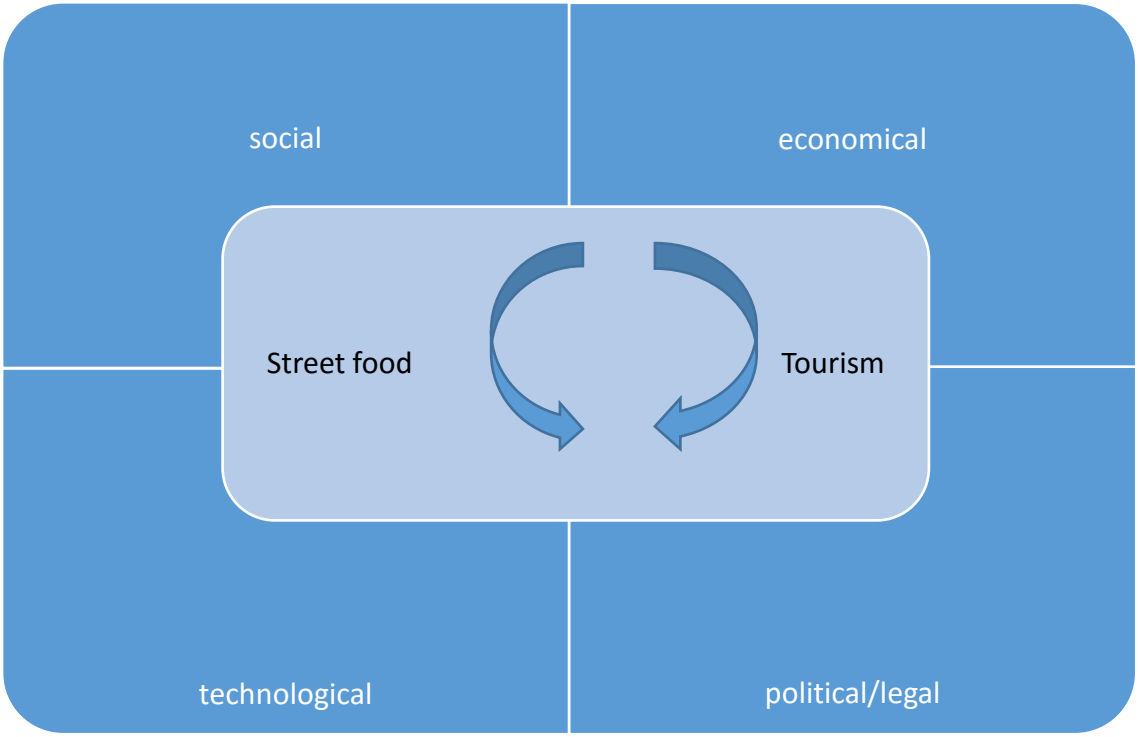

Figure 2.1: The impact of street food and tourism

Figure 2.1 depicts the relationship between street food and tourism and its impact on social, technological, economic and political factors.

Tourism is defined as “any tourism experience, in which one learns about, appreciates or consumes branded local sources” Stephan, Smith and Xiao (2008) cited by Sengal, Karagoz, Cetin, Dincer, Ertugral and Balik (2015:430). The food reflects a destination's cultural and societal identity, and it plays a significant role in the destination choice of the tourist (Sengal *et al.* 2015:430). It is highlighted by Bellia *et al.* (2016:2) that “tourism, street food and food safety are closely related and when put together can positively impact on destination performance and image for the benefits of the visitors and the locals.” Food tourism has become increasingly popular over the past years. It

is one of the most dynamic segments of the tourism industry. Many destinations are now developing products and marketing them accordingly, to attract food tourists (United Nations World Tourism Organisation (UNWTO) 2012:4).

The consumption of food while travelling allows the tourist to learn about the local people and their culture. Street food is the reason that many people travel to certain cities. For example, Bangkok is a famous destination for street food tourism. Many travellers are disheartened that the military intends to ban street food in the city. Travellers have said that it is the only reason that they travel to Bangkok (Augustin 2018:3).Hundreds of guided food tours provide a steady flow of income to Bangkok's tourist industry, a major part of the city's economy. In 2017, 20 million people visited Bangkok, making it one of the world's most popular cities (Augustin 2018:3).

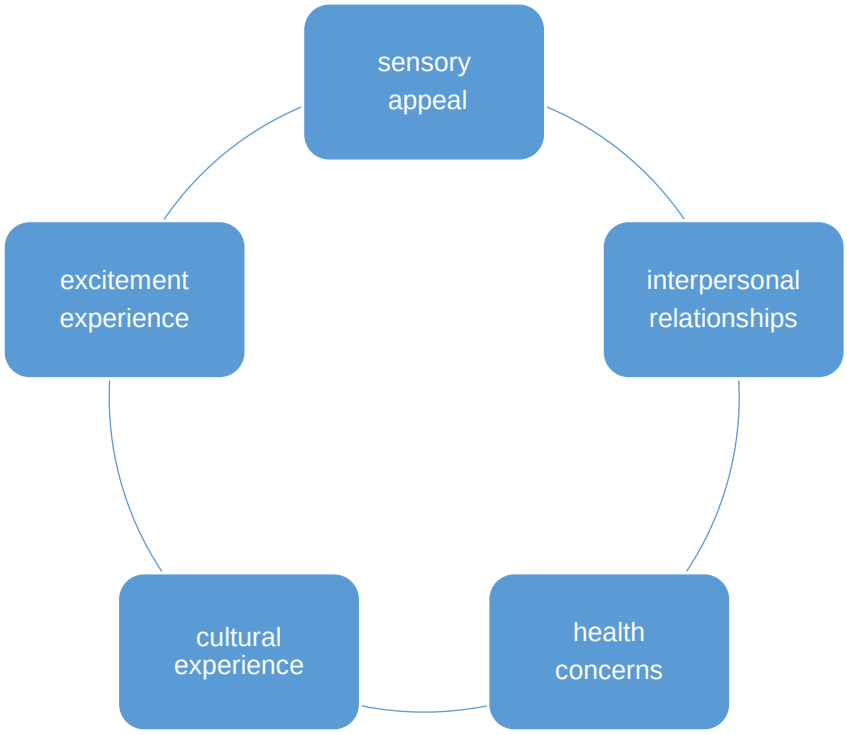

Figure 2.2: Items of tourist motivation to taste street food (Privitera and Nesci 2015: 721)

A study conducted by Privitera and Nesci (2015:720) found that there is a direct relationship between street food and tourism. Figure 2.2 is an indication of the factors which motivate tourists to taste street foods (Privitera and Nesci 2015: 721). Sengal *et al.* (2015:30) support this by stating that “local food is an essential part of the tourism experience since it can serve both as a cultural and an entertaining activity.” The local food of an area adds value to that destination as tourists would rather enjoy the authenticity of a product and enjoy it in the city it originated from, therefore, “familiarity with local, regional and national cuisine has become a main motivation to travel for some tourists" (Sengal *et al.* 2015:30).

Street foods are mostly traditional and are prepared with ingredients that are locally sourced. It, therefore, plays an important economic and social role in many cities. Popular examples are “hot dogs in New York, the kebab in Istanbul, panelle in Palermo, and sauerkraut in Germany” (Privitera and Nesci 2015:717).

The Italian Association of Street Food, cited by (Privitera and Nesci 2015:717) has referred to street food as a culture to bring back, “one that cannot be separated from the road or social experience in which it was born.” The consumption of street food allows the tourist to discover new tastes and also to see places they have never seen. They not only fulfil their need for food but also experience the local culture and network with their hosts.

Technological advances in street food vending, allow vendors to increase the scale and scope of their foods for sale and even the safety of the food. For example, if a street vendor has access to a refrigeration/cooling system s/he can store ready cooked foods instead of exposing the food to time and temperature abuse.

When street food started, the most used method of cooking was the earthenware stove which was then followed by the kerosene stove, modified kerosene stove, IPS battery and more recently, liquid petroleum gas (LPG) (Alauddin 2015). Using LPG, vendors can provide meals more efficiently. A study conducted by Alauddin (2015) in Dhaka City, India, found that:

> Technology changes have brought multiple benefits to the informal sector with regard to reducing hard physical labour, health and environmental hazards,

building the trust and confidence of citizens about quality and hygiene issues of food, increasing work opportunities, expanding business and earning good income and improving working conditions.

As consumer demands change, so does the technology required to meet those demands. Although it is essential to keep up with technological trends, street food vendors have difficulty in keeping up with technology as the modification of technologies depends on financial capacity and vendors cannot afford to make the necessary changes (Alauddin 2015).

Most street food vendors are poor and uneducated. They experience difficulties in keeping up with technology as they cannot afford to and do not have the knowledge to use them.

In the United Kingdom (UK), “street food is at the cutting edge of culinary innovation” (Khalifa 2015), but it requires technology to meet the demands of the digital-first consumer. In the UK, a street food application (app), Hawwker, was expected to launch in 2018. This app has been designed to keep up the demands and expectations of the digital age. The digital natives, described as Millennials and Gen Z by Khalifa (2015), are very picky when it comes to food. They have many expectations. They want fresh, locally produced, authentic and affordable food and want to have access to all this by a click of a button. Hawwker surveyed 75 UK consumers and found that they would consume street food more often if it met the following requirements (Khalifa (2015) :

- They were sure that vendors in their area were open for business and that they can peruse menus online before placing an order.
- They were informed of ingredients, quality and dietary information.
- They were able to avoid queues during busy periods.

Hawkker intends to fulfil these requirements in order to make street food, more convenient, reliable and accessible.

It is clear that street food vendors need to keep up with modern technology if they want to market their products better and to engage with their customers. Also improving technology will assist in producing better meals and more efficient service.

2.4 THE NATURE AND OPERATION OF STREET FOOD VENDING

According to Martins (2006:18):

> There are three main categories of street food vendors, namely 'mobile' vendors, 'semi-mobile' vendors, who may be stationary or move from one site to another, and 'stationary' vendors who sell their food at the same site each day.

Draper (1996:3) explains that the street vendors are conveniently situated near the workplaces for thousands of travellers, and they provide affordable and nutritious food. The diversity of street foods is indicated in terms of the types of foods sold, as well as the ingredients used to prepare meals. (Draper 1996:3) further explains that

> The ways in which street foods are processed are also extremely variable and range from the preparation of foods on the street in relatively heterogeneous and unregulated conditions to the central processing of ready-to-eat foods, such as snacks.

Often the items sold include cooked meals, snacks and cool drinks (Steyn *et al.* 2011:1).

Most street food vendors are situated in residential areas, industrial areas and in areas where the exchange of transport takes place. Thousands of people in these areas consume street food daily as it is easily accessible and inexpensive for them (Lues, Rasephei, Venter, and Theron 2006:319). Street food consumers are mostly people who have to work and travel long hours (Lues *et al*. 2006:320).

The variety of street foods is widespread (Draper 1996:11). Most vendors operating in the same area sell various items. Ingredients used to prepare street foods are usually country-specific and usually consist of the country's staple foods. The characteristics

of street food vendors have been examined by Draper (1996:8), and he has found that vendors do not form groups of the same type; instead, they vary according to their demographic criteria.

Draper (1996:2) found that according to Tinker (1988), the negligence of street food vendors is mainly due to false theories such as:

- street food operations are insignificant and temporary economic activity, and which will in due time disappear and become insignificant;
- it is a trade only for women;
- it is concentrated only in main cities and urban areas;
- foods vended on the street are "unhygienic" and "unsafe" to consume;
- street food is only meant for poor people; and
- street foods do not make a meaningful influence on one's daily dietary consumption.

2.5 FOOD HYGIENE KNOWLEDGE AND PRACTICES OF STREET FOOD VENDORS

2.5.1 FOOD HYGIENE KNOWLEDGE OF STREET FOOD VENDORS

People who handle food should have the general knowledge and skills to do so (Ackah, Gyamfi, Anim, Oseil, Hansen, and Agyemang. 2011:194). A study conducted by Kidiku (2001:9) revealed that food vendors/handlers could be trained and many of them already do exercise some simple hygiene when preparing foods; however, they are not aware of its importance. The World Health Organisation report (2007) indicates that it would be a better strategy to invest in training and education of street vendors instead of fining them, although a study by Muine and Kuria (2005:9) found that most of the street food vendors have not undergone any formal training in food preparation nor did they attempt to seek it.

Kitagwa, Bekker and Onyango (2006:20) established that the poor knowledge of street food vendors is in direct relation to their poor hygiene practices, which leads to contamination of food during processing and storage. There is a relatively low level of knowledge and understanding issues among street food vendors and consumers

(Ekanem 1998:213). Kharel, Palni, and Tamang (2015:6) explain that vendors often have no formal education and training in food hygiene and operate their business under very unhygienic conditions. Furthermore, they have no knowledge of the cause of food-borne diseases.

A study by Samapundo, Climat, Xhaferi, and Devlieghere (2014:11) reported that 88.7% of vendors had not been for any food safety training and Thanh (2015:34) found that 95% of vendors had not been for any food safety training.

Martins (2006:21) conducted a study in Gauteng, South Africa, and observed that most of the vendors knew that they had to practice personal hygiene. The vendors understood that the practice of personal hygiene was important in order for them to provide safe food to their customers. The study revealed that most vendors maintained a high level of hygiene when processing and serving foods.

In contrast, a more recent study conducted in Guwahati, Assam revealed that coughing, sneezing and touching of hair were prevalent practices among food handlers (Pokhrel and Sharma 2016:85). Most handlers studied did not cover food items, wear gloves or cover hair while handling food.

A study conducted by Rahman, Arif, Bakar, and Tambi (2012:114) in Turkey indicated that “most vendors had no previous training in food safety and poor knowledge of hygiene practice in preparation and distribution of food.” In addition, a study conducted in Greece by Matalas and Yannakoulia (2000:20) revealed that many street food vendors were aware of the rules of hygiene but prepared foods according to their preference and the conventional way of doing things. On the contrary, a study conducted in Ghana by Ackah *et al*. (2011:191) revealed that even though most of the vendors were not in possession of a health certificate, they were mindful of the proper food handling practices.

It may be concluded from these findings that in some instances vendors are well aware of hygiene standards and practices required whereas others are purely ignorant on the matter.

2.5.2 FOOD HYGIENE PRACTICES OF STREET FOOD VENDORS

Gordon-Davis (2011:5) describes hygiene as

> A quality of living that is expressed in clean surroundings of the home, business or industry. It is a way of life and is something which should be an instinctive part of every person, and it is promoted by knowledge.

If handlers do not practice personal hygiene, this could result in the spread of microorganisms, which cause illness. Gordon-Davis (2011:5) explains that "all people working in the food production industry have a moral responsibility to maintain the highest standards of hygiene possible." In line with the World Health Organization, food handlers play a significant role in ensuring food safety throughout food processing and storage (Kwiri *et al.* 2014:217).

Kidiku (2001:18) defines food hygiene as "all measures necessary to ensure the safety and wholesomeness of food at all stages from its growth, production or manufacture until its final consumption."

Gordon-Davis (2011:6) explains that food hygiene includes all practices involved in the following:

- Protecting food from any hazards that may cause contamination.
- Avoiding the multiplication of bacteria so that it does not spoil food or cause food poisoning.
- Ensuring all food is cooked thoroughly thus destroying all harmful bacteria.

In addition, Kidiku (2001:19) identifies the following hygiene requirements:

- Food and potable water must be obtained from an approved source; this is extremely important regarding meat products.
- Both raw and prepared foods must always be stored in airtight containers at the correct temperatures.

Popular South African food types that encourage the growth of bacteria include (Kidiku, 2001:26):

- All meat products including processed meats,
- All dairy products, and
- Mielie meal pap, rice and gravy.

The abovementioned foods should always be cooked and stored correctly and handled hygienically.

The Food and Drug Association recommends that gloves be used to prevent hand contact with prepared foods (Green, Radke, Mason, Bushnell, Reimann, Mack, Motsinger, Stigger and Selman 2007:665). Research conducted on how often food handlers washed their hands and used gloves in food service establishments indicated that correct hygiene is not practised as it should be.

In confirmation, many food handlers indicated that they very often do not wear gloves and wash their hands as often as they should (Green *et al.* 2007:661).

Green *et al.* (2007:662) explain that there is a range of factors that affect the practices of food handlers and that need to be attended to in order to effectively change the behaviour of street food vendors. Recommended activities for hand-washing are displayed in **Table 2.1** on the following page.

Table 2.1: Activities for which hand-washing is recommended (Green *et al.* 2007:662):

When hand-washing should occur	Activity	Description
Before the activity	Preparation of food	Handling food during preparation, including handling food which is exposed, as well as utensils and equipment.
Before the activity	Putting gloves on to prepare food	Putting gloves on to begin preparing food
After the activity and before beginning another activity	Preparing any uncooked animal products	Preparing raw animal product
On completion of an activity and when beginning another	Consumption of any food or drink and smoking	Consumption of any food or drink and smoking
On completion of an activity and when beginning another	Coughing, sneezing, tissue use	Coughing, sneezing or using tissues
On completion of an activity and when beginning another	Handling of dirty equipment	Handling dirty equipment, utensils or cloths
On completion of an activity and when beginning another	Touching the body	Touching human body part unless clean

2.6 THE CONDITIONS OF STREET FOOD PREMISES AND CHALLENGES FACED BY VENDORS

A general perception in South Africa is that foods, which are prepared and sold in a street setting, are unsafe (von holy and Makhoane, 2006:89). Even with this perception, in 1996 an estimated R4399.4 million was spent on buying food for eating away from home (Kidiku 2001:5). Approximately 47% is being spent in hotels, restaurants and on street food. This should definitely give more concern to ensuring the safety of these foods.

Vendors often assemble in congested areas, where there is a high demand for street food. These areas often have limited to no access to basic hygiene and sanitary facilities (Municipality 2001). Street foods, exposed in open areas due to inadequate facilities, can be contaminated by many different elements such as dust and insects from nearby refuse and hands of customers. Usually, the infrastructure used by street food vendors is made up of equipment, which increases the possibility of contamination. In most circumstances, vending sites have no clean water which means vendors wash hands and dishes in bowls and pots and sometimes do not use soap. In addition, possible health hazards may be transferred from the use of contaminated raw materials (Kwiri *et al.* 2014:217).

Mustaffa and Abdalla (2011:5224) found that vendors used a single bowl for washing dishes. Even after the water became dirty, vendors would continue to use the same water. The hygiene practices of female vendors was found to be extremely poor. Also the infrastructure was very poor and no cooling facilities were available.

A study done by Lucca and Da Silva-Torres (2006:312) has identified similar factors and reports that:

> Points-of-sale usually have a limited infrastructure, with restricted access to drinking water, toilets, water disinfecting methods, refrigeration or ice, as well as to hand-washing and waste disposal facilities.

Furthermore, the ingredients used are usually of a meagre quality and kept in hazardous temperatures for an extended period (Lucca *et al*. 2006:312). Similarly, Hanashiro, Morita, Matte, R., Matte, M. and Torres (2005:439) found

that it is these very factors such as characteristics of the products sold, poor local infrastructure, and the lack of hygiene that stir an increase in the concern about possible food poisoning due to microbiological contamination. In a survey done by Skinner (2006:136) in Durban, South Africa, it was found that over 20% of respondents had no access to toilet or water facilities in their work area.

Even though it is an expectation that street food meets the nutritional requirements of consumers, it is equally important to ensure that the food is safe from contaminants (Food and Agriculture Organization 2001). A study conducted by the Food and Agriculture Organisation (2001) discovered that even though street vendors are able to prepare and sell safe meals, the need for basic sanitation is vital. Vending food at street level is a significant ground for concern due to the health dangers relative to food that is unsafe. The practice of street food sales presents serious risks to the health of consumers chiefly because of improper hygiene techniques (Lucca *et al.* 2006:312).

Rheinländer, Olsen, Bakang, Takyi, Konradsen, and Samuelsen (2008:953) conducted a study in the streets of Ghana and found that many people perceive street food as a health hazard to the public since it is difficult for vendors to practice food hygiene at street level. This study also informs that:

> Unsafe practices were especially related to inadequate storage and reheating of food before sale, insufficient hand-washing, inappropriate cleaning of cooking utensils, and inadequate rinsing of vegetables (Rheinländer *et al.* 2008:958).

Nicolas, Razack, Yollande, Aly, Tidiane, Philippe, De Souza, and Sababénédjo, (2007:1) indicate that according to street food studies carried out in Africa, the tremendous, indefinite and uncontrolled development of street food vendors has placed a harsh pressure on resources of the city. Mensah, Ablordedy, Yeboah-Manu and Owusu-Darko (2002:546) confirm that infrastructure at vending sites is usually very simple, and there is usually no available potable water. In addition, washing facilities are inadequate, and toilets are rarely available. Vendors usually wash their hands in bowls or buckets of water, which means the water remains contaminated. Vendors do not disinfect their work areas, and pests like flies and rodents are usually attracted to these sites. Lastly, refrigeration is almost never

available to store foods. Muinde and Kuria (2005:10) emphasise the importance of running water in order to maintain personal hygiene and environmental hygiene.

Kubheka, Mosupye and von Holy (2001:128) confirms that in street vending areas garbage is accumulated in large amounts, and this provides a breeding ground for pests and insects. In Africa, street foods are prepared and served in unhygienic environments, and this poses health hazards to the public (Ekanem, 1998:211).

Kidiku (2001:20) suggests that favourable street food conditions should include the following:

- A clean water supply;
- Access to clean toilets;
- Adequate plumbing systems;
- Lockable facilities to store utensils and equipment for food preparation and cleaning;
- Correct storage and removal of garbage; and
- Proper housekeeping practices are implemented to reduce the risk of pest infestation.

A very common risk factor includes temperature and time abuses involving, under cooking meat products to avoid shrinkage, handling ready to eat foods at unsafe temperatures and serving these foods at the incorrect temperature (Ekanem, 1998:212). With all these problems relating to storage, handling and poor infrastructure, there is an extreme risk of developing food-borne illnesses (Lucca *et al.* 2006:313).

According to Gordon-Davis (2011:51) standards or requirements for the temperature, storage and display of food are as follows:

Frozen products:	-18°c
Food marketed as frozen:	-12°c

Chilled products:	+4°c
Perishables:	+7°c
Heated products:	+65°c

Ackah *et al.* (2011:194) explains that people are representative of the largest contamination sources of food and Gordon-Davis (2011:23) confirms that:

> The bacteria are naturally present in and on the body and those picked up from surrounding environment are easily transferred onto food being prepared or served which can result in illness.

Hands are major carriers of intestinal parasites and microorganisms to food (Lucca *et al.* 2006:312), therefore, Gordon-Davis (2011:22) suggests that:

> They "should always be washed before starting work, immediately after using the bathroom, after handling contaminated material or any other material that could possibly transmit diseases, and whenever necessary to reduce the risk of food poisoning.

Food poisoning is the cause of bacteria which are everywhere, in raw food, on animals and man, contaminated water, dirty equipment, utensils and working areas. Stomach pain, diarrhoea and vomiting are the main symptoms of food poisoning (Kidiku 2001:26).

There are many factors which could possibly contribute to an outbreak of food-borne illnesses (Kidiku 2001: 7). These include:

- Incorrect cooking temperatures;
- Storage and displaying of food at warm temperatures (ideal for the growth of bacteria);
- Improper handling and storage of prepared foods;
- Cross-contamination; and
- Unhygienic practices;

Proper hygiene practices and a professional, clean appearance of food handlers can have a good influence on the image of the food premises.

Kidiku (2001:19) have identified the following requirements for the personal hygiene of food handlers:

- Food handlers should not handle food while they are ill and must cover any infected lacerations;
- Personal hygiene requires that handlers take a daily shower and always cover their hair; and
- Vendors are to wear protective clothing and always keep their nails short and clean;

Food vendors/handlers must wash hands:

- Before they begin food preparation,
- After having used the toilet,
- During food preparation,
- After coughing or sneezing,
- After touching the body, and
- After handling garbage

It is essential that street food vendors are provided with the required support in order to improve vending and thus prevent any food-borne illnesses. This support from local Municipalities will allow vendors to provide safe food to consumers.

2.7 MICROBIOLOGICAL SAFETY OF STREET FOODS

> The foods that we eat are rarely if ever sterile since they carry microbial associations whose composition depends upon which organisms gain access and how they grow, survive and interact in the food over time (Adams and Moss 2008:2).

Gordon-Davis (2011:109) explains that pathogenic bacteria cause food-borne illnesses, like food poisoning. Food poisoning is an illness, which occurs when

people have consumed contaminated food. It is characterised by symptoms such as headache, abdominal pain, vomiting, diarrhoea and fever (Gordon-Davis 2011:13).

In South Africa, there has been minimal evidence on the microbial safety of street foods until the 20th century, although information was easily available in many developing countries (von Holy and Makhoane 2006:89). The fact that vending is done in places of extremely poor sanitation poses a significant risk to the microbial safety of these foods. Furthermore “street food vendors are mostly uninformed of good hygiene practices and causes of diarrhoeal diseases, which can increase the risk of street food contamination” (Tambekar, Kulkarni, Shirsat and Bhadange 2011:350).

Makelele, Kazadi, Oleko, Foma, Mpalang, Ngbolua, and Gédeon, (2015:287), suggest that the practice of hygiene during the preparation and sale of street food could reduce the microbial risk significantly

Adams and Moss (2008:1) define microbiology as,

> The science which includes the study of occurrence and significance of bacteria, fungi, protozoa and algae, which are the beginning and ending of intricate food chains upon which all life depends.

It is well-known that food and water are carriers of harmful pathogens (Snyder Jr, 2006:1). Bacteria can be found almost anywhere and everywhere including the human skin, and this bacteria can be transferred to food products in different ways. Some sources of bacteria are water, food handlers, food utensils, air and dust (Adams and Moss, 2008:1).

During food preparation, microbes can be transferred to food by infected food handlers or from any raw plant or animal produce due to unsanitary food handling practices. (Snyder Jr.2006: 4). “For example, bacteria can be introduced by the unwashed hands of food handlers who are themselves infected” (Adams and Moss, 2008:2).

> Today, because of the way food is grown, harvested and supplied to the consumer; the person who prepares the food becomes the hazard control point. Lack of hazard control at the source of supply in the food system is so severe that the food preparer will remain the hazard control point for many years to come (Snyder Jr, 2006:3).

Kwiri *et al. (*2014:220) concurs with Snyder (2006:3) above that "Most food preparation steps including their environment and handling personnel significantly contribute to the contamination, growth and survival of the microbes responsible for food-borne illness" Therefore, it is crucial to monitor food preparation steps up to consumption.

Kidiku (2001:18) has identified "Three channels for transmission of the disease-causing bacteria", which include

- Food, which is the main source;
- Improper food handling, inadequate storage methods, and unwashed vegetables and fruit; and
- Bacteria, which may be present on
    - Unwashed hands;
    - Infected persons; and
    - Unclean utensils or equipment.

Provided foods are stored, prepared and handled hygienically; they can prove to be safe, microbiologically. Microorganisms present on food can be eliminated or reduced: by washing foods, heating, sterilisation, fermenting or adding amounts of acidic products to the food (Snyder Jr, 2006:5). Snyder Jr, (2006:5) emphasises that when raw, high moisture foods are on display under unsafe temperatures, they stand a greater chance of food spoilage. Many microorganisms thrive when moisture levels are high.

Kidiku (2001:9) conducted an "assessment of the microbiological safety of certain street foods and reported with the following results".

- Most of the food samples indicated low counts of microbial growth;
- Tests for *Salmonella* were all negative; and

- While being sampled, the holding temperature of foods were between 20.1°C and 98.8°C;

  Some of the food samples with high bacterial growth had also high holding temperatures, and those with low bacterial counts had low holding temperatures. No clear pattern was reported regarding high counts *vs* low holding temperatures (Kidiku 2001:9).

The results of the assessment conducted by Kidiku (2001) results indicate possible cross-contamination during food handling or contamination from utensils and working surfaces.

2.7.1 PATHOGENS ISOLATED FROM STREET FOODS

Bryan *et al.* (1992) cited by Kharel *et al.* (2015:8) indicates “food-borne bacterial pathogens commonly detected in street-vended foods are *B. cereus, Clostridium perfringens, S. aureus* and *Salmonella* spp.” Most food pathogens originate from soil or intestines of animals, and are spread through unhygienic food processing; personal cleanliness or public hygiene practices (Madueke, Awe and Jonah 2014:207).

Rane (2011:101) identified, in an article sources and types of hazards, as well as the microbial risk for each hazard associated with street food vending displayed in **Table 2.2.**

Table 2.2: Source and type of hazard and the microbial risk involved with street foods (Rane 2011: 101)

Source number	Source	Hazard	Risk involved
1	Location of the vendor	Improper handling of food	Transmission of pathogens like E. coli, S. aureus and Salmonella from the body and into foods
		Incorrect disposal of waste	Transmission of enteric pathogens like E. coli, Shigella and Salmonella.
2	Raw materials used	Water	Passage of pathogens like E. coli, fecal streptococci, Salmonella and Vibrio cholera
			Introduction spore formers like Bacilli and Clostridium and pathogens like L. monocytogenes, Shigella, Salmonella, etc.
		Vegetables and spices	
3	Equipment and utensils	Chemical contaminants	Leakage of chemical leading to poisoning
		Microbial contaminants	Cross contamination of food with Staphylococcus aureus, E. coli and Shigella due to transference of bacteria from handlers, water and dish cloths
4	Reheating and storage	Incorrect storage and reheating temperatures of food	Possibility of heat stable toxins from pathogens like B. cereus and C.perfringens
5	Personal hygiene of vendors	Biological hazards	Introduction of Staphylococcus, Salmonella and Shigella via carriers

2.7.2 MICROORGANISMS AND IMPLICATED FOOD SOURCES

"Various studies have identified the sources of food safety issues involved in street foods to be microorganisms belonging to the genus *Bacillus, Staphylococcus, Clostridium, Vibrio, Campylobacter, Listeria* and *Salmonella"* (Rane 2011:100*).* These microorganisms and common sources thereof are displayed in **Table 2.3** below.

Table 2.3: Microorganisms and commons food sources thereof (Rane 2011:100)

Microorganism	Common food source
Salmonella	Inadequately cooked poultry, eggs, and tomatoes.
Listeria monocytogenes	Deli meats, cheese, seafood and processed meats.
Staphylococcus aureus	Temperature abused meat, other meat Eggs, poultry and mayonnaise-based salads.
Escherichia coli	Undercooked beef and lettuce

2.7.2.1 *SALMONELLA*

Salmonella is a non-spore forming rod, which is usually regarded as a human pathogen. It can be recognised as "one of the most important causes of food-borne illness worldwide" *Salmonella* spp. is sensitive to heat and can, therefore, be destroyed by heat treatment (Adams and Moss 2008:225 and 236). According to Martins (2006: 20), "growth of *Salmonella* has been recorded from temperatures just above 5°C up to 47°C with an optimum at 37°C."

2.7.2.2 *LISTERIA MONOCYTOGENES (L. MONOCYTOGENES)*

L. monocytogenes is a major risk in milk and dairy products and is able to survive unfavourable environmental conditions (Motarjemi and Lelieveld 2014:95). *L. monocytogenes* are able to grow over a range of temperatures from 0°C – 42°C with the optimum temperature being between 30°C and 35°C (Adams and Moss 2008:225). In South Africa, an outbreak of listeriosis was declared in December 2017. By March 2018 a total of 978 cases of the disease had been reported (National Institute for Communicable Diseases 2018:1). According to the WHO report (2018), 91% of the strains belonged to L*. monocytogenes.* This strain was indicated in a widely consumed processed meat called polony.

2.7.2.3 *STAPHYLOCOCCUS AUREUS* (*S. AUREUS*)

"*Staphylococcus aureus* is a bacterium commonly found on the skin and in the nose of healthy people and is one of the most prevalent pathogens causing several outbreaks" (Githaiga 2012:11). *S. aureus* has a growth temperature range of between 7°C and 48°C with an optimum of 37°C (Adams and Moss 2008:252 and 253). *S. aureus* has a high tolerance of salt in some foods (Adams and Moss 2008:254).

2.7.2.4 *ESCHERICHIA COLI (E. COLI)*

E. coli is commonly found in the stomach of humans and animals where it is the main facultative anaerobe (Adams and Moss 2008:216). A significant amount of *E-coli* in foods indicate improper food handling and storage and a general lack of hygiene (Department of Health 2012).

2.8 FOOD-BORNE ILLNESSES

Snyder Jr, 2006:1 explains that:

> Food-borne disease or injury occurs when a person consumes food that contains pathogenic, disease-causing, microorganisms, harmful chemicals or hard foreign objects that can cause choking, injury to the mouth, or other internal injury.

According to Gordon-Davis (2011:109), pathogenic bacteria cause food spoilage and food poisoning. However, other microorganisms that cause illness can also be transmitted by food. These are classified as food-borne illnesses. They include typhoid, cholera, dysentery, hepatitis, tuberculosis and other less dangerous diseases such as giardiasis or tapeworm (Linscott 2011:41).

Various authors expressed their concerns about food- borne illnesses as being a major problem globally and a reason for the significant reduction in economic growth (De Sousa 2008:815). “Over two hundred different diseases are known to be transmitted by the food” (Bryan, 1982) cited by De Sousa (2008:815).

> In the early 1990s, there were approximately 1.5 billion episodes of diarrhoea annually of which around 70 percent were associated with contaminated food. Further, it is estimated that 2.1 million people died from diarrheal diseases in 2000 (Henson 2003: 5).

These statistics are evidence that food-borne diseases have become a concern that is recognised internationally. Henson (2003:5) explains, “In industrialized countries, the percentage of people suffering from food-borne diseases each year has been reported to be up to 30 percent” (Henson 2003:5).

2.8.1: Food-borne illnesses as a result of the consumption of street foods

The Food and Agriculture Organisation and several authors stipulated that food which is vended on the street increases concerns regarding the possibility for serious food poisoning due to the presence of pathogenic bacteria, incorrect food handling procedures and environmental contaminants (FAO, 2012).

The frequency of food-borne diseases can be seen in the table below:

Table 2.4: Projected incidences of bacterial infections in selected regions (Henson 2003:8)

Disease	Africa	Central America	East Asia	Western pacific
Bacillus cereus Gastroenteritis	+++	+++	+++	+++
Botulism	+	+	++	+
Brucellosis	+/++	++	+/++	+
Campylobacteriosis	+++	+++	+++	+++
Cholera	+/++	+/++	+++	+++
Clostridium perfringens enteritis	+++	+++	+++	+++
E.Coli Disease	+++	+++	+++	+++
Listeriosis	+	+	+	+
Typhoid and Paratyphoid fever	++	++	++	++
Salmonellosis	+++	+++	+++	+++
Shigellosis	+++	+++	+++	+++
Staphylococcus Aureus Intoxication	+++	+++	+++	+++
Vibrio parahae-Molyticus enteritis	*-:*	*-:*	++	++
Vibrio vulnificus septicaemia	*-:*	*-:*	*-:*	++

Note: -: absent; +: occasional or rare; ++: Frequent; +++: Very frequent. Source: WHO.

There is a global increase in incidences of food-borne illnesses. There are many reasons for this which include “changes in eating patterns and food production and handling practices, the enhanced geographical movement of people, animals and plants, and emergence of new pathogenic organisms” (Henson 2003:4). Many reported food-borne illness outbreaks are from restaurants (Green *et al.* 2007:661). Millions become sick and suffer long-term complications or even die from eating contaminated food (Githaiga 2012:3). Due to improper hygiene and sanitation, people often become sick from the consumption of street food (Bhowmik 2005:2257). Contaminated food causes many diseases (Githaiga 2012: 10). “Foods can be a major vehicle of infection. Different foods, including rice, vegetables, and various types of seafood have been implicated in outbreaks of cholera” (Henson 2003:4).

Green *et al.* (2007:661) explain that “annually between 1993 and 1997, 27% to 38% outbreaks of food-borne illnesses has been due to poor personal hygiene of food handlers.” Even though globally, governments are trying to safeguard the supply of food, there are still many outbreaks of food-borne diseases, and this is a major health concern (Githaiga 2012:3). (Githaiga 2012:3) found that in 2005, 1.8 million people reportedly died from diarrheal diseases.

“In 2007, The World Health Organisation estimated that each year up to 30% of the world population suffer from food-borne diseases” (Jia and Jukes 2013:237). Governments then saw a need to create an “effective national food control system.” This involved educational programmes for food handlers and regulatory approaches to the handling of food (Jia and Jukes 2013:237).

Jia and Jukes (2013:237) explain, “The types of food incidents occurring in developing and developed countries vary.” In developed countries, the main food safety issues are “due to application of new technology, new craft, and new materials in agriculture and food manufacturing.” While in developing countries, the most significant difficulties are food shortages and poor quality of food.

Vollaard, Ali, van Asten, Widjaja, Visser, Surjadi, and Dissel (2004:2607) have reported that a study done in Jakarta, Indonesia, identified buying foods off the street as a risk factor, and buying food in restaurants proved otherwise.

Vollaard *et al.* (2004:2613) conclude that:

> Personal hygiene and knowledge of hygienic food preparation, faecal contamination of basic ingredients or water used for food preparation and/or isolation rates of enteric pathogens may differ between street food-vendors and vendors in restaurants.

2.9 FOOD SAFETY AND REGULATORY ASPECTS

Jia and Jukes (2013:237) describe food legislation as,

> The complete body of legal texts (laws, regulations and standards) that establish broad principles for food control in a country, and that governs all aspects of the production, handling, marketing and trade of food as a means to protect consumers against unsafe food and fraudulent practices.

According to Jia and Jukes (2013:237), “food safety is a significant public health issue for all governments around the world” Relevant food safety systems are vital from the production of food to consumption. If consumers are to enjoy the total benefits of street foods without any danger of food-borne disease, then it is crucial that governments intervene (Kwiri *et al.* 2014:217). Numerous studies have indicated that in instances where city management have policies which allow vendors to trade on city streets, many positive results have been achieved such as a decrease in poverty due to the increase of employment; entrepreneurship, as well as lawfulness (Kusakabe 2006:3).

In the City of Durban, people who would like to sell any foodstuffs are required to apply for a trading license. They are also required to apply to Informal Trade and Small Business Opportunities (ITSBO) for a site permit. According to the Health Act, the City Health Department will issue the vendor with a certificate of acceptability, which allows the vendor to then trade foodstuff (EThekwini Unicity Municipality 2001:9). It is crucial for guidelines or regulations to be developed which are specific to this sector to enable complete control and recognition of street foods (WHO 1996). “Many governments consider a Code of Hygienic Practice as an essential in the street food trade” (WHO 1996).

Many countries currently license street food vendors, but there is still a significant number of vendors who remain unlicensed. Although there is still a large number of unlicensed vendors, most municipalities do not have the required resources to stop vendors from operating (WHO 1996). Kidiku (2001: 23) explains that there are no standard licensing procedures and no uniformity.

Registration of vendors can prove to be very advantageous for authorities. It allows authorities to develop food safety and hygiene in food handlers; it also enables authorities to identify street food vendors including the types of foods sold (WHO 1996). For the vendor, however, licensing can be a very complicated process and requires expenditure from the vendor with the minimal return and many vendors see this as a financial liability (WHO 1996).

In South Africa, the Department of Health finds it challenging to keep track of food handlers due to rapid turnover. The Regulations Governing the General Hygiene Requirements for Food Premises and the Transport of Food (R918) have been published by the Department of Health on 30 July 1999. These regulations are published under the Foodstuffs, Cosmetics and Disinfectants Act (FCDA) (FCDA Act no. 54 of 1972) which governs the sale and handling of food. According to the above regulations, it is a condition that the municipality issue a certificate of acceptability to all food handlers before they prepare any food for consumption by the public.

In Ghana, it is a requirement by public health that all food handlers be medically screened for any contagious illnesses like cholera, tuberculosis, typhoid fever and any other air borne illnesses. Health inspectors also do screening periodically. It is a condition that vendors carry out both medical and physical examinations and produce a health certificate as proof of doing so. Vendors are expected to renew these certificates and may be required to produce these certificates during any random inspection done by health inspectors (Ackah, *et al.* 2011:193).

2.9.1 FOOD HYGIENE REGULATIONS IN SOUTH AFRICA

In South Africa, according to the General Hygiene Requirements for Food Premises and the Transportation of Food, “no person may handle food or permit food to be handled on food premises in respect of which a valid certificate of

acceptability has not been issued or is in force" (Department of Health:2012). A food premises is defined by the (Department of Health: 2012) as "a building, structure, stall or other similar structure and includes a caravan or vehicle, stand or place used for or in connection with the handling of food."

The number of toilets, urinals and hand wash basins for the use of employees on a food premises are specified in Table 2.5. Separate sanitary facilities are not provided if there are less than ten workers on the premises.

Table 2.5: Sanitary conveniences required of food premises by Department of Health (Department of Health: 2012)

Population: Staff and customers	Number of sanitary facilities to be installed in relation to the population as given in the first column				
	Men			Women	
For a population of up to:	Toilets	Urinals	Hand washbasins	Toilets	Hand washbasins
10	1	1	1	1	1
20	1	2	2	2	2
40	2	3	2	3	3
60	3	3	2	4	4
80	4	4	3	6	5
100	4	4	3	8	6
120	5	5	4	9	7
140	5	5	4	10	8
180	5	6	5	11	8

According to Department of Health (2012), food premises are to be planned and constructed in such a way that they do not create a health hazard, and that food handlers are able to prepare food hygienically. Food must be protected effectively from any form of contamination. The materials used to design and construct the food premises must be easily cleaned and must not contaminate the food. Adequate ventilation must be provided.

Department of Health (2012) requires that food premises must

- Have cleaning facilities with a potable supply of water;
- Ensure the prevention of any rodents and pests; and
- Have an adequate wastewater disposal method.

2.9.2 DUTIES OF THE PERSON IN CHARGE OF THE FOOD PREMISES STATED BY THE DEPARTMENT OF HEALTH

According to the Department of Health (2012), a person who is in charge of a food premises is to ensure the following:

- Effective pest control
- All staff working on the premises have been adequately trained
- Regular and frequent refuse removal
- Hygienic refuse storage
- Cleaning and disinfection of refuse bins
- Refuse must be stored and disposed of in a manner that will not be a nuisance to others
- Effective wastewater disposal, cleanliness of food premises, vehicle compartments and food containers
- Food handlers are not to wear jewellery that may contaminate food during preparation
- No animals, except a guide dog, is allowed in the food handling areas
- Compliance with food regulations
- No condition, act or omission that contaminates food is allowed on the premises
- Food handling areas must not be used for sleeping, laundry of clothes, or anything else that may contaminate the food.
- Reporting diseases and recording conditions for perusal by an inspector
- All food handling staff meet the regulations

- No food handler may touch prepared food with their bare hands.

2.9.3 DUTIES OF THE FOOD HANDLER STATED BY THE DEPARTMENT OF HEALTH

The food handler has a duty to ensure that his or her own actions do not cause contamination and/or spoilage of food.

The Department of Health (2012) stipulates that handlers are to comply with the following:

- Fingernails, hands and clothes must be clean
- Wash hands thoroughly with soap and water:
  - Before each shift
  - Before starting work or after any breaks
  - After using the toilet
  - After blowing their noses, or coming into contact with skin, or their hair, nose or mouth
  - After handling money or refuse
  - After smoking
  - After hands have become contaminated by another person
  - After preparing any raw meat, vegetables, fish or eggs.

The General hygiene requirements for food premises and the transportation of food regulation R918 prohibit the following:

- Spitting in the area where food is handled
- Smoking or use of tobacco in the area where food is handled
- Coughing or sneezing over non-packed food
- Walking, standing, sitting or lying on food
- The use of a hand-washing basin for cleaning facilities
- Spitting on any food equipment
- Inflating any food wrappings with the mouth
- The use of any action which could spoil or contaminate food

2.10 CONCLUSION

The literature in this chapter provides insight to the nature and operation of street food vendors. The literature has clearly indicated that there are serious concerns regarding the safety of foods prepared or sold in a street setting.

Literature has shown that government intervention is crucial in maintaining safe street food. “Governments must invest more in training food producers, suppliers and the public” (WHO 2007). It is evident that street food is a phenomenon on the rise and is here to stay and every effort must be made to ensure the hygienic supply of street food.

The next chapter of this study will present an operational perspective of the study area.

CHAPTER 3

AN OPERATIONAL PERSPECTIVE OF THE WARWICK TRIANGLE AND ITS MANY MARKETS

3.1 INTRODUCTION

Warwick Junction also referred to as the Warwick Triangle, is a marginal space, rich in history and culture. Located on the outskirts of Durban CBD, Warwick Junction has been described as many things, from “Pandora’s box of treasures” (Botha 2016) to a “City within a city” (Rosenberg 2011:7).

The Warwick Junction is a famous market area, which boasts approximately 8000 vendors and has been operating since the late 1800s (Botha 2016). It is a central transport exchange hub for people who make use of the five bus terminals, the main railway station and nineteen taxi ranks situated here (Dobson, Skinner and Nicholson 2009:5). The Warwick Junction is the largest transportation exchange and trading hub in South Africa (Skinner, Mkhize and Dube, G. 2013: 5). The transport exchange can be seen in **figure 3.1** below.

Figure 3.1: The Famous Warwick Junction area (East Coast Radio, 2014)

3.2 THE MANY MARKETS OF THE WARWICK TRIANGLE

The Warwick Junction is made up of nine distinct markets: The Early Morning Market, the Bovine Head Market, Berea Station, Music Bridge, Brook Street Market, Impepho and Lime Market, Victoria Street Market, Bead Market, and the Herb Market.

The markets of the Warwick Triangle make the area a major attraction in the city of Durban. These areas are depicted in **Figure 3.2.**

> Workers in these nine markets belong to the following sectors: Bovine head meat, plated/fast food, fresh produce, traditional herbs and medicines, traditional and fashionable attire, music, Impepho (traditional herb), Lime (sunscreen and medicine), bead work, flowers, poultry, hardware and mealies (Conley 2015:1).

Amongst the many markets of Warwick Junction, you will find about 2000 taxis, 140 000 daily departures on trains and buses and 460 000 pedestrians passing through it each day (Masojada, Saunders, Peters, Bingham, and Asmal 2014:6). The area is very vibrant, with music blasting from many loudspeakers, loud taxi horns and roaring buses as they pass the markets. It is an experience never to be for forgotten and will certainly never be experienced anywhere else. Inhabitants of Durban and tourists are able to browse the markets where they may buy a variety of goods from fresh produce, beadwork, clothing, traditionally cooked meals, music and entertainment and herb medicine.

Figure 3.2: An aerial view of the Warwick Triangle (Skinner *et al*. 2009:6)

3.2.1 BROOK STREET MARKET

Brook Street Market is a beautiful, vibrant and colourful market. Situated alongside the Badsha Peer Shrine, the market boasts beautifully made traditional Zulu wear, brightly coloured pinafores, hat, bags and shoes, an absolute feast for the eyes. On the upper level of the market is where the food vendors are situated Skinner *et al*. (2009:6).

Here, customers may decide to sit down or buy a take away meal. A wide variety of meals are sold here including traditional foods like usu (tripe), isigwaqana (sugar beans and maize meal), igwinya (yeast fat cakes) and maize pap. Food vendors even sometimes take lunch orders and have the meals delivered to other vendors during lunch times.

On entering the market, you are welcomed with the delicious smells of fresh foods, friendly smiles and greetings from vendors situated along the corridors.

Figure 3.3: The Beautiful Brook Street Market (Project for public spaces, 2015)

3.2.2 THE HERB/MUTI MARKET

Described as 'one of the most fascinating parts of Warwick" (Skinner *et al*. 2009:6) and "the equivalent of a modern pharmacy" (Skinner *et al*. 2009:29), the Muti market is where one would find a wide array of traditional medicines. Medicines include, bulbs, roots, including animal carcasses, skins and fats (Skinner *et al*. 2009:65). The Herb Market is a quiet, respected area of Warwick, populated with approximately 700-1000 traders (Conley 2015:14).

3.2.3 THE BOVINE HEAD MARKET

The Bovine Head Market is home to one of Durban's most popular Zulu delicacies, the sheep and cow head. The heads are boiled and displayed on chopping boards with salt and other condiments. "Although there are men and women customers, it is only the men who sit down at the long trestle tables provided to enjoy their meal. For women, it's a takeaway!" (Skinner *et al*. 2009:13). A picture of a bovine stall can be seen in **figure 3.4** below.

Figure 3.4: Ladies of the Bovine Head Market (Botha 2016)

3.2.4 THE EARLY MORNING MARKET

Situated in a huge warehouse, the Early Morning market is a fresh produce market with over 670 stalls (Skinner *et al.* 2009:19). Here street traders are able to buy fresh fruit and vegetables, as well as flowers at very reasonable prices.

3.2.5 THE MUSIC BRIDGE

The vibrant music bridge is the connection between the Early Morning Market, the station and the bus terminal. There are mostly male traders here who sell music, men's hats and small hardware items (Skinner *et al*. 2009:25). The walk over the music bridge is an exceptional one, as the maskanda (traditional Zulu music) and Zulu gospel music vibrate at your feet and blares through the air.

3.2.6 THE LIME AND IMPHEPHO MARKET

Situated under a large bridge, the Lime and Imphepho (Zulu incense) Market is made up of 60 trading spots (Conley 2015:14). Here one can purchase lime balls (balls of clay used as sunscreen) and imphepho, which is a traditional herb used to communicate with ancestors (Botha 2016).

3.2.7 BEREA STATION MARKET

Berea station market is situated alongside the Berea station, which is one of the busiest railway stations in the city. It is made up of 295 stalls and 54 kiosks with an average of 494 traders (Conley 2015:14). Here you will find both formal and informal traders selling fresh produce, traditional attire, church garments and other fashion items.

3.2.8 VICTORIA STREET MARKET

The two-floored Victoria street market is more than 100 years old and is a more formalised one, in comparison to all the others. Many refer to this is the old Indian market. Traders at this brightly painted market sell over 100 types of spices, fresh produce, beadwork, jewellery items and lots more (Botha 2016). The beautiful Victoria Street Market can be seen in **figure 3.5** below.

Figure 3.5: The Victoria street market (Project for public spaces, 2015)

3.2.9 THE BEAD MARKET

This colourful market showcases the most beautiful beadwork created by vendors. Beadwork sold include, hats, shoes, jewellery, traditional wear and bags. A picture of the Bead Market vendors can be seen in **figure 3.6.**

Figure 3.6: The Bead Market (Skinner *et al.*2009:102)

3.3 CONCLUSION

The primary objective of this chapter is to introduce the reader to the different markets which operate within the Warwick triangle and describe what each market has to offer. The nine markets described in **Chapter 3** are all distinct areas situated in the Warwick Triangle. These markets are all joined to each other by bridges, walkways and corridors. A walk through Warwick is described as a sensory overload that everyone needs to explore (Botha 2016).

The subsequent chapter is a description of the research methodology used in the study. It comprises the aim of the study, objectives, research design, study sample, and sample preparation used in the study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The food service industry has a moral responsibility to guarantee that all food made for human consumption is safe. “According to the Codex Alimentarius Commission, food safety is the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use” (Motarjemi and Lelieveld 2014:4).

Kidiku (2001:7) has recognised that “the greater part of food served in street food vending is safe for consumption.” In contrast, a number of authors have indicated that countless microorganisms of public health concern have been linked to street foods sold in some African countries (Rane 2011:24).

This study is an investigation of the hygiene and safety of street foods by research and observation of food premises and hygiene practices. The study involves microbiological testing of these foods by the Department of Microbiology at Durban University of Technology (DUT). The sample chosen to complete the study is the food vendors who conduct their business in the Warwick Triangle in Durban. These people will, therefore, have the ability to answer questions based on their experience and operational activity.

This study comprises of quantitative research. A descriptive survey will include a study conducted by the administration of a structured questionnaire and an observation checklist.

The following instruments are used to obtain data in this study

- Street food vendors questionnaire,
- Observation sheet for food premises, and
- Microbial sampling and testing

Chapter 2 was a review of the literature, which provided insight into the nature, and operation of street food vendors, as well as the food hygiene knowledge and practices of street food vendors. This chapter will discuss the research methodology and design used to execute this study. The purpose of this chapter is to give insight into the methods used in this study for the results and findings to be evaluated.

4.2 RESEARCH METHODOLOGY

There is an assumption that due to the poor infrastructure and bad hygiene practices of street food vendors, the food sold is unsafe (Kidiku 2001:5). A quantitative approach to this research will best apply to this research problem and allow the researcher to examine the relationships between the challenges faced by street food vendors, the condition of food premises, and the safety of food sold by street food vendors. A study conducted by Mjoka and Selepe (2016:3) on food safety in a street setting used the same methods to obtain data.

This study requires a detailed analysis of data to examine the nature and operation of street food vendors within the study area. Participant questionnaires and observation will give the researcher insight into the actual operation of a street food vendor located in the study area. Using a quantitative approach to the study allows the researcher to generalise and to make recommendations based on findings after analysis (Fielding 2009:5).

4.2.1 METHODS OF RESEARCH

Research Methods are the tools and techniques for doing research (Walliman 2011:97). These tools provide a way for the researcher to collect, sort and analyse data to draw conclusions and recommendations. In this study, quantitative data is used to examine the relationship between the challenges experienced by street food vendors, the conditions of food premises and the safety of the actual food that is sold by them.

This research focuses on street vendors in the Warwick Triangle of Durban and data was collected through a survey by means of questionnaires and also through observation. Microbial tests were also conducted on food samples which were collected from the study area.

According to Walliman (2011:97),

> As a method of data collection, the questionnaire is a very flexible tool that has the advantages of having a structured format, is easy and convenient for respondents, and is cheap and quick to administer.

Questionnaires form an essential part in descriptive research (Bird 2009:1306). In this study, descriptive research was done by means of a structured questionnaire, which is used to answer questions regarding the condition of the food premises, facilities like potable water, sanitation, and food hygiene practices exercised by food vendors in the study area.

Bird (2009:1307) explains that:

> The questionnaire is a well-established tool within social science research for acquiring information on participant social characteristics, present and past behaviour, standards of behaviour or attitudes and their beliefs and reasons for action with respect to the topic under investigation.

The questionnaire is essential in obtaining evidence on perception and knowledge (Bird 2009:1307).

“Microbiological assessment for quality and safety of foods traditionally relies upon the enumeration and specific detection of pathogenic and spoilage microorganisms” (Deak 2009:1). Microbial testing is also a form of quantitative research. “Microbial safety and quality of foods are determined by the kinds and number of microorganisms occurring in them” (Deak 2009:1). The primary objective of food microbiology is to use the best testing methods to identify and enumerate the microorganisms in a food product (Deak 2009:1). In this study, samples of food will be collected, and microbial tests will be conducted to identify and enumerate any pathogenic microorganisms present in the food.

4.2.2 QUANTITATIVE RESEARCH

Quantitative research methods involve methods which systematically deal with numbers and measurements. Quantitative research, although more challenging

to design in the beginning, is usually specific and well-structured and the results can be easily organised and presented in the form of statistics. Using quantitative methods allows the researcher to gain a broad set of findings and present them concisely and economically (Yilmaz 2013: 313).

Creswell (2014: 22) claims that:

> Specific methods exist in both survey and experimental research that relate to identifying a sample and population, specifying the type of design, collecting and analysing data, presenting the results, making an interpretation, and writing the research in a manner consistent with a survey or experimental study.

"Quantitative research is an approach for testing objective theories by examining the relationship among variables" (Creswell 2014:54) and allowing the researcher to reduce data into numerical indices. Choosing to do quantitative research requires the researcher to pre-construct instruments into which the participant's different experiences and responses will fit (Yilmaz 2013:313). Yilmaz (2013:313) indicates that quantitative studies comprise "outcomes, generalisation, prediction, and cause-effect relationships through deductive reasoning."

4.3 RESEARCH DESIGN

"The research design provides a framework for the collection and analysis of data and subsequently indicates which research methods are appropriate" (Walliman 2011:13). A research design describes the method that the researcher trusts is the most appropriate to collect, analyse and use data that is applicable to the study. As the data in this study is expressed in terms of quantity, it is a quantitative study (Kothari 2004:3). Quantitative techniques are used in this study in the form of a questionnaire, observation checklist and microbial testing to collect, analyse and summarise data.

This study is both of a descriptive nature and experimental nature. It is descriptive in using a quantitative method of data collection to describe the knowhow and practices of street food vendors and experimental in the microbial testing to determine the safety of foods. This design was chosen as it would make available to the researcher, information on the knowledge and operations of the study

population. “Descriptive research is conducted to describe phenomena as they exist. It is used to obtain information on the characteristics of a particular problem” (Collis and Hussey 2014:4). Rubin and Babbie (2009:254) suggest that surveys can be used for descriptive and explanatory reasons.

Cresswell (2014:59) reports that:

> Experimental research strives to determine if a specific treatment will have an influence on an outcome. The researcher makes an assessment by providing a treatment to one set and withholding it from another and then concluding how both sets scored in the results. Microbial testing allows the researcher to seek a relationship between cause and effect. From the data collected, averages are used to draw conclusions.

4.4 SAMPLE PROCEDURE

The study was conducted within the Warwick Triangle in Durban, South Africa. A physical count of 30 vendors was conducted in the study area. On the day of sample collection for microbial testing, only 26 vendors were operating; therefore the researcher was only able to collect 26 samples for microbial testing.

4.4.1 SAMPLE COLLECTION AND PREPARATION FOR MICROBIAL TESTING

This study is a survey during which 26 samples of prepared salads and meat dishes were collected and analysed for total plate count*, E coli, Salmonella, Listeria monoctytogenes,* aerobic and anaerobic formers and *Staphylococcus Aureus*. One full meal was purchased from each point of sale. Each meal consisted of a starch, protein and a mayonnaise or vinegar-based salad.

The microbiological quality of vegetables (salads) was tested because vegetables require minimal cooking and their microbial content may indicate a risk factor for the consumers’ health. Nyenje, Odjadjare, Tanih, Green and Roland (2012:2610) indicates that “vegetables may serve as a reservoir from which these bacteria can colonise and infect a susceptible host.” Holding vegetables in cool temperatures during sales could possibly prevent any contamination (Vural and Erkan 2008:285).

Separate samples of meat and salad were taken from each meal purchased. Each sample was placed in sterile poly plastic bags, labelled and stored in cooler boxes. Once all samples were collected, they were transported in cooler boxes to the Microbiology laboratory at the Durban University of Technology where the microbial testing was conducted.

Serial dilutions were conducted on each sample tested up to the fifth dilution and each sample tested was conducted in duplicate, this was done to decrease the microbial concentration in the sample tested to determine the colony forming unit per ml (CFU/ml).

Total plate count (TPC) was determined using nutrient agar by the pour plate method using Nutrient Agar (Liofilchem, Italy). “The pour plate method is used to count the number of microorganisms in a mixed sample, which is added to a molten agar medium prior to its solidification” (Sanders 2012:2). One millilitre of the 10^{-5} dilution was then presented aseptically into the Petri dish and was incubated for 72 hours at 30°C. Colonies were then enumerated after incubation. The quantity of colony-forming units (cfu) found is multiplied by the reciprocal of the dilution.

“This technique is used to perform viable plate counts, in which the total number of colony forming units within the agar and on surface of the agar on a single plate is can be counted” (Sanders 2012:3).

“Standardized methods (e.g., International Organisation of Standards (ISO) methods) are usually considered the reference analytical methods for official controls” (Lopez-Campos *et al.* 2012:16).

4.4.2 STOCK SAMPLE PREPARATION

A 25g food sample was weighed aseptically using a sterile spatula, and a sterile cutter (when needed) added to 225ml sterile buffered peptone water (BPW) prepared according to the manufacturer’s instructions. Both the food sample and BPW were placed in a sterile zip plastic bag and macerated in a stomacher blender for approximately 2 minutes.

4.4.2.1 *STAPHYLOCOCCI AUREUS*

The level of *S. aureus* was determined according to ISO 1999. Serial dilution was conducted, 1 ml from stock sample was transferred to 9 ml of BPW up to fit dilution. Spread plating method was carried where approximately 0.1 ml of each dilution was released on Baird Parker (Oxoid) agar plates which contained egg-yolk tellurite solution (Oxoid). The plates were then incubated for 24 hours at 37°C and typical colonies were then counted and recorded. The data is recorded as log cfu ml-1 of the sample *Staphylococci* (Mkhungo 2015:22).

4.4.2.2 *SALMONELLA*

Salmonella spp. was determined according to ISO 1993. A 25g food sample was added to 225ml sterile BPW and macerated after which it was incubated for 24 hours at 37°C 1st enrichment. The sample suspension of 10ml was then transferred into 100ml of Selenite cystine medium (Oxoid) and incubated for 24 hours at 37°C 2nd enrichment. XLD (Oxoid) agar plates were inoculated with 1ml cultures from Selenite cystine medium. The plates were incubated at 37°C for 24hours. Typical colonies were then counted and recorded (Mkhungo 2015:23).

4.4.2.3 *E. COLI*

Food samples were prepared in the following manner:

The sample of 1ml taken from stock sample was transferred to 10ml of Lauryl sulphate broth (LSB) and stored in an incubator for 24 hours at 37°C. 1ml from LSB was transferred to *E. coli* broth and incubated again at 37°C for 24 hours, and positive *E. coli* broth samples were injected onto the surface of L-EMB (Oxoid) agar plates with inoculating loop and incubated at 37°C for 24hours (Mkhungo 2015:23).

4.4.2.4 *LISTERIA MONOCYTOGENES*

A 1ml food from the stock sample and swab sample were added to 9ml of one-half Frazer broth (Oxoid), and it was incubated at 37°C for 48 hours. A total of 0.1ml of the one-half Frazer broth culture was then transferred into a test tube containing 10ml of full Frazer broth (Oxoid) and also incubated at 37°C for 48 hours. Oxford agar (Oxoid) plates were injected with culture from the full Frazer broth. The plates were sited in an anaerobic jar and incubated micro-aerobically at 37°C for 24 hours (Mkhungo 2015:23). Typical colonies were then enumerated.

4.5 ORGANISATION AND ADMINISTRATION OF QUESTIONNAIRES

Before the administration of questionnaires contact, was made with the participants for permission to undertake a study in their area of sale and also to establish the most appropriate time to do so. Questionnaires were designed carefully, and questions were made simple enough for participants to understand and to ensure that there is no confusion or interpretation. This would ensure that no date is uninterruptable and also that the return rate of questionnaires would be adequate.

Field assistants were briefed on the questionnaires and checklists and the purpose of the study so that they would be able to answer any questions posed by participants. No schedule or setting up of appointments was required to administer the questionnaires as this was best done during the operating times of the vendor. The administration of questionnaires was carried out by the researcher, as well two field assistants. Before filling in the questionnaires, participants were informed of the research and consent was given. Field assistants were present to assist with the language barrier, by reading the Zulu questionnaires and helping to explain questions to the participants. This also helped to record answers correctly.

The researcher and field assistants assessed if the equipment was available, for example, soap, hand-washing equipment, and cloths. If these were available the response, “Yes” was ticked and if not available, the response “No” was ticked by the researcher or field assistant.

Administration of questionnaires (Appendices 3 and 4) and observation checklists (Appendices 6 and 7) took approximately 10 to 15 minutes, each, for the researcher and field assistants to complete.

4.6 ORIENTATION OF THE FIELD RESEARCH ASSISTANTS

The field assistants who assisted in the administration of questionnaires were students who had already graduated with a B-Tech in Food Technology. They were chosen as they were the students who were to carry out the microbiological testing on foods and also because they were most suitable for the task. These students have also conducted research of their own and were, therefore, well aware of the importance of a completed, reliable research instrument.

The fieldworkers were briefed on the aim of the research and also the content of both questionnaire and checklist. They also assisted in explaining the study to participants and administering of the consent forms.

4.7 DESIGN OF QUESTIONNAIRES AND OBSERVATION CHECKLIST

Murray (1999:149) defines a questionnaire as “an instrument with open or closed questions or statements to which a respondent must react.” “A questionnaire is relatively economical, can ensure anonymity and contains questions written for specific purposes” Murray (1999:149.) Structured questionnaires engage the respondent in answering questions posed orally by the interviewer. “In using questionnaires, researchers rely totally on the honesty and accuracy of participants’ responses” (Marshall 2006:125). The interviewer will write down the responses. It included a combination of open and closed-ended questions. The respondent will be intercepted in the course of daily activity. The questionnaire and observational data were coded to facilitate statistical analysis

The valid and reliable questionnaire and observation checklist used in this study were developed using a questionnaire and observation checklist developed by Campbell (2011:17) as a guideline. Permission to use these instruments was granted by the original source **(Appendix 5)**. The questionnaire used in this study consisted of 17 questions. The questionnaire was designed in a multi-choice format, where the respondent may choose the best-suited option. Questionnaires were designed in both the English and Zulu languages so that all participants could understand and participate. Each questionnaire took approximately 10 to 15 minutes for the researcher to complete.

Crucial elements to hygiene and food safety were listed on the observation checklist which was the last section of the questionnaire. Observation involves the systematic recording of operations, behaviours, and objects in the study area (Marshall 2006:98). It includes the researcher in examining, recording and analysing events and activities of interest (Blaxter, Hughes and Tight 2001:199). By using the observation method, information is sought by the researcher’s own observation and not having to involve the respondent (Kothari 2004:96). Taylor–Powell and Steele (1996:1) confirm that observation allows the researcher to

“document activities, behavior and physical aspects without having to depend on people’s willingness and ability to respond to questions.” This method of data collection assumes that behaviour is purposeful in concluding the findings of the study. Observation allows the researcher to make a qualitative inquiry into the operation of the street food vendors, as well as the infrastructure used and conditions of surrounding areas. The observation conducted in this study will allow the researcher to confirm information collected from participants from the questionnaires administered.

Even though most of the food served on the street is safe enough to consume, there is, however, evidence, which suggests possible dangers of food-borne diseases (Kidiku 2001:17). The activities taking place at a street food-vending site must be observed while food is being handled and all the possible health risks must be observed at many phases until the food is handed to the consumer. An observation will, therefore, be done on the vendor, study area and all infrastructure used in street food preparation within the study area. In this study, each observation checklist is made up of 22 items to be checked. The observation checklist will be used to observe and monitor things like clothing worn by food handlers, preparation methods, and food handling practices. “Observers’ comments are often a quite fruitful source of analytic insights and clues that focus data collection more tightly” (Marshall 2006: 99).

4.8 MICROBIAL TESTING

According to Lopez-Campos, *et al.* (2012:13):

> The detection and enumeration of pathogens in food and on surfaces that come into contact with food are an important component of any integrated program to ensure the safety of foods.

For the purpose of this study, the bacterial pathogens tested include *Listeria monocytogenes Salmonella* spp., *Staphylococcus aureus*, and *Escherichia coli* as they may be linked with foods or food handling practices and may cause consumer illness or disease (Food and Drug Administration, 2015).

Samples of meat and salads were collected and immediately placed in labelled poly sterile bags and stored in cooler boxes. The process of collection took approximately three hours. These samples were then transported to the

Department of Microbiology at DUT where microbiological testing was conducted. A detailed explanation of the sample preparation for microbiological testing is presented in **section 4.4.1.**

4.9 CONCLUSION

This chapter provided an outline of the research methodology used in this study. A description of the quantitative methods used in this study was identified and discussed.

The design and administration of research tools were explained. The administration of questionnaires and collection of samples have been explained. The collection of data by researcher and field assistants has been discussed in detail.

The presentation of findings from the questionnaire and observation checklists used in the study will be discussed in **Chapter 5**.

CHAPTER 5

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION OF DATA COLLECTED FROM QUESTIONNAIRE AND OBSERVATION CHECKLISTS

5.1 INTRODUCTION

This chapter provides the results and a discussion of the results acquired from the questionnaires and observation checklists in this study. The data collected from the responses were analysed using SPSS version 24.0. The results for the quantitative data collected will be presented in the form of tables and figures.

5.2 RESEARCH OBJECTIVES OF THE STUDY

The specific objectives of this study are to determine the hygiene practices, food safety knowledge of street food vendors and also to determine the safety of the food sold. The research objectives of this study may be summarised as follows:

- Determine the conditions of food premises and hygiene practices used by street food vendors operating at the in the Warwick Triangle.

- Investigate challenges facing street food vending operations within the Warwick Triangle.

- Determine the microbial safety of prepared food sold by vendors.

The first two research objectives were discussed in the literature review **(Chapter 2)** of the study, in which a broad reasoning of the objectives was covered. The discussion was essential in order to understand the conditions of street food premises and the challenges faced by them.

The third objective was to determine the microbial safety of street food sold within the study area. This objective was also discussed in **Chapter 2**. Within the discussion, similarities were found amongst other street food vendors, and the consequences of unsafe food were identified.

5.2.1 RESULTS OF THE STUDY

The results of the study are organised in two chapters and presented with responses which were received from participants. The results derived from the questionnaires and observation checklists will be presented and discussed in this chapter **(Chapter 5),** and the results of the microbial testing will be presented and discussed in **Chapter 6.**

5.2.2 THEMES OF THE STUDY

The concept of street food safety has emerged in various themes. These themes surfaced in dominant components in determining the safety of street foods sold within the study area and are discussed as follows:

1. *The nature and operation of street food vending* is a key theme in determining the nature and operation of street food vendors, as well as hygiene knowledge. Within this theme, favourable and unfavourable conditions of food premises are addressed as well as challenges experienced by street food vendors.
2. *Food hygiene regulations* refer to the regulations linked to the preparation of food for the public.
3. *Microbial safety* refers to the assessment for quality and safety of foods by the enumeration and detection of pathogenic bacteria.

5.2.3 RELIABILITY

The two most vital qualities of accuracy are reliability and validity. Yilmaz (2013:317) explains reliability as the “consistency or the degree to which a research instrument measures a given variable consistently every time it is used under the same condition with the same subjects.” Reliability is not applicable to measuring instruments, but rather to data collected (Yilmaz 2013:317).

Reliability is computed by taking several measurements on the same subjects. The table below reflects the Cronbach’s alpha score for all the items that constituted the questionnaire.

Cronbach's Alpha	No. of items
.534	4

The reliability score approximates the recommended Cronbach's alpha value. This indicates a degree of acceptable, constant scoring for these sections of the research.

5.3 GENERAL INFORMATION

This section summarises the biographical characteristics of the respondents, as well as training and education information of vendors.

5.3.1 VENDOR GENDER

All of the respondents were African (Black) with the gender distribution as indicated in **Table 5.1** below.

Table 5.1: Gender of street food vendors

Response	Frequency	Percent
Male	6	20.0
Female	24	80.0
Total	30	100.0

The ratio of males to females is 1 is to 4 (p = 0.001). This indicates that the trade is predominantly women driven, with only 20% being male street food vendors. These results are in contrast with a study conducted in KwaDlangezwa (Kwazulu Natal) by Mjoka and Selepe (2016:4), which reports most vendors (62.5%) as being male. FAO (2016: 4) reports that selling "street food enables women to start up and operate a business by relying on small amounts of capital, traditional skills such as cooking, home equipment, and the help of other family members."

5.3.2: VENDORS TRAINING/EDUCATION

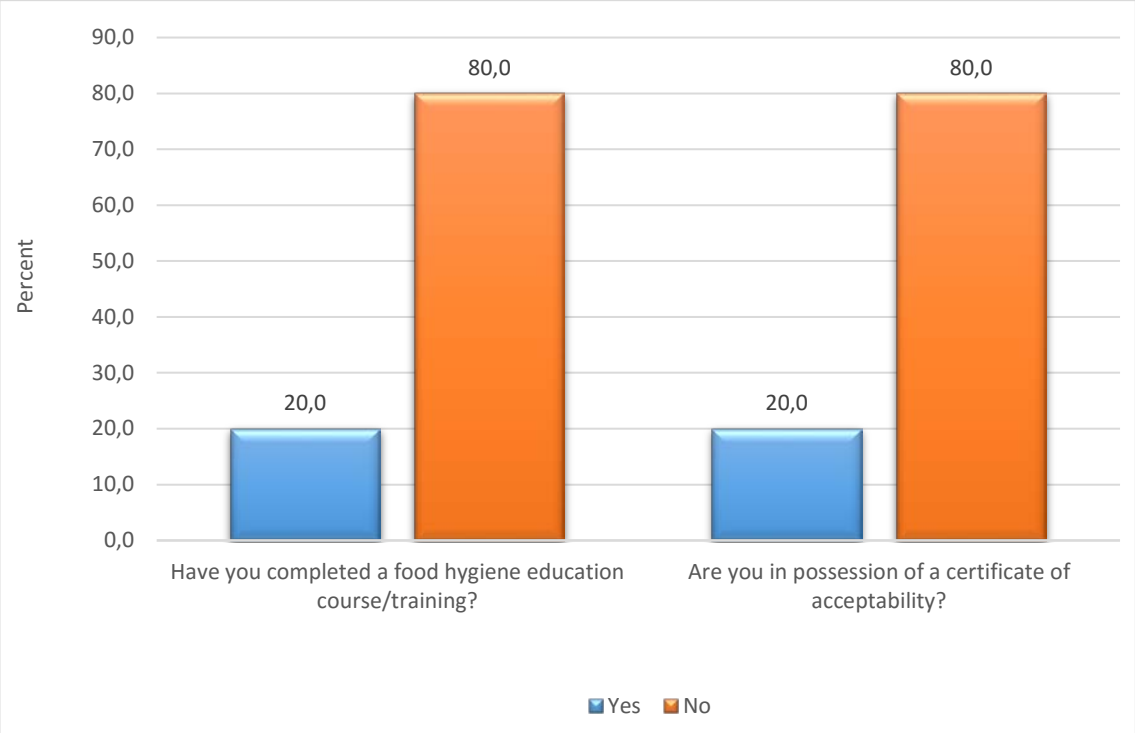

Figure 5.1: Education/training levels of the respondents.

The majority of respondents (80.0%) (p = 0.001 in both instances) had not received any education or formal certified training regarding food hygiene. It is evident from Figure 5.1 that only 20% of street vendors at the Brook Street Market do not have a certificate of acceptability (CoA). Possession of a CoA implies that an Environmental Health Practitioner has inspected the food premises (Campbell 2011:59). According to Department of Health (2012:5), “no person shall handle food or permit food to be handled on a food premises in respect of which a valid certificate of acceptability has not been issued or is in force.”

The results found in this study are in agreement with studies by Samapundo, *et al.* (2014:11) and Thanh (2015:34). Samapundo *et al.* (2014:11) reported that 88.7% of vendors had not been for any food safety training and Thanh (2015:34) found that 95% of vendors had not been for any food safety training.

The results presented in Table 5.2 illustrate that, of the 80% who did not have a certificate of acceptability, 63.3% learnt food preparation at home, 6.7% learnt

from their mothers, 3.3% of vendors learnt preparation of food from friends, and 6.6% of food vendors learnt from their boss.

“It was important to know how the vendors acquired their cooking skills to establish their knowledge in handling street food” (Muinde and Kuria 2005:4).

A study conducted by Muinde and Kuria (2005:4) also found that the majority of vendors (61%) acquired their cooking skills by observation at home, and 33.3% of the vendors were taught by their parents.

WHO and FAO have recommended education of food handlers as a method of improving the practices of food handlers, as well as the safety of food (Campbell 2011: 17).

Table 5.2: The knowledge base of respondents

Response	Frequency	Percent
Learnt at home	19	63.3
Learnt from mother	2	6.7
Learnt from a friend	1	3.3
Learnt from my boss	2	6.6

5.4 FOOD STALLS

This section deals with the preparation premises of food, the types of foods sold and whether or not there are any hand-washing facilities on the food premises.

A ‘food stall’ is included in the definition of ‘food premises’ provided by (Department of Health 2012: 4).

5.4.1 FOOD PREPARATION SITE

In **Table 5.3** all respondents indicated that food was prepared at the stall.

Table 5.3: Food preparation site

Response	Frequency	Percent	Valid percent	Cumulative percent
Food stall	30	100.0	100.0	100.0

All vendors have indicated that they prepare food at the point of sale. The fact that vendors prepare food on site is good practice because this means that food is not cooked and transported. The transportation of food may jeopardise the temperature of the food and create breeding grounds for pathogens to grow.

5.4.2: Types of food sold by vendors

Figure 5.2 is a depiction of the different types of food prepared and sold in the Warwick Triangle.

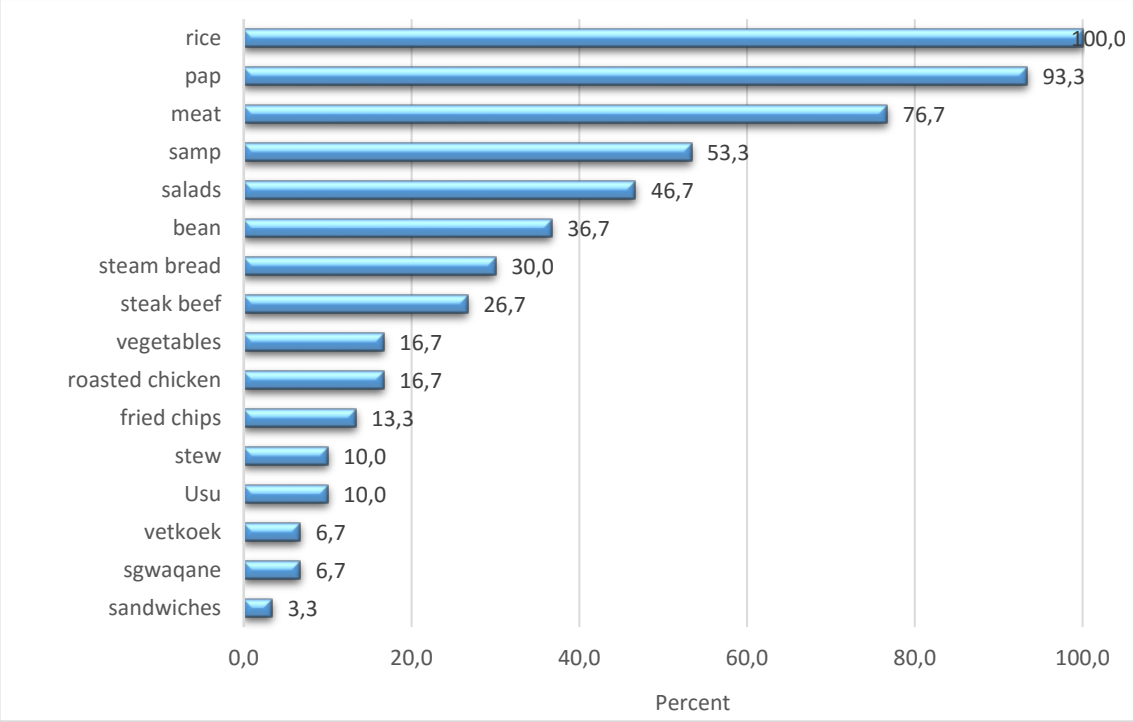

Figure 5.2: Different types of food sold by street food vendors in the Warwick Triangle

All of the respondents surveyed indicated that they made rice every day. Rice, pap and samp are staple foods in South Africa. These are all starches and are served as a base for most meals which is probably why 76.7% to 100% of vendors consider these foods as essential and include them on the menu.

Each meal is served with a type of meat and a salad. Other foods indicated in **Figure 5.2** include beans, steam bread, vegetables, fried chips, usu, vetkoek, sgwaqane and sandwiches. **Figure 5.2** indicates that these are the least prepared foods.

5.4.3: HAND-WASHING FACILITIES

Figure 5.3 below indicates whether there are adequate hand-washing facilities for food handlers.

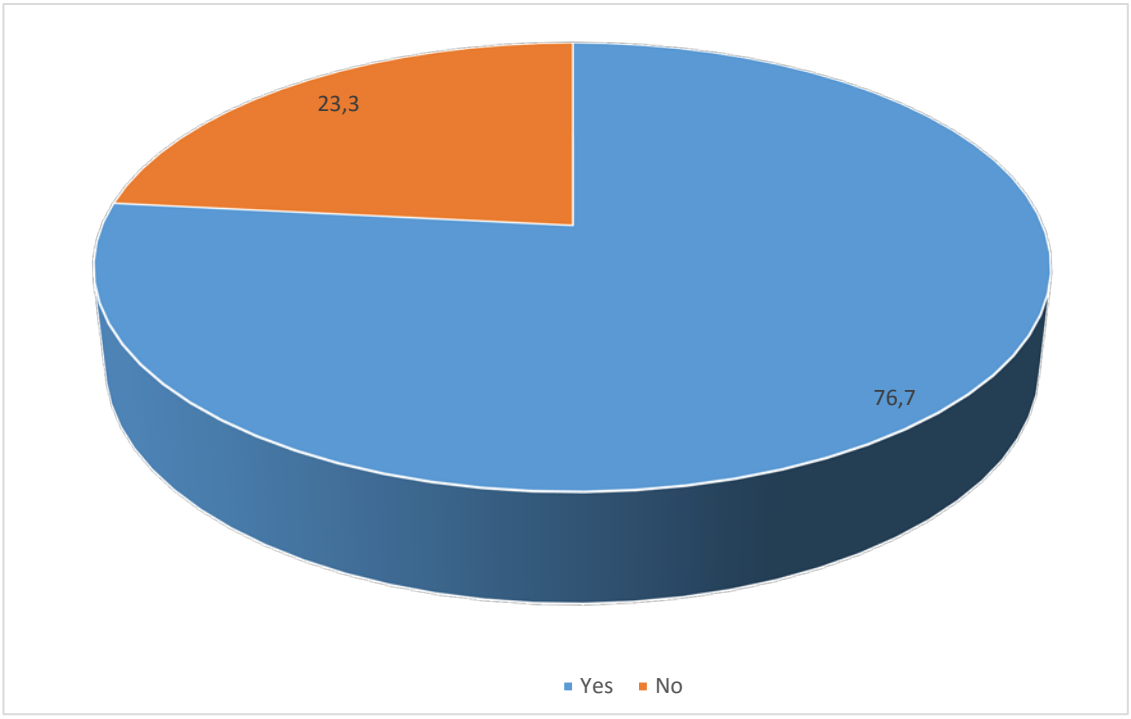

Figure 5.3: Hand-washing facilities available

Approximately three-quarters of the respondents (76.7%) indicated that sufficient hand-washing facilities were available (p=0.003).

All food premises are to be equipped with hand-washing facilities with cold and/or hot water for hand-washing by both food handlers and people who are buying food. Hand-washing facilities must be provided with soap and a hygienic means of drying hands (Department of Health 2012:10). The results presented in Figure 5.3 illustrate that a significant amount (76.7%) of vendors are equipped with hand-washing facilities as required by the Department of Health; however there are still 23.3% of food vendors who do not have adequate hand-washing facilities.

According to Department of Health (2012:16), “no person shall use a hand basin for the cleaning of his/her hands and simultaneously for the cleaning of facilities”, therefore, in the next section of the questionnaire vendors were asked if there is another running/potable water supply available.

5.5 INFRASTRUCTURE

This section looks at the electricity and potable water supply in the vending area. It also covers the access that vendors may or may not have to hygienic toilets and a garbage disposal area.

A study conducted by Skinner (2013:18) revealed that basic infrastructure is one of the main aspects that hinder the work of street food vendors.

5.5.1: Running water and toilets and electricity access

The table and figure below summarise the scoring patterns relating to infrastructure.

Table 5.4: Vendor access to running water, hygienic toilets and electricity

Response	Yes%	No %	Chi-Square p-value
Running water supply	60.0	40.0	0.273
Hygienic toilets	100.0	0.0	-
Electricity	60.0	40.0	0.273

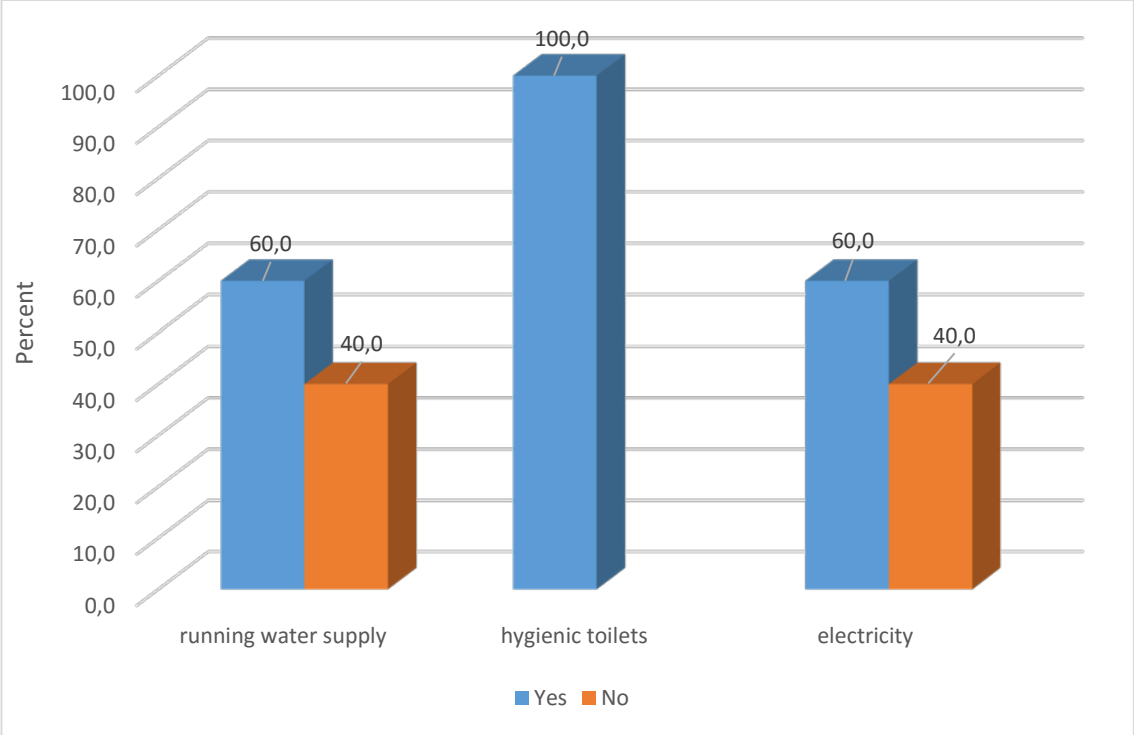

Figure 5.4: Vendor access to running water, toilets and electricity

Running water and toilets are essential facilities of a proper work environment (Skinner 2013:21). The lack of these facilities poses a health risk to both vendors and customers.

As depicted in **Figure 5.4** above more respondents (60%) indicated that they do have access to electricity and running water, but this was not significantly different to those who indicated that they did not ($p = 0.273$). All of the respondents indicated that they did have access to clean toilets.

Of the 40% who indicated they do not have access to running water, 11 people indicated that they use a communal tap which is within walking distance from the vending site and one vendor indicated that they pay someone to supply water to them. This is depicted in **Table 5.5** on the following page:

Table 5.5: Vendors access to potable water

Response	Frequency	Percent
Do have potable water	18	60
Communal tap	11	36.7
Pay someone to give them water	1	3.3
Total	30	100

5.5.2: Distance from the garbage disposal area

The table below indicates the distance of street food stalls from the garbage/waste disposal area.

Table 5.6: The distance of food stall from garbage disposal area

Distance	Frequency	Percent
3 - < 6	10	33.3
6 - < 9	11	36.7
9+	9	30.0
Total	30	100.0

Table 5.5 indicates that most garbage areas (70%) are in close proximity to the food stall. Only 30% of food stalls have garbage bins, which are not close to the food preparation area.

Refuse bins harbour flies and other pests such as cockroaches and rats. It is, therefore, a requirement that the refuse storage area is not in close proximity to the food preparation and service areas. Separate storage areas for refuse bins are required by the Department of Health (2012:10).

5.6 PERSONAL HYGIENE AND SANITATION

This section presents information on methods of wastewater and garbage disposal, food storage methods, means of dishwashing and leftover food.

The figures and tables below are summarised responses to the questions asked regarding disposal.

5.6.1 WASTEWATER DISPOSAL

Figure 5.5 presents information on how food vendors' dispose of any wastewater they may have accumulated during operation.

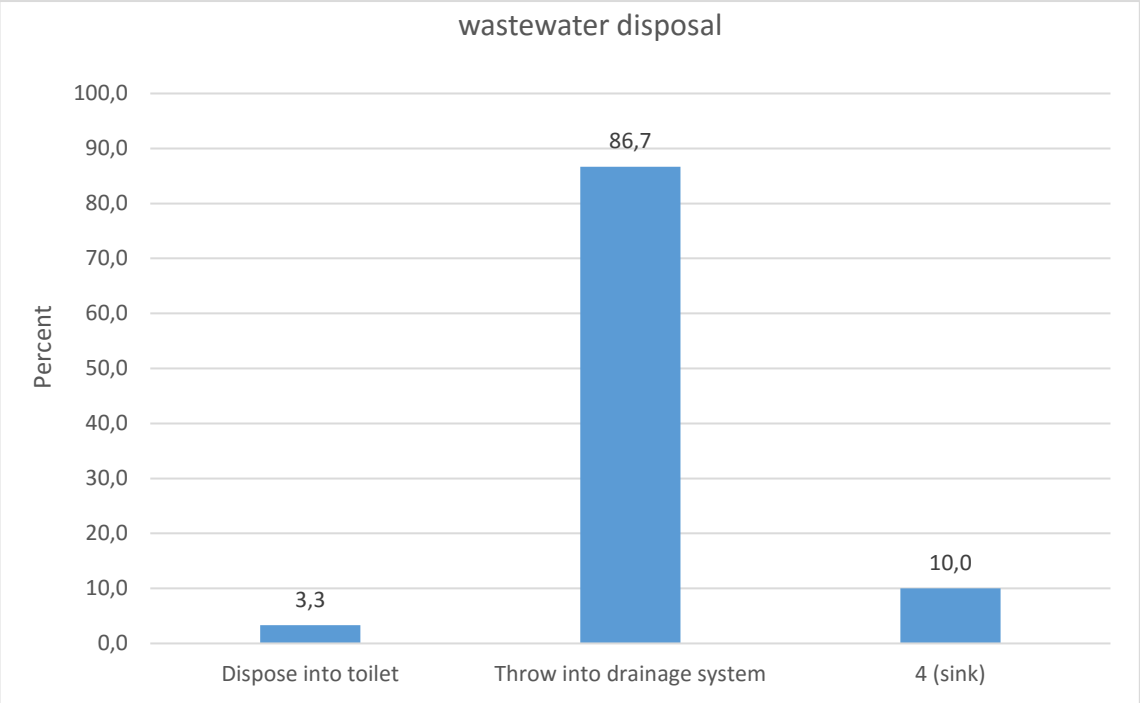

Figure 5.5: Methods of wastewater disposal

Significantly more respondents (86.7%) threw the wastewater into the drainage system which is in contrast with requirements of the health department. According to the Department of Health (2012:9), a food premises should have a wastewater disposal system approved by the local municipality. A study conducted by Muinde and Kuria (2005:6) in Kenya found that 92% of the vendors disposed of wastewater alongside the food, making the area

surrounding the food stalls filthy. This practice creates breeding grounds for pests like rats, flies and cockroaches.

5.6.2 GARBAGE DISPOSAL

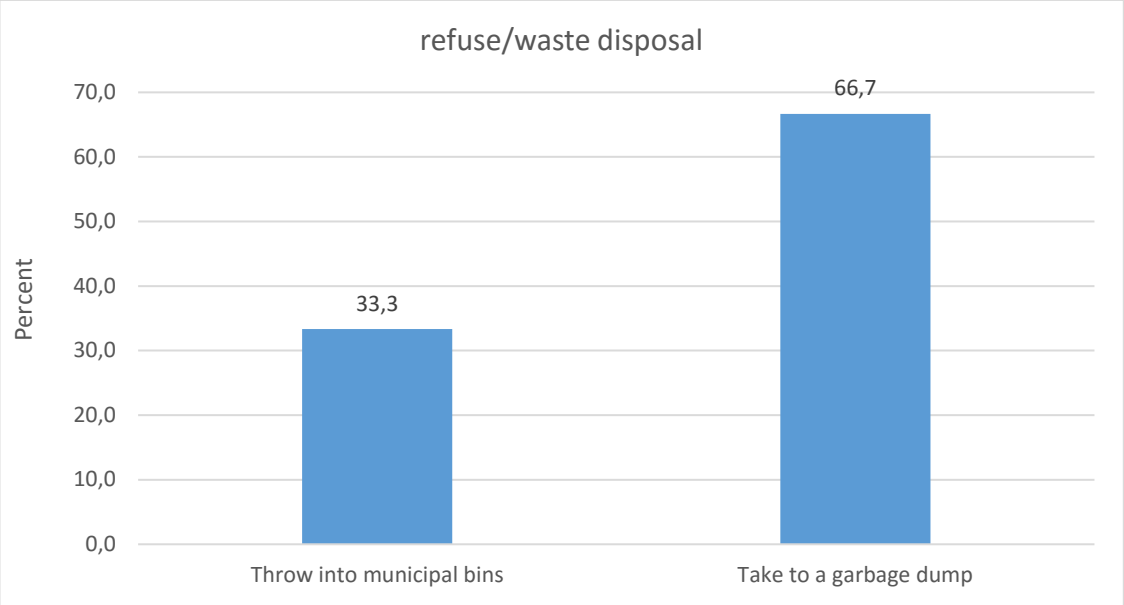

Figure 5.6: Methods of garbage disposal

Most vendors (66.7%) in this study have indicated that they dispose of their garbage at a nearby garbage dump as opposed to municipal bins. A garbage dump acts as a perfect breeding point for flies, rodents and microorganisms (Rane 2011:101).

In a study conducted by Muinde and Kuria (2005:6), 95% of vendors did not have bins to dispose of their garbage and therefore, just disposed of it near their food stalls. About 85% of the vendors who were interviewed prepared their foods in unsanitary conditions because garbage and other waste were evidently surrounding their stalls (Muinde and Kuria 2005:6).

According to the Department of Health (2012:10), a food premise must have a liquid proof, easy to clean garbage bin. All garbage bins must have a close-fitting lid. It is also a requirement that vendors do everything they can to eliminate all pests (Department of Health 2012:14).

5.6.3 DISHWASHING METHODS

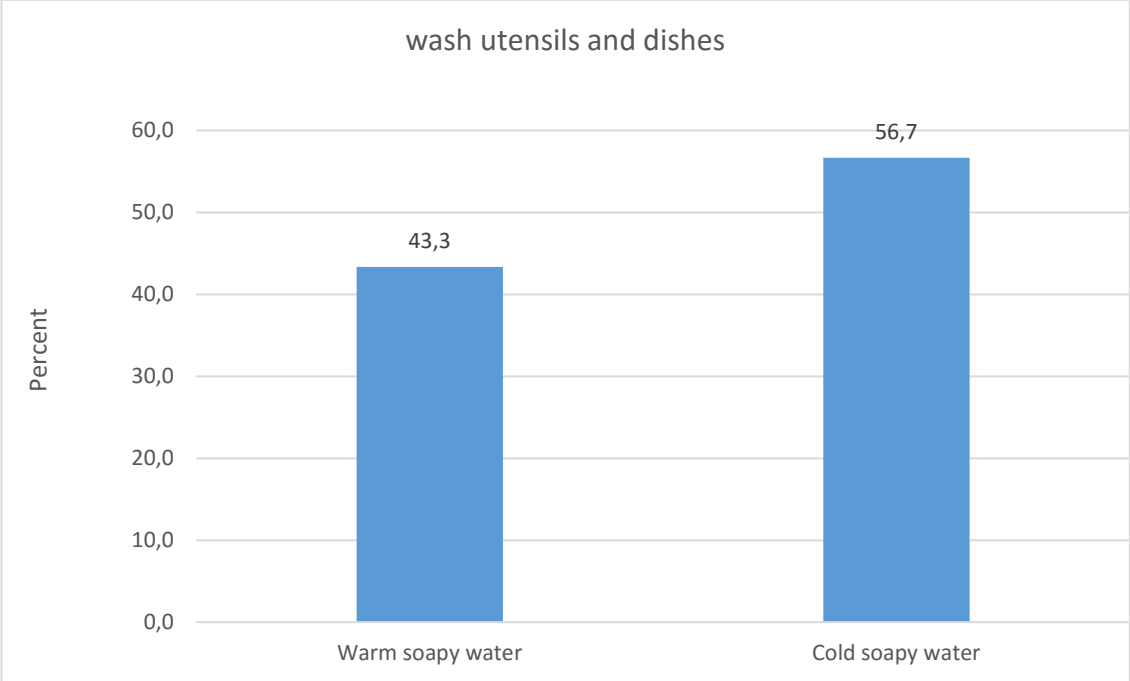

Figure 5.7: Methods of washing cooking utensils and dishes

Concerning refuse and washing of utensils, the p-value is greater than 0.05 implying that respondents did not favour one method over another. In other words, they used the most convenient method that was available at the time.

5.6.4 UTENSILS USED TO PREPARE DIFFERENT FOODS

Table 5.7: separate utensils used to prepare raw and cooked food

Response	Frequency	Percent
Yes	3	10.0
No	27	90.0
Total	30	100.0

Table 5.7 above, shows that only 10% of food vendors ensure that they separate utensils when handling cooked and raw foods. This is an extremely dangerous practice by vendors. Cross contamination is likely to occur from raw food to

cooked food or from utensils used. This poor hygiene practice is possibly one of the reasons for a high percentage of foods containing pathogens in this study.

Often, utensils used to prepare and serve food are contaminated with *Staphylococcus spp*. and *Micrococcus spp*. These microorganisms may have been transferred from the hands of vendors during food preparation or dishwashing processes (Rane 2011:103). Food handlers may introduce pathogenic microorganisms by cross contamination if they handle raw materials (Rane 2011:102). “Cross-contamination occurs when harmful microorganisms are spread between food, surfaces and equipment” (Campbell 2011:68) and is the main cause of many food poisoning outbreaks, resulting from poor food handling and processing (Gordon Davis 2011: 13).

“Any utensil or item which is suitable for a single use only may only be used once for that purpose and stored in a dust free container” (Department of health 2012:11). It is vital to use the correct utensils when preparing and serving food. “Poor quality of material coupled with improper practices may lead to toxin formation, pathogen growth or recontamination” (Rane 2011:102).

5.6.5 METHOD OF STORAGE FOR PREPARED FOODS

All food premises are to ensure hygienic storage of foods (Department of Health 2012:10). **Table 5.8** below is an illustration of the storage methods used by vendors once the food is prepared.

Table 5.8: Storage methods of prepared food

Response	Frequency	Percent
Refrigerator	2	6.7
Other	28	93.3
Total	30	100.0

Only 6.7% of respondents indicated that they use a refrigerator to store prepared foods. Of the remaining 93.3%, all vendors indicated that they use pots to store food.

This means that already prepared foods are left to stand at room temperature, which is extremely dangerous. “Foods that are cooked immediately prior to consumption are safer than those which have been cooked and stored at ambient temperature” (WHO 1984), cited by (Campbell 2011:15). The growth of most pathogenic organisms is enhanced by time and temperature abuse (Campbell 2011:68).

Time and temperature abuse occur when prepared food cooked and allowed to cool without being stored correctly (Campbell 2011: 69).

Results of other studies conducted also revealed that vendors, stored and served food at unsafe temperatures (Muinde and Kuria 2005:7).

5.6.6 USE OF LEFTOVER FOOD

The table below indicates what the food vendors do with any leftover food they may have after the day’s operation.

Table 5.9: Use of leftover food

Response	Frequency	Percent
Throw away	2	6.7
Use at home	7	23.3
No leftovers	13	43.3
Give to others	7	23.3
Will not say	1	3.3
Total	30	100.0

There is an indication that 43.3% cook enough food to sell and do not have any leftovers. An equal number of respondents (23.3%) indicated that they either used it at home or gave it away. 6.7 % of respondents indicated that they dispose of the food and 3.3% refused to indicate what they did with the leftover food.

There generally seems to be good practice amongst vendors regarding leftover food. If the food is sold the next day, then it would subject the food to time and temperature abuse, which will then enhance bacterial growth and possibly cause food poisoning (Campbell 2011: 68).

5.7 OBSERVATION 1: FOOD HYGIENE EQUIPMENT LIST

The table below lists the observation in descending order.

Table 5.10: Findings from observation checklist 1

Observation	Percentage
Soap liquid to wash dishes	96.7
Cleaning cloths	96.7
Bleach	93.3
Broom	90.0
Rubbish bags to dispose of waste	90.0
Apron	90.0
Clean hand drying towels	86.7
Refuse stored of and disposed correctly	86.7
A bowl/bucket for washing dishes/utensils	83.3
Plastic table cloth	83.3
Soap for washing hands	80.0
A water container to carry water	70.0
A bowl/bucket for washing hands	60.0
Scarf/ hair coverage	53.3
Means of refrigeration	53.3
Means of food coverage	13.3
Use of gloves	6.7
Nail brush	0.0

As indicated in **Table 5.10**, most vendors were equipped with cleaning materials (86.7% to 96.7%). 83.3% of vendors used plastic table clothes, which are easy to clean, and non-absorbent, which limits cross contamination.

Only 6.7% of vendors wore gloves when handling prepared foods and according to the Department of Health (2012:15), no food handler may handle prepared foods with their bare hands.

According to observation illustrated in Table 5.9 above, 90% of vendors wore aprons during food preparation, whereas in the study by Muinde and Kuria (2005:7), only 18.7% of vendors wore aprons.

Basins for washing hands were observed at 60% of food stalls, and this is good practice as food handlers are required to ensure they wash their hands and avoid any form of cross contamination (Department of Health 2012:15).

5.8 OBSERVATION CHECKLIST 2

There were six recorded observations of pests. Amongst these were flies, rats and cockroaches recorded in **Table 5.11** below.

Table 5.11: Findings from observation checklist 2

Type of pest observed	Percent
Flies	3.3
Rats	3.3
Cockroaches	6.7

Pests carry food-borne illness; therefore a person who is in charge of a food premises must use the best measures to reduce all types of pests (Department of health 2012:9). Pests are likely to contaminate food, which can lead to the illness of those who consume it.

5.9 HYGIENE PRACTICE AND UTENSILS USED TO PREPARE FOODS

Figure 5.8 below refers to the observations as reported.

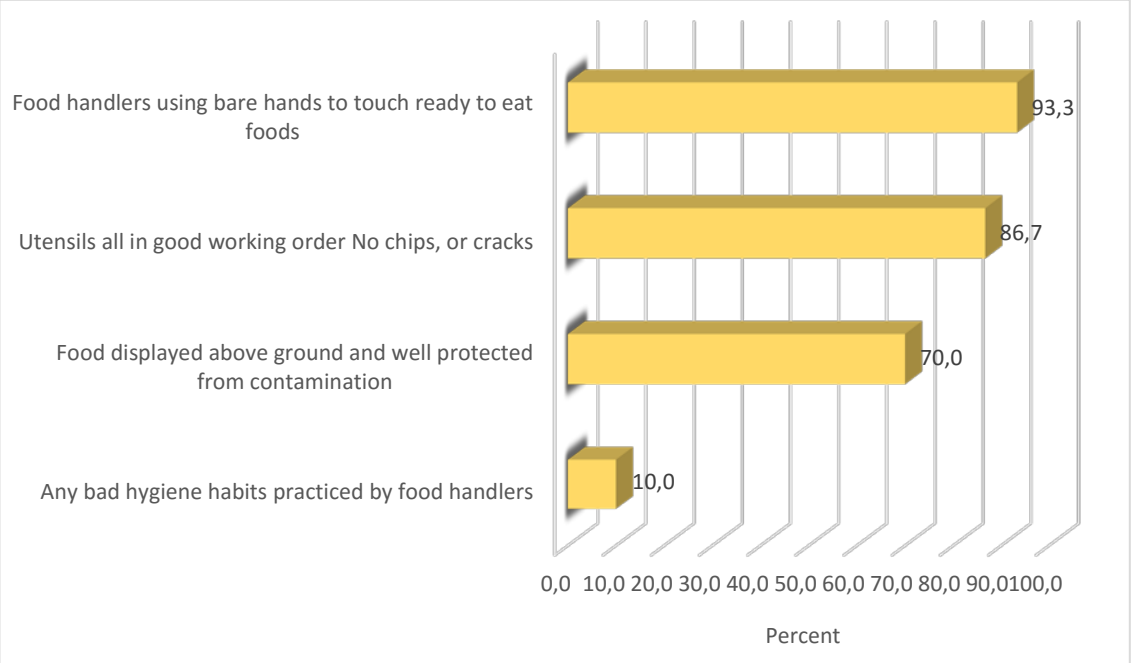

Figure 5.8: Bad hygiene practices displayed by vendors

Based on observation, a significant amount (96.3%) of food vendors have been handling food with bare hands. In good practice, 86.7% of vendors used equipment, which was in good working order. Vendors may not use equipment that has any chips or cracks as this may contribute to cross contamination (Department of Health 2012:11). It is of extreme importance to use proper utensils for cooking and storage of foods. The incorrect use of these tools can affect the safety of foods (Rane 2011:102). If utensils are not in the best working order to prepare or serve foods, they should not be used as they can contribute to pathogen growth and recontamination (Department of health 2012:11 and Rane 2011:102).

Ten percent (10%) of vendors were observed using unsafe hygiene practices, which contravenes the regulations governing general hygiene requirements for food premises and transportation of food (Department of health 2012:9). “The Centres for Disease Control (CDC) has identified five risk factors related to the human factor and preparation methods that contribute to the high prevalence of food-borne illness” (Campbell 2011:18). These factors are incorrect and improper cooking, holding temperatures, contaminated equipment and utensils, poor

hygiene and using food from sources that are unsafe (Campbell 2011: 18). Food may not be displayed or stored on the ground or have any contact with the floor. **Figure 5.8** indicates that 70% of vendors ensured that food was displayed or stored above the ground.

5.10 CONCLUSION

This chapter investigated the findings of the primary data retrieved through questionnaires and observation checklists.

When analysing the results of this chapter, it can be seen that most (80%) of the vendors are female and this is consistent with other studies conducted in Johannesburg on hygiene features of street vending where 90% of vendors were female (Campbell 2011:43).

The results of the present study revealed the urgent need for training of food handlers. A significant amount of vendors (80%) are not in possession of a certificate of acceptability which is mandatory to serve food to the public.

Having the certificate will at least ensure that vendors are adequately educated on food handling and hygiene matters. These vendors do not have any informal education on hygiene practices and are mostly basing their hygiene practice on what they have learnt at home.

It seems that even though vendors do have access to basic facilities like hand-washing facilities and toilets, there are still matters to be addressed like access to a potable water supply, proper waste and water disposal areas. Water used to wash dishes and foods is inadequate, and more potable water supply is required.

The findings reveal that very few vendors practice proper hygiene as some still use damaged equipment and utensils and bare hands to handle prepared food. Vendors are not doing everything they can to prevent cross contamination. They are not using clean utensils to handle food. Food can easily be contaminated using contaminated equipment and bare hands.

The street foods were prepared in unsanitary conditions. Water and garbage are disposed of close to the food stalls, and this increases the presence of pests. Equally, the presence of pests indicates unhygienic conditions.

The next chapter will interpret and discuss the findings of data collected for the microbial quality of chicken, beef and salads sold within the Warwick Triangle.

CHAPTER 6

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION OF DATA COLLECTED FOR MICROBIAL TESTS

6.1 INTRODUCTION

“It is frequently necessary to conduct a microbiological examination of food to determine its quality” (Adams and Moss 2008:70).

In this chapter, the findings of data collected for microbial tests were interpreted and discussed. In total, 26 meals were collected, and the meat and salad of each meal were tested.

All samples were tested for the most common food-borne pathogens which are: *E. coli, Listeria monocytogenes* and *Salmonella* spp.

A total plate count (TPC) was conducted to determine the bacteria level in the food samples (Canini, Bala, Maraginot, and Mediana 2013:108). Counts of *Staphylococcus aureus was conducted to* determine the possible human contamination after handling (Madueke 2014:206). The quantity of Aerobic and Anaerobic spore formers in each sample determined whether food was adequately cooked as spore forming bacteria are resistant to heat (Andre, Zuber and Remize 2013:135). Cross contamination may happen due to vendors being the carriers of such microorganisms upon food handling; therefore these tests were conducted to evaluate possible food cross contamination (Tambekar et *al.* 2011:350).

6.2 PREVALENCE OF FOOD-BORNE PATHOGENS IN CHICKEN, BEEF AND SALAD SAMPLES

Table 6.1 is a presentation of positive percentage pathogens found in tested food samples.

Table 6.1: Positive percentage of pathogens in chicken, beef and salad samples.

Food type	no. of Samples	% positive *Salmonella*	%positive *L.monocytogenes*	% positive *E.coli*
Chicken	14	26.7	60.0	80.0
Beef	12	10.0	60.0	72.7
Salads	26	3.8	26.9	7.7

6.2.1 RESULTS AND DISCUSSION OF TABLE 6.1

Results presented in **Table 6.1** indicates that of the 14 chicken samples tested, 26.7% presented a positive presence of *Salmonella*, while beef meals indicated a 10% presence and salads a lower 3.8% presence of *Salmonella*. A similar study conducted in Sudan also reported relatively low levels (5%) of *Salmonella* (Mustaffa and Abdalla 2011:5221). According to the Department of Health (2001), "precooked or ready-to-eat foods should contain no *Salmonellae.*" The presence of *L. monocytogenes* found in this study is relatively high with 60% positive indication for both chicken and beef and 26.9% of salads yielding a positive result. El-Shenawy, Soriano and Manes (2011:2) explain that sources of *L. monocytogenes* include poultry, dairy products, seafood, meat and other types of food. "Street vended foods can be easily contaminated with this pathogen as the organism is widespread in nature and can overlap the environmental conditions" (El- Shenawy *et al.* 2011:2). In contrast to this study, a study conducted on street foods by Thanh (2015:50) in Vietnam reported that none of the samples tested were contaminated by *L. monocytogenes.* The presence of *E. coli* in this study

has been isolated from 80% of the chicken meals and 72.7% of beef meals. According to the World Health Organisation, beef and beef products are the most frequent source of *E. coli* (WHO), which explains the very high count presented in **Table 6.1**.

A substantial presence of *E. coli* in foods also indicates a lack of hygiene and improper storage (Department of Health 2001). *E. coli* may also be commonly associated with fresh fruit and vegetables (WHO 2017). In this study, the presence of *E. coli* in salads (vegetables) is 7.7%. The presence of *E.coli* was found in 60% of meals tested by Thanh (2015: 52) in a study conducted in Vietnam on street foods.

"E. coli is a natural component of the human gut flora and its presence in the environment, or in foods, generally implies some history of contamination of faecal origin" (Adams and Moss 2008:371). It has proven to be "a useful indicator organism of faecal pollution of water used for drinking or in the preparation of foods" (Adams and Moss 2008:371).

6.3 TOTAL PLATE COUNT, AEROBIC SPORE FORMERS, ANAEROBIC SPORE FORMERS AND S*. AUREUS* IN CHICKEN, BEEF AND SALADS.

The results presented in Tables 6.2, 6.3 and 6.4 are the microbiological qualities of chicken, beef and salad respectively. The actual counts, as well as acceptable limits of TPC, ASF, ANSF and *S. aureus* are presented. Acceptable limits are determined using Guidelines for the microbiological examination of ready-to-eat foods by the International Commission on Microbiological Specifications for Foods (ICMSF) (2001:1-7).

Table 6.2: Results of positive findings and acceptable limits for TPC, ANSF, ASF and *S. aureus* found in chicken meat

Type of pathogen	**Actual counts (log CFU/g)**	**Acceptable limit (log CFU/g)** (ICMSF 2001:3-7)
TPC	6.22 ± 1.62	7
ANSF	5.03 ± 0.22	4
ASF	4.27 ± 1.31	4
S. aureus	4.21 ± 1.70	4

1. 14 Chicken samples were tested
2. Results presented as Mean ± STDEV

Table 6.3: Results of positive findings and acceptable limits for TPC, ANSF, ASF and *S. aureus* found in beef meat.

Type of pathogen	**Actual counts (log CFU/g)**	**Acceptable limit (log CFU/g)** (ICMSF 2001:3-7)
TPC	6.45 ± 1.64	7
ANSF	1.92 ± 1.92	4
ASF	3.24 ± 1.24	4
S. Aureus	3.49 ± 1.54	4

1. 12 Beef samples were tested
2. Results presented as Mean ± STDEV

Table 6.4: Results of positive findings and acceptable limits for TPC, ANSF, ASF and *S. aureus* found in salads.

Type of pathogen	Actual counts (log CFU/g)	Acceptable limit (log CFU/g) (ICMSF 2001:3-7)
TPC	4.05 ± 2.06	7
ANSF	1.66 ± 0.45	4
ASF	2.09 ± 0.52	4
S. aureus	1.96 ± 0.97	4

1. 26 salad samples were tested
2. Results presented as Mean ± STDEV

6.3.1 RESULTS AND DISCUSSION OF TABLES 6.2, 6.3 AND 6.4

In this study, the mean values for TPC ranged from 4.05 log CFU/g, being the lowest count found in salads to 6.45 log CFU/g, being the highest count, which was found in cooked chicken meat. The TPC for beef is 6.45 log CFU/g. All these counts were below the acceptable limit which is 7 log CFU/g. A similar study conducted in Congo, by Makelele, *et al* (2015:287), found that 90.5% of the meals were considered to be of unacceptable quality (above the acceptable limit), and this result showed noncompliance with correct hygiene practices during the preparation, cooking and storage of foods.

The mean values for counts of ANSF from foods tested indicated 5.03 log CFU/g in chicken meat, 1.92 log CFU/g in beef meat and 1.66 log CFU/g in salads. Acceptable limits for ANSF is 4 log CFU/g. Both beef and salad results are below the acceptable limits, but chicken is higher than the acceptable limit. The high count in chicken could be indicative of temperature abuse (Andre *et al.* 2013:136)

The mean value for ASF found in chicken was 4.27 log CFU/g, which is slightly over the acceptable limit of 4 log CFU/g. The counts found in beef and salads are

3.24 log CFU/g and 2.09 log CFU/g respectively. Both these counts are within their acceptable limits of 4 log CFU/g. The findings in the present study are in contrast with a study conducted Turkey, where vegetables had the highest ASF count (Vural and Erkan 2008:285). The ASF counts of salads in this study are lower than those found in cooked meat.

Tests conducted for *S. aureus* in this study found that the mean values for beef and salads are well within acceptable limits of 4 log CFU/g. The count found for chicken is 4.21 log CFU/g which is slightly over the acceptable limit. Even though all (100%) of the salad samples tested positive for the presence of *S. aureus* the mean value is 1.96 log CFU/g which is safely within the acceptable limit. **Table 6.5** is a summary of **Tables 6.2, 6.3 and 6.4** and is an indication of the significant difference found in each row.

Table 6.5: Microbiological qualities of chicken, beef and salads presented in means of TPC, ANSF, ASF and *S. aureus.*

Type of Pathogen	**Actual counts (log CFU/g)** chicken	**Actual counts (log CFU/g)** beef	**Actual count (log CFU/g)** salad
TPC	6.22^{a}+ 1.62	6.45^{a} ± 1.64	4.05^{b} ± 2.06
ANSF	5.03^{c}± 0.22	1.92^{d} ± 1.92	1.66^{d}± 0.45
ASF	4.27^{e} ± 1.31	3.24^{e} ± 1.24	2.09^{f} ± 0.52
S. aureus	4.21^{g} ± 1.70	3.49^{g} ± 1.54	1.96^{h} ± 0.97

1. Results presented as Mean ± STDEV

2. Means with the same superscript letters in rows are not significantly different ($p \geq 0.05$)

6.4 CONCLUSION

This chapter has given detailed results of microbiology tests conducted on chicken, beef and salads samples collected from the Warwick Triangle.

The results of this study indicate that street-vended foods in the Warwick Triangle were contaminated with various pathogenic bacteria. Bad personal hygiene, improper handling, poor infrastructure and incorrect storage are among the associated risk factors to contamination of street vended foods in this area. Access to potable water, proper garbage and wastewater disposal would improve the quality of food sold by vendors in this area. “The application of hygienic practices during the preparation and sale of street food could reduce the microbial risk” (Makelele, *et al*. 2015:285).

Conclusions and recommendations will follow in the next chapter of this study.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The previous chapter presented a discussion of the findings established in this study. **Chapter 6** is a summary of the findings of this study and provided recommendations for the safe and hygienic operation of street food vendors within the Warwick Triangle.

The overall purpose of this study was to evaluate the operation of street food vendors in the Warwick Triangle and determine how their operation can affect the microbial safety of the foods prepared by them.

The deduced results of this study will provide support to express practical recommendations to street food vendors in the Warwick Triangle, as well as to the relevant authorities, so that proper training programmes may be put into place to assist these vendors.

The findings of this study will also educate street food vendors on the dangers of bad hygiene practices and the risks they are exposing their consumers to.

7.2 SUMMARY OF THE STUDY

The overall aim of his study was to determine the safety of street foods sold within the Warwick Triangle. A flowchart of the study conducted is represented below.

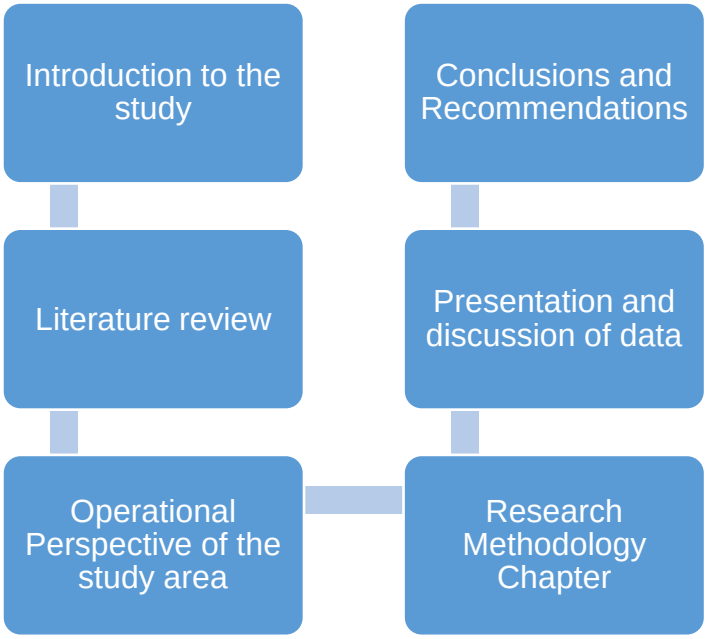

Figure 7.1 Flowchart of the study

7.3 CONCLUSIONS OF THE STUDY

The findings in this study indicate that food vendors in the Warwick Triangle practice minimal hygiene and sanitation. The unhygienic food handling practices by vendors, improper utensils and lack of refrigeration may be contributing factors to the high pathogenic counts found in this study. Vendors using buckets to wash dishes and hands may also be another reason for contamination.

Nyenje *et al.* (2012:2612) found that vending sites which had better infrastructure like cemented floors and running water indicated lower levels of bacteria. Nyenje *et al.* (2012:2612) also indicate that roadside cafeterias, where vendors used buckets to wash hands and dishes have higher bacterial counts.

The utensils used for preparation and serving are often contaminated with *S. aureus,* which may have been transferred from food handlers' hands, dishcloths and the water used to wash dishes (Tambekar *et al.* 2011:350). The presence of *S. aureus* in large numbers is also a good indication of temperature abuse (Department of Health, 2001). In this study, the majority of the vendors indicated that they do not use gloves during food handling and preparation and only 53% had a means of refrigerating food. These could be the reason for the very high count of *S. aureus* in this study as all findings of *S. aureus* were above the acceptable limits. Food that is contaminated with *S. aureus* can cause

staphylococcal food poisoning, which accompanies symptoms like diarrhoea and vomiting (Githaiga 2012:40).

Prepared foods are most vulnerable to *L. monocytogenes* (Leong, D., Alvarez-Ordóñez, A., Jooste, P and Jordan, K. 2016:3). In this study, microbial tests have indicated that 60% of both chicken and beef meals tested positive for *Listeria monocytogenes* and 26.9% in salads. The presence of *L. monocytogenes* in cooked foods indicates that foods have been undercooked or contaminated after the cooking process (Guidelines for Assessing the Microbiological Safety of Ready-to-Eat Foods Placed on the Market, 2009). Poor water quality or improper hygiene practices can also lead to contamination with *L. monocytogenes* (Leong *et al.* 2016:3).

In this study, the mean values for TPC ranged from 4.05 log CFU/g, being the lowest count found in salads to 6.45 log CFU/g, being the highest count which was found in cooked chicken meat. All these counts were below the acceptable limit of 7 log CFU/g (ICMSF 2001:3-4). Although the actual counts found are below acceptable limits, the counts found may still be indicative of noncompliance with proper hygiene practices of preparation, cooking and storage/display, which are evident in the findings of this study.

The positive percentage for *Salmonella* in this study ranges from 3.8% in salad samples to 26.7% in chicken samples. Ready to eat foods should not contain any *Salmonella* according to the Department of Health (2001). *Salmonella* is responsible for 95% of reported cases of food infection (Gordon Davis 2011:15). The findings of this pathogen could be due to direct contact with raw food which is already contaminated, or with infected work surfaces, wiping cloths, utensils and hands (Gordon Davis 2011:15). It is evident in this study that food handlers are responsible for the positive percentage of this pathogen due to improper hygiene practices. Undercooking and incorrect storage of meat and poultry are also favourable processes for the growth and multiplication of *Salmonella* if present. “The contamination of street food due to *Salmonella* can be explained by the use of dirty dishwater (from dirty dishes) or lack of good hygiene practices of vendors when handling street food” (Makelele *et al.* 2015:289).

The mean values for counts of ANSF from foods tested are within their acceptable limit except for the chicken meat, which is 5.03 log CFU/g and the acceptable limit is 4 log CFU/g (ICMSF 2001:3). The actual finding is higher than the

acceptable limit and is indicative of temperature abuse (Andre *et al.* 2013:136). The ASF counts of salads in this study are lower than those found in cooked meat. ASF count in chicken meat is the highest being, 4.27 log CFU/g. The count of ASF in beef is 3.24 log CFU/g, and the salad count is 2.09 log CFU/g. High counts of spore formers also indicate temperature abuse (Andre *et al.* 2013:136).

7.4 RECOMMENDATIONS

7.4.1 FOOD HYGIENE TRAINING

Vendors must be educated on correct hygiene and preparation. Special attention must be paid to cross contamination and the causes thereof. Vendors will then become more aware of the importance of using clean hands and utensils to prepare food, as well as the consequences of temperature abuse. Suitable training will ensure vendors understand the need for proper garbage and waste-water disposal, as well as the dangers of pest infestation.

7.4.2 PROPER HYGIENE AND SANITATION PRACTICES

It is evident by the findings of this study that poor hygiene practices and improper sanitation have a direct impact on the poor microbial quality of the food sold. Vendors are clearly uneducated and therefore unaware of the dangers of their unhygienic practices. Consumers are exposed to different food-borne pathogens which cause serious illness. It is, therefore, recommended that vendors ensure the safety of foods by maintaining clean food areas/surfaces, and ensuring high levels of personal hygiene while preparing food. Crockery and utensils used must be clean and in proper working order. Vendors must ensure the correct disposal of garbage and waste-water. Vendors are also to ensure that food is adequately cooked and stored correctly.

7.4.3 MUNICIPAL INVOLVEMENT

It is clear that infrastructure like potable water, proper drainage, toilets and hand basins are present but inadequate. It is recommended that the necessary authorities assist in ensuring that hygiene and sanitation are suitable for vendors to prepare safe food. In some cases electricity and potable water, as well as hand basins and an adequate wastewater disposal system is still required. The municipality could also become involved in the proper training and educating of vendors

7.5 CONCLUSION

The results of this study should draw the attention of the responsible authorities, so that they may assist and ensure the standards of hygiene are improved in the Warwick Triangle.

There is a need to reduce bad hygiene practices and levels of bacteria by properly educating street food vendors. Educating the vendors will ensure that they are aware of the dangers of bad hygiene practice and they will also understand the importance of hygiene and sanitation.

It is recommended that all food handlers in the Warwick Triangle undergo adequate training to ensure that they follow the necessary requirements of food safety, hygiene and sanitation. Proper training and education will ensure all else falls into place.

Lastly, the municipality should ensure the necessary infrastructure is present for vendors to prepare safe meals for customers as the street food trade contributes to the growth of the South African economy.

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APPENDIX 1

Department of Hospitality and Tourism

Tel. (031) 373 5508

P.O. Box 1334, Durban 4000

CONSENT FORM

Hygiene and safety of street food vendors

The project has been described to me in language that I understand, and I declare that I voluntarily agree to participate. I have had the opportunity to discuss relevant aspects with the researcher, and I understand that my identity will not be disclosed and that I may withdraw from the project without giving reasons at any time.

Participant's number……

Signature……

Date ……

APPENDIX 2

Department of Hospitality and Tourism

Tel. (031) 373 5508

P.O. Box 1334, Durban 4000

Incwadi yokucela imvume

Igama lami ngingu-Ronelle Crocker, inombolo yami yomfundi ithi-20152631. Ngenza izifundo ze-Masters ku-Hospitality Management (Izifundo Zokuphathwa kwezivakashi).

Kumanje ngenza ucwaningo olubandakanya ukufunda mayelana nokuhlanzeka kanye nokuphepha kokudla okutholakala emgwaqeni okudayiswa ngabadayisi abatholakala ku-Warwick eThekwini.

Ukubamba kwakho iqhaza esifundweni sami ngingakujabulela kakhulu futhi kuzoba nomthelela omkhulu kulesi sifundo.

Uyacelwa ukuba uqaphele ukuthi imininingwane ozoyikhipha izogcinwa iyimfihlo futhi uma ufisa igama lakho angeke livezwe.

Ngiyabonga ngesikhathi nangokuzinikela kwakho.

Uma ngabe udinga ukucaciseleka ngokuthile ungabi nayo inkinga yokungithinta:

I-Faculty yakwa-Management Sciences

Umnyango Wezokupheka nokuphathwa kwezivakashi kanye Nezokuvakasha (Hospitality and Tourism)

Inombolo yasehhovisi: 0313735505

Inombolo kamakhalekhukhwini: 0621403001

I-imeyili: ronellek@dut.ac.za

APPENDIX 3

Survey of Street food vendors in Durban CBD conducted by Ronelle Crocker

Date conducted: _____

Location of street food stall: _____

1. General information

a. Gender of respondent

Male	1
Female	2

b. Race of respondent

Asian	1
Black	2
Coloured	3
White	4
Other	

c. Have you completed a food hygiene education course/training?

Yes	1
No	2

d. Are you in possession of a certificate of acceptability?

Yes	1
No	2

If no to c and d, how did you learn about food preparation?

---

2. Food Stall

a. Where do you prepare the food which is for sale?

Stall	1
Home	2
Other	

b. What do you sell? (List in order of importance)

1.
2.
3.
4.
5.
6.
7.

c. Is there an adequate hand-washing facility for workers?

Yes	1
No	2

3. <u>Infrastructure</u>

a. Do you have access to a running water supply?

Yes	1
No	2

If no, where do you get water from?

_____

b. Do you have access to hygienic toilets?

Yes	1
No	2

If no, where do you go when you need to?

_____

c. Do you have access to electricity?

Yes	1
No	2

d. Indicate the distance of street food stall from the garbage disposal area.

0-3m	1
3-6m	2
6-9m	3
9m or more	4

4. Personal hygiene and sanitation

a. What method of disposal do you use for waste-water?

Throw it onto the floor	1
Dispose into toilet	2
Throw into the drainage system	3
Other	4

b. What method of disposal do you use for refuse/waste?

Leave behind uncovered	1
Throw into municipal bins	2
Take to a garbage dump	3
Take rubbish home	4
Other	

c. What method do you use to wash utensils and dishes?

Warm soapy water	1
Warm water	2
Cold soapy water	3
Cold water	4
Other	

d. Do you use separate utensils to prepare raw and cooked food?

Yes	1
No	2

e. What method of storage do you use for prepared foods?

Refrigerator	1
Plastic container	2
Cupboard	3
Polythene bags	4
Open place	5
Other	

f. What do you do with any food left over from the day's activity?

Throw away	1
Resale	2
Use at home	3
No leftovers	4
Give to others	5
Will not say	6

APPENDIX 4

Ukuhlolwa kokudla kwabadayisi basemgwaqeni enkabeni yedolobha iTheku okwenziwa ngu-Ronelle Kok

Usuku okwenziwe ngalo

Indawo lapho ukudla kutholakala khona:

1. ingwane yobulili

a. Ubulili bomuntu ophendulayo

Owesilisa	1
Owesifazane	2

b. Uhlanga lomuntu ophendulayo

Umuntu wase-Asia	1
Umuntu omnyama	2
Umuntu oyi-Coloured	3
Umlungu/omhlophe	4
Olunye uhlanga	

c. Ingabe usuke wafunda noma waqeqeshelwa isifundo esiphathelene nokuhlanzeka kokudla?

Yebo	1
Cha	2

d. Ingabe unaso isitifiketi esikuvumelayo ukuba udayise emgwaqeni?

Yebo	1
Cha	2

e. Uma uthe “Cha” ku-c kanye no-d, ukufunde kanjani ukulungiswa kokudla?

_____

_____

_____

2. <u>Indawo lapho kuthengiselwa khona ukudla</u>

a. Ingabe ukulungiselela kuphi ukudla okuthengisayo?

Indawo lapho uthengisela khona ukudla	1
Ekhaya	2
Enye indawo	

b. Yini oyidayisayo? (Bala ngokulandelana kokubaluleka kokudla)

1.
2.
3.
4.
5.
6.
7.

c. Ingabe ikhona indawo elingene yokugeza izandla yabasebenzi?

Yebo	1
Cha	2

3. <u>Inggalasizinda</u>

a. Ingabe unayo indawo lapho okwazi ukuthola khona amanzi aphuma empompini?

Yebo	1
Cha	2

Uma uthe “cha”, ingabe uwathola kuphi amanzi?

_____

_____

b. Ingabe unazo izindlu zangasese ezihlanzekile?

Yebo	1
Cha	2

Uma uthe “cha”, ingabe uya kuphi uma udinga ukusebenzisa indlu yangasese?

Ingabe unayo yini indawo othola kuyo ugesi?

Yebo	1
Cha	2

c. Khombisa ubude bendlela phakathi kwendawo lapho odayisela khona ukudla nalapho kulahlwa khona udoti.

0-3m (amamitha)	1
3-6m (amamitha)	2
6-9m (amamitha)	3
9m noma ngaphezulu	4

4. <u>Ukuhlanzeka komuntu kanye namasu okuthutha ukungcola.</u>

a. Ingabe iyiphi indlela yokuthutha ukungcola oyisebenzisayo uma unamanzi angeke esasebenza?

Uwachitha phansi	1
Uwathelaendlini yangasese	2
Uwathela esitamkokweni noma epayini	3
Enye indlela	4

b. Iyiphi indlela yokulahla udoti oyisebenzisayo uma unodoti odinga ukulahlwa?

Uwushiyakanjalo ungavaliwe	1
Uwulahlaemigqomeni kamasipala	2
Uwuhambisalapho kulahlwa khona udoti	3
Uyawuthatha udoti uye nawo ekhaya	4
Enye indlela	

c. Iyiphi indlela oyisebenzisayo ukuwasha izitsha kanye nezipuni?

Amanzi ashisayo anensipho	1
Amanzi ashisayo	2
Amanzi abandayo anensipho	3
Amanzi abandayo	4
Enye indlela	

d. Ingabe usebenzisa izipuni ezihlukene ukulungiselela ukudla okungakaphekwa noma osekuphekiwe?

Yebo	1
Cha	2

e. Ingabe iyiphi indlela yokugcina ukudla oyisebenzisayo ukugcina ukudla osekulungile?

Ifriji	1
Isitsha seplastiki	2
Ikhabethe	3
Izikhwama zeplastiki	4
Indawo evulekile	5
Enye indlela	

f. Ukwenza njani ukudla okusalile osukwini?

Uyakulahla	1
Uphinde ukudayise	2
Ukuphatha ekhaya	3
Akukho ukudla okusalayo	4
Ngikunikeza abanye abantu	5
Angeke ngikwazi ukusho	6

APPENDIX 5

PERMISSION TO USE QUESTIONNAIRE

From: Penny Campbell
To: Ronelle Erica Kok
Subject: Re: FW: request for permission to use questionnaire
Date: Wednesday, 25 January 2017 8:34:12 AM

Good Morning Ronelle,

Yes you may definitely use that Questionnaire.

I would be most interested in the outcomes of your results as it adds to the evidence around the safety of street foods.Please keep me updated with your findings.

Kind Regards

Penny

>>> Ronelle Erica Kok <ronellek@dut.ac.za> 2017/01/25 07:58 AM >>>
Dear Penelope
My name is Ronelle Kok. I am completing my M-Tech in Hospitality management at the Durban University of Technology. (DUT).
In researching articles on the internet I have found your dissertation and would like request your permission to use your questionnaire in my study. I am doing a study on the microbial safety of street foods at the Old Berea station in the Warwick Triangle in Durban.
Your permission will be much appreciated.
Ronelle KoK
Hospitality and Catering Management Lecturer
Hospitality and Tourism Department
Office: 0313735505

APPENDIX 6

Observation check list 1

Observations done by researcher: Ronelle Crocker

Food hygiene equipment list (researcher to tick equipment respondent has at the point of sale)

	YES	NO
1. A water container to carry water		
2. A bowl or bucket for washing hands		
3. Clean hand drying towels		
4. Nail brush		
5. Use of gloves		
6. Soap for washing hands		
7. A bowl or bucket for washing utensils and dishes		
8. Soap liquid to wash dishes		
9. Cleaning cloths		
10. Bleach		
11. Broom		
12. Rubbish bags to dispose of waste		
13. Refuse stored and disposed of correctly		
14. Cooler box/means of refrigeration		

15. Apron		
16. Scarf/hair coverage		
17. Clothes to cover all food/means of food coverage		
18. Plastic table cloth		
19. Means of reheating food		

APPENDIX 7

Observation check list 2

Observations done by researcher: Ronelle Crocker

Observation date: _____

Location of street food stall: _____

Other observations to be made as per hygiene requirements for street foods (under Regulations governing General Hygiene Requirements for Food Premises and the Transport of Food).

	Please tick	Comments
1. Presence of pests		
2. Utensils all in good working order. No chips/cracks		
3. Food displayed above ground and well protected from contamination		
4. Food handlers using bare hands to touch prepared foods		
5. Any bad hygiene habits practised by food handlers		

Observation of any other bad hygiene practices exercised by vendors: