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**Food safety knowledge, attitudes, and practices of Tshwane street vendors
when managing fresh produce**

by

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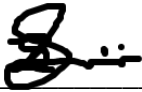
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DECLARATION

I, Siphephile Thandokuhle Zwane, declare that this dissertation submitted for the degree of Masters in Consumer Science at the University of Pretoria is my work and has not previously been submitted by me for a degree at this or any to any other tertiary institution.



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Street vendors in developing countries continue to ensure guaranteed food supply to all members of the community (especially those from low-income groups) at very affordable rates as compared to formal food retailers. Food safety, however, is a major public concern amongst street vendors in South Africa in an industry that is rapidly growing, in particular amongst more vulnerable consumer groups. It has been noted in the literature that vendors' deficit in terms of knowledge, attitudes and practices is not conducive to ensuring the delivery of safe food to consumers. Unfortunately, information regarding street food safety in South Africa tends to be limited. This study, therefore, aimed to investigate the food safety knowledge, attitudes, and practices of street vendors in Tshwane when managing fresh produce.

A semi-structured questionnaire was used to collect quantifiable data from respondents within the Tshwane metropolitan. The data analysis included both descriptive and inferential statistics

using IBM SPSS (V.25). An Analysis of Variance as part of inferential statistics was run to identify any possibly significant differences between demographic groups. To identify possible relationships between knowledge, attitudes and practices, a Pearson's Correlation Test was used.

The results revealed that street vendors in Tshwane are well informed regarding issues relating to food handling (M=71%) compared to food preparation (M=45.33%), and storage (M=44.58%). The respondents demonstrated good knowledge of the importance of covering their hands with bandages or using gloves if and when they have sores or abrasions (M=82.3%), washing hands with soap and water before touching fresh produce (M=76.4%), and separating fresh produce from meats during storage (M=77%). The respondents, overall, demonstrated neutral attitudes towards food safety (M=2.4). Of all three dimensions (food handling, preparation, and storage), the respondents displayed positive attitudes towards food handling (M=2.53). In terms of food safety practices, the results indicated inconsistent practices amongst the respondents in this study, especially regarding issues relating to food preparation (M=2.1) and food storage (M=2.12). A significant difference in practices was found between vendors originating from Mozambique and South Africa and between genders (male and female).

A strong relationship was found between food safety knowledge and practices, which potentially implies that training programmes/campaigns are a good idea and could potentially lower consumers' vulnerability and exposure to foodborne illnesses.

Key words: Food safety, street vendors, fresh produce, knowledge, attitudes, practices.

This thesis is dedicated to God, my family, and my boyfriend

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TABLE OF CONTENTS

Declaration	i
Abstract	ii
Dedication.....	iv
Acknowledgements.....	v
List of tables	ix
List of figures.....	ix
CHAPTER 1 THE STUDY IN PERSPECTIVE.....	1
1.1 Introduction and background.....	1
1.2 Problem statement.....	2
1.3 Justification for the study	4
1.4 Research Aim and objectives.....	1
1.5 Study Area.....	2
1.6 Unit of analysis	2
1.7 Research design and methodology.....	2
1.8 Ethics.....	3
1.9 Structure of the study	3
1.10 Definitions.....	4
1.11 Conclusion.....	5
CHAPTER 2 THEORETICAL MODEL AND LITERATURE REVIEW	6
2.1 Theoretical model: KAP (Knowledge, Attitudes, and Practices) Survey.....	6
2.1.1 What is a KAP survey	6
2.1.2 The key concepts defined: Knowledge, attitudes, and practices	7
2.2 Literature review	9
2.2.1 Street vending as a global phenomenon	9
2.2.2 Food trade in South Africa (formal and informal retail).....	11
2.2.3 Street vending in South Africa.....	13
2.2.4 The types of vendors and commodities sold, and the target market in South Africa ...	14
2.2.5 The profile of South African street vendors.....	16
2.2.6 Food safety.....	18
2.2.7 Food safety regulations and reported outbreaks in South Africa	23
2.2.8 Reported outbreaks in South Africa	26
2.2.9 Fresh produce and its perishable characteristics	27
2.2.10 Food safety concerns in fresh produce trading.....	31
2.3 Conclusion.....	36

CHAPTER 3	CONCEPTUAL FRAMEWORK, RESEARCH OBJECTIVES, AND METHODOLOGY.....	37
3.1	Introduction	37
3.2	Research design	37
3.3	Conceptual framework	38
3.4	Research aim and objectives.....	39
3.5	Methodology.....	42
3.5.1	Study areas and unit of analysis and sampling.....	42
3.5.2	Sampling technique	43
3.5.3	The measuring instrument.....	44
3.6	Data collection	50
3.7	Data analysis.....	52
3.8	Data quality validity and reliability.....	54
3.8.1	Validity	54
3.9	Reliability	55
3.10	Ethics.....	55
3.11	Conclusion.....	56
CHAPTER 4	RESULTS AND DISCUSSIONS.....	57
4.1	Introduction	57
4.2	Demographics and additional descriptors of the sample	57
4.2.1	Gender distribution.....	58
4.2.2	Age distribution.....	59
4.2.3	Country of origin.....	60
4.2.4	Level of education	60
4.2.5	Vending location in Tshwane.....	62
4.2.6	Street vending as a profitable income.....	62
4.2.2	Other sources of income	63
4.2.3	Type of street vendor (stationary or mobile).....	63
4.2.7	Fresh produce sold by street vendors.....	63
4.3	Results and discussion.....	66
4.3.1	Objective 1: Tshwane street vendors' knowledge when managing fresh produce	66
4.3.2	Objective 2: Tshwane street vendors' food safety attitudes when managing fresh produce	70
4.3.3	Objective 3: Tshwane street vendors' food safety practices	75
4.3.4	Objective 4: Correlation between knowledge, attitudes and practices	82
4.4	Summary	83

CHAPTER 5	CONCLUSION OF THE STUDY.....	86
5.1	Introduction	86
5.2	Conclusions reached for each of the objectives	87
5.2.1	Objective 1	87
5.1.1	Objective 2.....	88
5.1.2	Objective 3.....	89
5.1.3	Objective 4.....	91
5.2	The research in retrospect.....	92
5.3	Achievement of the objectives set out for this research	93
5.4	Limitations of the study.....	93
5.5	Recommendations for further research	95
5.6	Implications of the findings.....	95
5.6.1	Implications for street vendors.....	95
5.6.2	Implications for government.....	96
5.7	Concluding remarks	96
REFERENCES.....		98
Addendum A: Questionnaire.....		118
Addendum B: Consent letter		125
Addendum C: Ethical clearance letter		126
Addendum D: conference attendance and contribution.....		127
Addendum E: Language editing certificate		128

LIST OF TABLES

Table 1.1: Terms and concepts	4
Table 2.1: Food Hygiene Regulation R638.....	25
Table 2.2: Ethylene producers VS Ethylene foods (Nutritionyoucantrust, 2020).....	30
Table 3.1: Sections of the measuring instrument.....	46
Table 3.2: Operationalisation table in terms of objectives, concepts, dimensions, and statistical methods	47
Table 4.1: Participants' country of origin	60
Table 4.2 Food safety knowledge of Tshwane street vendors.....	67
Table 4.3: Summary of the food safety knowledge ANOVAs per demographic category.....	70
Table 4.4: Tshwane street vendors' food safety attitudes	71
Table 4.5: Summary of ANOVAs for food safety attitudes	74
Table 4.6: Post-hoc test results for food safety attitudes amongst age group	74
Table 4.7: Tshwane street vendors' current food safety practices	76
Table 4.8: Summary of the ANOVAs on food safety practices	79
Table 4.9: Posthoc test for practices per country of origin	80
Table 4.10: Post-hoc test for practices per income group	81
Table 4.11: Descriptive statistics for food safety practices per gender.....	81
Table 4.12: Correlation between knowledge, attitudes, and practices.....	83

LIST OF FIGURES

Figure 3.1: Conceptual Framework (Baser et al., 2017)	39
Figure 3.2: Map of Tshwane.....	44
Figure 4.1: Visual summary of the demographics of the sample	58
Figure 4.2: Age distribution of the participating street vendors.....	59
Figure 4.3: Level of knowledge	61
Figure 4.4: Monthly income generated from street vending	62
Figure 4.5: Number of street vendors selling type of fruit.....	65
Figure 5.1: Picture of a respondent cutting and packaging fresh produce on-site.....	90
Figure 5.2: Correlations between knowledge, attitudes and practices.....	91

CHAPTER 1 THE STUDY IN PERSPECTIVE

1.1 INTRODUCTION AND BACKGROUND

Street vendors have been in existence since ancient times. However, times have changed and this once vibrant and essential source of daily merchandise that lined the streets of many cities, towns and settlements is no more. When reflecting on what street vending is today, thoughts of congested sidewalks, goods of poor quality, and increased health and safety risks might come to mind (Bromley, 2000; Trafialek, Drosinos, Laskowski, Jakubowska-Gawlik, Tzamalis, Leksawasdi, Surawang & Kolanowski, 2018). Globally, urbanisation has many individuals turning to street vending as it is often viewed as a lucrative income-generating opportunity that requires less skill and capital (Rahman, Arif, Bakar & bt Talib, 2016). Due to its informal nature and limited regulation by governments (both in developed and developing countries), street vending tends to be an easy source of employment for anyone willing to get into the business (Alimi, 2016).

In South Africa, it is reported that approximately 2.8 million of the population is employed in the informal sector, with most of them being in street vending (Nkrumah-Abebrese & Schachtebeck, 2017). Street vendors are considered to be an integral part of the community - besides their role in modelling cultural practices to tourists, street vendors provide goods and services to a vast number of consumers, especially those from lower-income groups (Ronquest-Ross, Vink & Sigge, 2015). These consumers are often more vulnerable and tend to be dependent on the informal market around their settlements for their daily source of food commodities, such as fruits and vegetables, as retail products tend to be relatively expensive (Ronquest-Ross *et al.*, 2015; Wills, 2009). Although affordable, the services rendered by street vendors, especially in developing countries such as South Africa, are usually poorly monitored, with food safety issues left to chance, thus leaving consumers exposed to foodborne illnesses (Aluko, Ojeremi, Olaleke & Ajidagba, 2014; Asiegbu, Lebelo & Tabit, 2016). The sale of fresh produce, as a highly perishable commodity, in street vending exacerbates the problem.

In order for fruits and vegetables to retain and be sold at the optimal quality, produce needs to be traded in conditions that support the utmost hygienic, food handling, storage and preparation practices (Abdalla, Suliman & Bakhiet, 2009; Baser, Ture, Abubakirova, Sanlier & Cil, 2017).

To achieve these conditions and practices, street vendors not only need to acquire supportive resource infrastructure and trading locations, but they also need to be knowledgeable about the necessary protocols and practices. Unfortunately, most vendors are rarely up to this task and tend to present somewhat negative attitudes when confronted with related matters (Akabanda, Hlortsi & Owusu-Kwarteng, 2017; Asiegbu *et al.*, 2016; Cortese, Veiros, Feldman & Cavalli, 2016; Kasriel-Alexander, 2016; Lubos, 2014; Mukherjee, Mondal, De, Misra & Pal, 2018).

Gamieldien and Van Niekerk (2017) note that street vendors are seldom committed to training or gaining more knowledge regarding their craft and/or merchandise due to time and financial constraints. “Street vendors are opportunist entrepreneurs who take advantage of busy hours of the day to generate income, usually committing to undergo training of any sort requires money and time, which are resources that street vendors rarely have, hence their poor knowledge on food safety.” (Gamieldien & Van Niekerk, 2017:25). When considering the fact that the majority of street vendors are often involved in food-related ventures, their lack of knowledge, as well as their attitudes and practices pertaining to food safety becomes of great concern (Akabanda *et al.*, 2017; Asiegbu *et al.*, 2016; Ayub, Siddiqui & Inamullah, 2017).

In South Africa, unfortunately, there is a shortage of information or literature on the knowledge, attitude and practices of street vendors regarding food safety. This makes it hard for consumers to make informed decisions. It further makes it difficult for government and other organisations to formulate mitigation strategies in the absence of such identified gaps. Most consumers in nowadays are pressed for affordable sources of foods, hence studies that provide updated information on the safety of foods sold in the street are necessary. This study aimed to address this need by investigating the food safety knowledge, attitudes and practices of street vendors in Tshwane when managing fresh produce.

1.2 PROBLEM STATEMENT

Foodborne diseases, among other illnesses, continue to claim the lives of many globally (WHO, 2019b). In the past, cooked meals have been the ones to be implicated in foodborne outbreaks; however, fresh produce has been reasonably recorded over the past years as a source of contamination (Herman, Hall & Gould, 2015). Street vendors in South Africa are amongst the highest distributors of fresh produce, which somewhat raises food safety concerns, not only

due to the informal nature of, or lack of regulation in this industry, but also due to the limited skills and knowledge presented by the traders themselves (Nkrumah-Abebrese & Schachtebeck, 2017).

Although street vendors provide essential and affordable services to urban residents, they are disadvantaged in areas that tend to support hygiene (e.g. their lack of reliable water supplies, storage spaces, shelter and ablution rooms). This, therefore, leaves consumers vulnerable to food contamination that could lead to foodborne disease outbreaks (Sekhani, Mohan & Medipally, 2019b; Trafialek *et al.*, 2018; Willemse, 2011; Wills, 2009).

Street vendors' poor educational background has been an area of discussion in the literature with one of the main concerns being their comprehension of food safety principles. Street vendors' lack of positive attitude and understanding in terms of undergoing food safety training prior to selling food (including fresh produce) to consumers is particularly concerning. In other countries, due to street vendors' illiteracy and the lack of resources in their places of business, they tend to have a negative attitude towards and disregard for food safety principles (Abdalla *et al.*, 2009; Callejón, Rodríguez-Naranjo, Ubeda, Hornedo-Ortega, Garcia-Parrilla & Troncoso, 2015b; Chatziprodromidou, Bellou, Vantarakis & Vantarakis, 2018; Gil, Selma, Suslow, Jacxsens, Uyttendaele & Allende, 2015). Such shortfalls have resulted in the informal sector becoming an area of concern considering that street vendors cater to the vulnerable members of the community who only rely on vendors for their daily food supplies.

In South Africa, there is not enough literature that has investigated the knowledge, attitudes, and practices of street vendors regarding food safety, something which has increased the reliance on relevant studies done in other countries for information on this area. Although these studies are scientifically relevant, they may not be precise to the situation faced by South African vendors. This study, therefore, set out to investigate Tshwane street vendors' food safety knowledge, attitudes and current practices pertaining to fresh produce management. The findings and conclusions of this study aimed to present empirical evidence that could facilitate the formulation of realistic mitigation/strategies that could encourage the amendment of the identified areas of concern.

1.3 JUSTIFICATION FOR THE STUDY

To date, there is limited literature on food safety issues in the informal sector regarding how much street vendors know about food safety, as well as their attitudes and current practices.

Academically: This study will introduce new theory in the areas of concern regarding food safety knowledge, attitudes, and practices. Going forward, this theory can be used to provide sound justifications for other studies conducted to investigate the microbial quality of fresh produce sold by street vendors. Departments in the plant and soil sciences could gain from the results of this study in justifying their findings on food safety-related projects, which includes projects led by the Centre of Excellence (COE) at the University of Pretoria.

KAP Methodology: The KAP survey has been richly used in the health sector in the past (Marías & Glasauer, 2014). It is still an untapped territory amongst other disciplines within the social sciences, especially in South Africa. Its use in this study as a theory and a new methodology will serve as a point of reference for other relevant studies in the future.

Fresh produce industry: The results of this study will inform the fresh produce industry on the gaps in knowledge, attitudes and practices in the informal sector, which may be used to strengthen food safety initiatives that will work best in both the formal and informal food sector.

The results of this study may also be used to by the **Government or municipalities** to develop training materials that are informed and target specific gaps. The World Health Organisation (2017) reports that often, investigations on foodborne outbreaks are centred around reports of gastrointestinal illnesses but do not consider the modes of transmission and underlying factors that must have led to their occurrence (WHO, 2019a). Recorded cases may not be representative of the real situation regarding foodborne diseases. This could be due to the fact that foodborne illnesses have symptoms similar to gastrointestinal illnesses that can easily be confused for something else and dismissed. It is therefore vital to put in place instruments that will eliminate the occurrences of these illnesses and that will ensure better consumer health.

1.4 RESEARCH AIM AND OBJECTIVES

Aim: *This study aimed to investigate the food safety knowledge, attitudes, and practices of street vendors in Tshwane when managing fresh produce.*

Objective 1: *To investigate and describe street vendors' knowledge pertaining to fresh produce.*

- Objective 1.1: To investigate and describe the street vendors' food safety knowledge pertaining to fresh produce handling.
- Objective 1.2: To investigate and describe street vendors' food safety knowledge pertaining to fresh produce preparation.
- Objective 1.3: To investigate and describe street vendors' food safety knowledge pertaining to fresh produce storage.

Objective 2: *To investigate and describe Tshwane street vendors' attitudes towards food safety*

- Objective 2.1: To investigate and describe street vendors' attitudes towards food safety when handling fresh produce.
- Objective 2.2: To investigate and describe street vendors' attitudes towards food safety when preparing fresh produce.
- Objective 2.3: To investigate and describe street vendors' attitudes food safety when storing fresh produce.

Objective 3: *To investigate and describe Tshwane street vendors' current food safety practices when managing fresh produce.*

- Objective 3.1: To investigate and describe Tshwane street vendors' current food handling practices when managing fresh produce.
- Objective 3.2: To investigate and describe Tshwane street vendors' current food preparation practices when managing fresh produce.
- Objective 3.3: To investigate and describe Tshwane street vendors' current food storage practices when managing fresh produce.

Objective 4: *To identify underlying correlations between street vendors' knowledge, attitudes, and practices (KAP) in order to present possible areas of concern.*

1.5 STUDY AREA

This study was conducted in Pretoria, Municipality of Tshwane, Gauteng province, South Africa. Areas in Tshwane where street vending is most prevalent were selected for this study (i.e. Marabastad, Pretoria CBD, Sunnyside, Atteridgeville, and Bosman).

1.6 UNIT OF ANALYSIS

The unit of analysis was female and male street vendors aged 18 years and older. The study area was the Tshwane metropolitan, South Africa. Inclusion in this study was limited to only street vendors who sold a variety of commonly consumed fruits and vegetables in South Africa. Street vendors who sold freshly cooked meals and ready-to-eat foods or beverages were not included in this study.

The respondents' educational background, nationality, income or population group were not used to determine participation in this study.

1.7 RESEARCH DESIGN AND METHODOLOGY

This study was empirical in nature, which included both exploratory (exploring street vendors' current knowledge, attitudes and practices pertaining to food safety) and descriptive (describing possible areas of concerns that could benefit from mitigation strategies) investigations.

Data were collected over the period of a week (19th - 23rd November 2018), thus making it cross-sectional in nature. Semi-structured questionnaires were administered through face-to-face interviews.

Street vendors (aged 18 and older, irrespective of their gender and/or population group) who sold a variety of commonly consumed fruits and vegetables in South Africa were targeted. This study did not restrict data collection in terms of the type and/or format of street vending and therefore allowed selection from both stationary and mobile vendors.

A non-probability, convenience-snowball sampling technique yielded 183 respondents. The data were captured and stored in the Qualtrics program. This system made the analysis of

preliminary results more manageable. Furthermore, IBM SPSS (version 25) was used for the analysis of frequencies, descriptive analysis, correlations, and ANOVAs.

1.8 ETHICS

The University of Pretoria, like most institutions, has set and adheres to a code of conduct regarding social research. The proposed research is was evaluated by the Ethics Committee under the Faculty of Natural and Agricultural Sciences, which scrutinises the protocol's relevancy and if it adheres to ethical practices before its implementation. This study, therefore, went through the same process. Although it was part of a bigger study, the instrument used for this investigation was resubmitted for ethical clearance and was granted permission (EC 180327-172).

The purpose of the study was clearly explained to the individuals approached for participation in this study and they were made aware that their participation was purely voluntary. Their anonymity was assured, and they were guaranteed that their responses were solely to be used for the purposes of this study and nothing else, as stated when requesting the respondents' consent.

The researcher ensured that she properly acknowledged all types of data borrowed from other researchers, including ideas and thoughts, to avoid plagiarism.

1.9 STRUCTURE OF THE STUDY

This dissertation is presented in five chapters.

Chapter 1: Introduction

This chapter presents the background of the research, and introduces the problem statement and justification of the research. It highlights the aim and objectives of the study and gives a brief overview of the research design and methodology.

Chapter 2: Theoretical model and literature review

This chapter commences with an introduction of the theoretical model chosen to guide this study (the KAP survey). A comprehensive review of the literature that presents the main themes

of the study is then presented. In this section, street vending is extensively defined and discussed from both a local and global perspective in terms of food trade in South Africa, food safety and fresh produce and its perishability and their relation to street vending.

Chapter 3: Conceptual framework, research objectives, and methodology

Chapter 3 presents the conceptual framework of the study where the interrelations of the main concepts and themes of the study are demonstrated. The objectives of the study, and the research design and methodology are presented in this chapter.

Chapter 4: Results and discussion

Chapter 4 presents the results and discussion based on the aim and objectives set for this study.

Chapter 5: Conclusion

This chapter presents the conclusions of the research regarding the main objectives set for the study. The recommendations are based on the interpretation of the findings. The shortcomings of the study are also highlighted to assist with idea formulation in future research.

1.10 DEFINITIONS

Table 1.1: Terms and concepts

TERMS AND CONCEPTS		
TERM OF CONCEPT	DEFINITION	REFERENCE
Food safety	Food safety refers to all the practices during food preparation, handling and storage that ensures that the consumption of food does not lead to foodborne illnesses.	(Lawley, Curtis & Davis, 2012:1; Motarjemi & Lelieveld, 2014:215)
Foodborne illnesses	Foodborne illnesses are those caused by microorganisms or bacterial cells carried by food into the gastrointestinal tract.	(Gregoire, 2013)
Food preparation	Food preparation refers to practices that are essential when making food such as the coring, peeling or washing of fresh produce, the cleaning of chopping boards and other cooking utensils, as well as sanitising kitchen surfaces.	(Payne-Palacio & Theis, 2016:99)

TERMS AND CONCEPTS		
TERM OF CONCEPT	DEFINITION	REFERENCE
Food handling	Food handling refers to hygienic practices put in place to prevent microbial growth and cross-contamination when working with food.	(Payne-Palacio & Theis, 2016:100)
Food storage	Food storage refers to practices that ensure that food stays fresh for longer through proper temperature controls. This avoids the chances of cross-contamination in pantries, refrigerators and cold rooms where food is stored.	(Gregoire, 2010:243)
Fresh produce	Fresh produce refers to all herbaceous plants whose leaves, stems, roots, tubers, seeds, flowers and fruits can be consumed. This word in this study is used interchangeably with fruits and vegetables.	(Labensky, Hause & Martel, 2015:566)
Street vendor	A street vendor refers to a person who sells goods or provide services in the street or sidewalks (pavement) in public spaces. They can either be stationary or mobile.	(Rogerson, 2016a; Saha, 2016)

1.11 CONCLUSION

This chapter introduced the topic being researched, highlighted the background information and justified the importance of the study based on the research problem presented. The relevant concepts and theories were introduced based on the objectives set for this study. The following chapter comprises a discussion and explanation of the relevant literature related to this field of study.

CHAPTER 2 THEORETICAL MODEL AND LITERATURE REVIEW

This chapter commences with an introduction and explication of the theoretical model (KAP) chosen for this study. The KAP model not only guided the investigation from the onset and facilitated in-depth insight into and discussion of the literature reviewed, but also assisted in the ultimate analysis of the results. The discussion of the KAP model is followed by a comprehensive literature review, which firstly describes street vending from a global and local perspective. The second section explores food safety, highlighting the three main dimensions: food handling, food preparation, and food storage. This chapter concludes with a reflection on fresh produce as a commodity traded by street vendors, and the basic characteristics, as well as possible food safety concerns during trading.

2.1 THEORETICAL MODEL: KAP (KNOWLEDGE, ATTITUDES, AND PRACTICES) SURVEY

2.1.1 What is a KAP survey

The KAP (Knowledge, Attitudes, and Practices) Model was chosen to serve as the theoretical framework for this study. In essence, the KAP Model is a quantitative methodological approach that provides access to quantitative and qualitative information about a target phenomenon or situation (du Monde, 2011). KAP surveys are popularly used in health programmes or studies with the aim of conducting a situational analysis before changing a programme, or as a monitoring instrument to evaluate interventions (Macías & Glasauer, 2014). The KAP survey is therefore often used to gather information for situational analysis¹, advocacy², communication³ and social mobilization⁴ (Marías & Glasauer, 2014; Organization, 2008). This model is thus profound in terms of measuring the reality of a known situation, its range or

¹ A situational analysis describes the type and magnitude of problem and helps to identify different causes of the problem (Marías & Glasauer, 2014).

² Advocacy is an act that seeks to influence stakeholders who are integral to making decisions like policy change and regulations.

³ Communication helps to increase awareness, influence social norms and create a change in behaviour in street vendors.

⁴ Social Mobilisation is an act that aims to improve norms and improve practises in service delivery by helping street vendors to work together towards food safety (Organization, 2008).

scope, and its ability to assist in exploring possible interventions with the aim of improving areas of concern through implementing new and fresh contributions (Gumucio, Merica, Luhmann, Fauvel, Zompi, Ronsse, Courcaud, Bouchon, Trehin & Schapman, 2011). Presently, KAP studies are used across all disciplines; however, they are mostly used in the social sciences to gain insightful information on a subject matter, hence the choice to use it in this study. The following section will introduce the basic assumptions and core constructs that are central to KAP. More detail pertaining to the implementation and values of the KAP survey will be discussed in Chapter 3.

2.1.2 The key concepts defined: Knowledge, attitudes, and practices

This section explores the definition and explanation of the key concepts of the KAP model (Knowledge, Attitudes and Practices).

2.1.2.1 Knowledge

Knowledge relates to individuals' ability to make intelligent decisions (Alba & Hutchinson, 1987), and has become an independent area of research interest (Nickols, 2000; O'Malley, 2009). Traditionally, knowledge was approached as a one-dimensional construct that encompasses individuals' familiarity with prior knowledge of the relevant constructs (Alba & Hutchinson, 1987). The critique against approaching knowledge as a one-dimensional construct is that it is restrictive to only a small portion of the richness that encompasses knowledge (Alba & Hutchinson, 1987). Many scholars today agree that knowledge should be approached as a multi-dimensional construct (Alba & Hutchinson, 2000; Li & Gao, 2003; Meyer & Medeni, 2005; Nickols, 2000; Nonaka, Sasaki & Ahmed, 2003; O'Malley, 2009). Nickols (2000) stipulates that individuals gain knowledge in two ways, namely: factual information and experience that respectively suggest their 'know about' and their 'capacity for action' or 'know-how'. These two dimensions of knowledge are described as explicit (also known as declarative knowledge) and tacit (also known as procedural knowledge) (Anderson, 1995; Meyer & Medeni, 2005; Nickols, 2000; Nonaka, 1991). Knowledge is therefore not only a body of information that is captured in books and documents that can be easily articulated (explicit knowledge), but is also something reflected in daily routines, processes, and practices (habits), which are often difficult to articulate (tacit knowledge), needing personal contact to be transferred. Identifying and/or recognising significant incongruities or deficits in these two

types of knowledge could thus provide essential information in terms of street vendors' ability to articulate and transfer it to practice (Nickols, 2000; Ott, 2004). Due to time constraints and a lack of resources, this study did not set out to investigate explicit and tacit knowledge as two separate constructs per se. Instead, questions were formulated in such a manner as to get some sense of the participating street vendors' general knowledge that comprises aspects of both dimensions of knowledge.

2.1.2.2 *Attitudes*

An attitude is a “psychological tendency that is expressed by a person’s evaluation of an entity with some degree of favour or disfavour” (Bohte, Maat & Van Wee, 2009:327). Put simply, attitudes can be defined as the way in which individuals think, feel and ultimately behave about or towards something or someone (De Meuse & Hostager, 2001; Vereecken, Van Damme & Maes, 2005). Attitudes thus have three components (De Meuse & Hostager, 2001):

- (i) **The cognitive component** refers to the beliefs, knowledge, and thoughts that individuals have about an object, a person or a phenomenon, whether true or false (Bagozzi & Burnkrant, 1985) (Think).
- (ii) **The affective component** represents the emotional reaction an individual has to an object, person or a phenomenon being investigated (Bagozzi & Burnkrant, 1985) (Feel).
- (iii) **The behavioural component** reflects on the behavioural intentions of a person, either towards or around the phenomenon being investigated (De Meuse & Hostager, 2001) (Behave).

The behavioural component can often be mistaken as a measure of practices when, in fact, it only measures what a person would do in certain situations (intentions). To avoid this confusion in this study, only the cognitive and affective components were explored to investigate street vendors' attitudes using words such as ‘think’, ‘feel’ and ‘believe’ (see Addendum 1, Section C).

2.1.2.3 *Practices*

The term practices refers to the way in which people express and articulate their knowledge, feelings, and beliefs through actions (Chaudhary, Singh, Agrawal, Agarwal, Kumar & Sharma,

2010). In the context of food safety, practices therefore refer to the actions taken towards achieving food safety, e.g. the washing of hands or the separation of raw from cooked foods, amongst others. Currently, the literature on food safety practices in the informal sector has indicated gaps caused by a lack of resources, such as reliable water sources, toilets and storage spaces (Apanga, Addah & Sey, 2014; Asiegbu *et al.*, 2016). Food handlers appear to mostly fall short in terms of hygiene and sanitation practices during food handling, preparation, and storage (Cortese *et al.*, 2016; Sekhani *et al.*, 2019b; Trafialek, Drosinos & Kolanowski, 2017). These issues will be discussed in detail in the next sections of the literature review.

2.2 LITERATURE REVIEW

This section comprises a comprehensive review of the literature on the main themes of the study, which are street vending as a global phenomenon and in South Africa; the types and profile of South African vendors; food trade in South Africa; food safety, highlighting the three main dimensions explored in this study (food handling, food preparation and food storage); food safety regulations; and outbreaks in South Africa. Fresh produce is also extensively explored (with emphasis placed on its perishability), and food safety concerns in fresh produce trading.

2.2.1 Street vending as a global phenomenon

Street vending is a global activity that has been around for hundreds of years in both developing and developed countries. It came about as an income-generating strategy for migrants and locals with little to no skill set to secure formal white- or blue-collar jobs (Sekhani, Mohan & Medipally, 2019a). Street vending has since grown, providing employment to vast numbers of urban citizens globally (Oppers, 2012). Street vendors, according to Skinner, (2008), are a large and very visible workforce in most metropolitan cities, yet accurate estimates on their economic contributions are minimal. Official statistics that are made available tend to be restricted to only a few countries, and often underestimate not only the population involved, but also the economic contributions made.

The dialogue in terms of Africa also seems to downplay the informal sector (of which street vending is a significant part). Fortunately, statistics pertaining to South Africa do present the vibrancy of street vending stipulating that it contributes 7% to the national Gross Domestic

Product (GDP) and generates 22% of the total employment in the country (Gamieldien & Van Niekerk, 2017). These contributions are also noted in other countries where street vending is said to make up 13% of the non-agricultural workforce in Dakar, 19% in Cotonou, 24% in Lomé Togo and 11% in Hanoi and Ho Chi Minh city (Roever, 2014). According to estimates made by the South African Local Development Network (LED) in 2015, the informal sector generates about \$4.62 billion US dollars (ZAR 88 billion) annually in the country. In terms of developed countries, the United States of America serves as a point of reference in the absence of substantial statistics from other countries regarding the contributions made by the informal sector to the economy. In New York alone, street vending contributes approximately \$105 million towards the economy annually compared to the \$11 billion that comes from restaurant sales (Reid, Fram & Guotai, 2010).

Despite the integral role that street vending plays in terms of urban economies around the world, it is unfortunate to note that street vending is often considered as not only a ‘nuisance’ (i.e. causing street congestion as these stands are often placed in subways, on the pavement or any public spaces) but also as being vendors of poor quality goods that diminish the aesthetics of cities around the world (Bromley, 2000; Trafialek *et al.*, 2018). This cynical view regarding street vending can, in essence, be attributed to the most basic definition of a street vendor, which is “someone who sells food or other goods and services in the street, sometimes illegally” (Bromley, 2000:2-3). In terms of South Africa, desperate socio-economic factors might have necessitated individuals’ participation in occupations such as street vending, which is considered as ‘less desirable’ (Gamieldien & Van Niekerk, 2017).

The debate regarding whether street vending should be considered as an entrepreneurial strategy or survival tactic is also viewed as a negative influence, perhaps because the definition of the informal sector is often confused with the idea of illegitimacy (Ranyane, 2015). Masonganye (2019) defines the informal sector as one that is mostly untaxed and excluded from the government’s gross national product and one that is not monitored closely by the government. It is perhaps the lack of governmental supervision that causes many to view street vending as less desirable, or even illegal in some cases. This negative view of the sector may also be attributed to the distinct management practices of street vending in developed countries as compared to developing countries. The management of the sector in developed countries over the years has reached a systematic peak, which makes it recognisable, even among the

upper-income classes, while in developing countries it remains ambiguous and unconventionally managed, hence attracting negative reviews (Devlin, 2011). As a result, service provision is reduced to the low- and middle-income classes in developing countries and most accessible to the marginalised, while in developed countries professionals enjoy the services provided by the sector and some even take advantage of the opportunities the sector presents (Carpenter, 2018).

2.2.2 Food trade in South Africa (formal and informal retail)

The South African food retail sector is growing fast owing to the rise in the middle-income group over the years (Bernstein, Schirmer & Roodt, 2014; Farfan, 2019). Farfan (2019) defines retail as the sale of goods to consumers for household use to suit diverse lifestyles, hence referring to them (consumers) as ‘end-users’ who do not aim to engage in reselling. The middle-income class⁵ consumption patterns and capacity has been reported to drive the level at which the overall food retail sector (formal and informal) is expanding in the country.

2.2.2.1 Formal retail sector

The formal sector refers to all businesses that are registered with the state and tax collectors, and whose contributions are included in the GDP calculations. These businesses usually generate 50% of their turnover from selling goods and services to consumers for household use (Tustin, 2004). In South Africa, this sector is made up of the ‘big five’ food retail groups in Africa, namely, Shoprite, Pick n Pay, Spar, Woolworths and Walmart’s Cambridge foods, which are reported to contribute about 60% of all retail food sales in the country (Promozione, 2013:10). This sector has grown to be more prominent over the years in the country as compared to other African countries, with malls occupying 38 acres in 2014 and sales reaching \$44.9 billion in 2017 (Farfan, 2019; Promozione, 2013).

All operations in the formal sector are conducted in regulated and controlled environments to ensure that consumers get their value for money (Abeberese & Chaurey, 2017; Van Scheers, 2010). Food safety is one of the highly regulated areas in this sector. These stringent restrictions

⁵ The middle-class, according to the NIDS research, refers to those who earn between a monthly per capita expenditure of between R2,920 and R10,678 based on January 2015 prices. This class comprises approximately 15% of the total population (Staff, 2017).

by the state have guaranteed consumers safe food with reduced chances of contamination that could lead to foodborne illnesses. This service may, however, come at a price considering that the infrastructure that supports compliance could require high and costly upkeep. This is one of the reasons that food commodities sold by formal retailers, especially fresh produce, are sometimes not be affordable for some lower-income consumers, hence channelling them towards the informal sector (Farfan, 2019).

2.2.2.2 *Informal retail sector*

The informal sector is defined as all economic-related activities that are unregistered and often unrecognised by the state (Ligthelm, 2005). These activities are likely to escape being dictated for inclusion in GDP estimates and calculations. Most of the business ventures under the informal sector, although small, would be subject to taxation if they were known by the state (Tustin, 2004). Over the years, the governance of informal traders has proven a difficult task as Benit-Gbaffou (2018) mentions that municipalities have been successful in managing street vending with regard to limiting the number of traders occupying streets rather than developing support systems that would improve their service delivery as an integral part of the urban economy.

Unfortunately, this sector is often mistaken for illegal dealings, causing street congestion and is sometimes considered an urban nuisance; however, Schneider (2002) clarifies that just like in the formal sector, there is a distinction between legal and illegal ventures. Illegal activities in the informal sector may include the trade or bartering of stolen goods, drug manufacturing and dealings, prostitution, illegal gambling, smuggling and fraud. All activities that involve unreported income from self-employment such as wages, salaries and assets from unreported work related to legal services and goods are considered legal activities, as well as the sale and bartering of legitimate goods and services (Ligthelm, 2005; Schneider, 2002).

Street vending, as part of the informal retail sector, falls under legal activities, provided that the street vendors abide by the bylaws put in place in that region (Bénit-Gbaffou, 2018). In South Africa, the bylaws state that a legal vendor in main towns and cities should be cleared for trade in an allocated location and those found trading outside that law are considered illegal (Masonganye, 2010). It is unfortunate, however, that although vendors are cleared as legal traders in urban areas, their ventures are still not registered and regulated by the state, which

leaves consumers vulnerable with regard to issues such as food safety (Béni-Gbaffou, 2018). The absence of regulations means that, in an effort to avoid high costs, street vendors may opt to source fresh produce and other food commodities anywhere (especially from informal producers that may be somewhat unregulated) without anyone determining the safety thereof for resale and consumption (Jaffe & De Koning, 2015). Although consumers who can afford to buy food from formal retail stores would instead choose food safety over price, informal consumers tend to take advantage of lower costs even if they risk being exposed to foodborne illnesses (Britwum & Yiannaka, 2019).

2.2.3 Street vending in South Africa

In African countries, the informal sector (including street vending) makes up 60% of all urban jobs and over 90% of new jobs in urban areas (Skinner, 2008a). The International Labour Organization (ILO), (2018) reports that in Africa, 85.8% of overall employment is informal compared to 68.2% in Asia and the Pacific, 68.6% in the Arab states, 40% in America, and 25.1% in Europe and Central Asia. These trends over the years are linked to urbanisation and migration, which lead to high unemployment rates, especially in urban areas. Skinner (2008) explains that international migration (usually caused by regional economic inequalities) increases the number of street vending businesses in African countries. These migrants move from their countries in hopes of better employment opportunities. Still, upon arrival, they usually settle for working in the segments of the economy where barriers to entry, and start-up costs are low (which most of the time is street vending).

In South Africa, the informal sector makes up 17% of the total employment force, providing 2.9 million jobs for the South African population (Fourie, 2018). Horn (2011) estimates that of all informal jobs in the country, 884,000 were in street vending. Over the years, precise statistics on the number of street vendors has proven difficult to obtain, however, a report by WIEGO (Skinner, 2020) indicates that of the 500,000 street vendors in 2007 in South Africa, approximately 360,000 were women. These estimates suggest that more women take advantage of street vending in this country than in other developing countries (Wills, 2009). The profile of street vendors in South Africa, however, differs from region to region as some cities have recorded more men in street vending compared to females.

The food and agriculture organisation (FAO) has recognised the significance of street vendors, especially with low- and middle-income consumers daily, especially in urban areas worldwide. South Africa is no exception; this market has allowed low-income households to have a source of nutritious foods daily at affordable costs (Abdalla *et al.*, 2009). Street vendors are usually easy to access, are always located in busy streets, and are closer to residential areas, which helps consumers to save on transportation and storage costs (de Zeeuw & Drechsel, 2015). It is true that nowadays supermarkets and formal retail shops offer fresh foods and produce at relatively lower prices; however, the travelling costs tend to be high for low-income consumers, hence their preference for street vendors (Mkwambisi, Fraser & Dougill, 2011).

Since street vendors are usually part of the low-income community trying to make a living for their families, they still lack adequate resources and infrastructure that could support hygienic trading conditions that seek to protect consumers from foodborne illnesses (Abdullah Sani & Siow, 2014; de Zeeuw & Drechsel, 2015). The provision of these infrastructures is something that vendors cannot control, e.g. vendors may not have the capacity to access water sources or toilets in their proximity, however, if they are well informed on food safety issues, they may be able to take the necessary precautions (Abdalla *et al.*, 2009; Wills, 2009). Currently, the literature has indicated that most street vendors in developing countries do not have a rich educational background, hence leaving the safety of consumers unguaranteed.

2.2.4 The types of vendors and commodities sold, and the target market in South Africa

Street vending practices come in different styles - some vendors are stationary, while other vendors prefer to be mobile; however, they share the same challenges with regard to the informality of the sector (Rogerson, 2016b).

(i) Stationary vendors

A global definition of stationary vendors is those that sell their goods or provide a service from a designated space on the street or sidewalk daily (Saha, 2016). Most stationary vendors work from structures made of wood or corrugated iron, especially in developing countries. In the developed world, they rely mostly on food carts or food trucks, whereas in developing countries, including South Africa, stationary vendors make use of spaza shops (Charman, Petersen, Piper, Liedeman & Legg, 2017; Wills, 2009). Spaza shops are structures

predominately made of corrugated iron or wood, especially in taxi/bus ranks and townships (Charman & Petersen, 2015). These informal structures may be built in a way that best suits the services offered by the vendor. These vendors (stationary vendors) have the advantage of building a relationship with consumers while enjoying the benefits of having loyal customers. The amount of space allocated to each vendor (especially in inner cities), however, often serves as a significant constraint, limiting the number of returns due to each vendor (Aluko *et al.*, 2014; Masonganye, 2010).

Stationary food vendors offer fresh meals or fresh produce to the public, specifically to individuals who run their daily errands in proximity to where street vending is prevalent. Charman *et al.* (2017) find that different vending ventures are feasible in specific locations, e.g. those that offer street barbeques and fresh meals prefer offering their services from bus or taxi ranks where they can have some form of temporary structure to support this kind of business. This service delivery means that the merchandise sold is exposed to all the traffic around the stalls, which makes these ventures more informal.

In South Africa, most stationary vendors who operate in the main metros, unlike those operating in townships⁶, do not operate under any form of structure, which makes them appear more informal (Charman & Petersen, 2015; Charman *et al.*, 2017; Masonganye, 2010). They sell their merchandise in the open air with only umbrellas, tents or mini gazebos to shield them and their merchandise from the external environment and its weather conditions (Bénit-Gbaffou, 2018; Masonganye, 2010; Skinner, 2008b). These vendors, especially those who sell fresh meals and fresh produce, have less control over food safety given the conditions where they work, hence raising concerns regarding consumers' safety against foodborne illnesses. Stationary vendors in townships usually run spaza shops where they predominately offer grocery services, sell liquor, run hair salons, and offer repair services, among other services. These are possibly likely to maintain hygienic standards (Charman *et al.*, 2017).

(ii) Mobile vendors

Mobile vendors, as defined by Rogerson, (2016), are those not restricted to a demarcated vending location. They have an ease of movement and the ability to personally identify busy

⁶ Townships usually refers to underdeveloped residential areas with predominately non-white residents. Some of these residential areas may consist of a high number of informal settlements.

areas where they can offer their services temporarily (Saha, 2016). Their ease of movement allows them a chance to identify events and streets with relevant clientele to the merchandise that they sell. Mobile vendors may be divided between those who sell from mobile food trucks or carts and those who carry baskets on their heads or push their merchandise in trolleys as they sell to consumers (Rahman *et al.*, 2016). Vendors who have food trucks and food carts are slightly advantaged over those who move around by foot and may be considered less informal (Rother, 2010).

Moreover, the flexibility to move from one place to the next widens the type of clientele they can reach (Rogerson, 2016b). While stationary vendors are confined to low-income consumers, mobile vendors may find themselves selling to consumers of all income classes at events where food trucks are allowed (Witepski, 2017). Due to the fact that they operate more temporarily, these vendors somehow escape being labelled informal and a nuisance (Lucan, Varona, Maroko, Bumol, Torrens & Wylie-Rosett, 2013). Food safety is usually not much of a concern for these types of vendors since they typically come prepared and are likely to operate under controlled conditions with all the necessities provided (Charman & Petersen, 2015).

Mobile vendors who move by foot or use pushcarts unfortunately suffer the same challenges as stationary vendors, and are most likely to get harassed by law enforcement personnel (Rother, 2010).

2.2.5 The profile of South African street vendors

Street vendors may be generally profiled based on their gender, country of origin and level of education, among other methods (Chakraborty & Koley, 2018). This section seeks to profile street vendors in South Africa based on the above demographics.

(a) Street vendors by gender

Existing data, although limited, suggests that the informal sector, particularly in terms of street vending, has opened up a new opportunity for women to be economically active, especially in developing countries. Global figures indicate that women account for almost 95% of the informal sector in countries such as Benin, Chad, Mali and India (Chen, 2007). The department of statistics reports that in the second quarter of 2018, there were more women (47.6%) than men (30.6%) in the informal sector in South Africa (Stats SA, 2018a). Studies that have been

done on street vending in developing countries, including South Africa, also seem to support statistics that suggest that there are indeed more women in street vending compared to men (Abdalla *et al.*, 2009; Aluh & Aluh, 2017; Apanga *et al.*, 2014; Chukuezi, 2010; Dun-Dery & Addo, 2016; Rahman *et al.*, 2016; Samapundo, Cam Thanh, Xhaferi & Devlieghere, 2016; Skinner, 2008b). However, recent studies highlight that a new trend is emerging amongst men in developing countries where they actively seek out job opportunities such as street vending in the absence of formal employment (Cortese *et al.*, 2016; Horn, 2011; Iwu, Uwakwe, Duru, Diwe, Chineke, Merenu, Oluoha, Madubueze, Ndukwu & Ohale, 2017a; McKay, Singh, Singh, Good & Osborne, 2016; Muinde & Kuria, 2005; Mukherjee *et al.*, 2018).

(b) Street vendor by country of origin

Globally, street vending over the years has been considered to be the sector constituted mostly by international migrants. For instance, in the USA, 51% of street vendors in the country are foreign migrants (Carpenter, 2018). The South African national statistics indicate that of the 105 million migrants in this country, 47.5% of them are most likely to settle in Gauteng, which is the province where street vending is most prevalent considering the high unemployment rate (Stats SA, 2018b). These reports may be consulted and used to draw assumptions that, perhaps, this is why Gauteng is a point of reference among other provinces when it comes to street vending in South Africa. Citizens from all other African countries and abroad (Zimbabwe, Lesotho, Swaziland, Pakistan, Nigeria, Ghana, and Cameroon among others) have been reported to be in the informal sector (Nkrumah-Abebrese & Schachtebeck, 2017).

(c) Street vendors' level of education

It has often been reported that a lack of education is the primary factor that pushes certain individuals towards street vending as it is a sector that requires no qualifications (Wills, 2009). Street vendors are reported to be predominately illiterate, especially those who migrate from rural to urban areas (Begari, 2017). In South Africa, the literature indicates that a reasonable number of street vendors have been exposed to formal education and are not entirely illiterate (Horn, 2011). In 2011, Willems (2011) reported that, at the time of her study, 40% of street vendors in Johannesburg had matric certificates, 34% in Tshwane and 19% had a tertiary qualification in Cape Town. These figures have improved as the years have progressed as a more recent study done in South Africa by Nkrumah-Abebrese and Schachtebeck (2017)

reported that 67% of the street vendors in their case study had matriculated, 30% had a tertiary qualification and only 3% had not been exposed to any education. This data (although limited) indicates that perhaps South African vendors are not driven into the sector by a lack of skills and educational background, but rather due to limited alternative job opportunities.

2.2.6 Food safety

Food safety is a “public health concern” that has been given a lot of attention over the decades in both developing and developed countries. It is defined as practices that ensure that food does not cause any harm to the consumer (Lawley *et al.*, 2012:1; Motarjemi & Lelieveld, 2014). Jones (1992:248) also defines food safety as the assurance that food is free from substances that can potentially cause harm to the consumer, but the author argues that it is impossible to achieve “absolute food safety”. For food to be “absolutely safe” it must be without physical, chemical and microbial contaminants, which tends to be a big task that is sometimes not attainable. Jones (1992) furthermore explains that food, in general, is considered as relatively safe, highlighting that any food commodity is safe if the level of pathogens present in the food is within the set limits fit for human consumption as defined by various legislations, depending on the country and sometimes region.

Food may be contaminated at any stage along the value chain, either by producers, retailers, consumers or both, however, this can be prevented by the effective prevention and removal of contaminants through the application of food safety principles (Gregoire, 2013; Lawley *et al.*, 2012). Griffith (2010) clarifies that the source of production inputs, the type of food produced, prepared and sold, and the way in which the food is being managed by its producers and consumers is likely going to determine the safety of the end product. Therefore, adhering to food safety practices during food handling, food preparation and food storage is mandatory when trying to prevent food from being contaminated. Failure to do so could thus result in foodborne disease outbreaks (Haileselassie, Taddele, Adhana & Kalayou, 2013; Jackson, 2011; Osaili, Jamous, Obeidat, Bawadi, Tayyem & Subih, 2013).

Foodborne diseases affect an estimate of 600 million or one in every 10 people globally per year, killing about 420,000, including 125,000 children under the age of five (Akabanda *et al.*, 2017; Asiegbe *et al.*, 2016; Ayub *et al.*, 2017). In the USA alone, an estimate of 76 million cases of foodborne diseases are reported annually with approximately 5000 deaths and 325,000

hospitalisations (Griffith, 2010; Mei Soon, Manning, Paul Davies & Baines, 2012), 23 million cases in Europe (WHO, 2019a) and 91 million cases of foodborne diseases in Africa, resulting in approximately 137,000 deaths every year (Tim, 2019).

The World Health Organisation (WHO) has indicated that although food safety is a global problem, African countries remain the most vulnerable to foodborne illnesses. Most low- and middle-income countries still lack safe water supply, have poor hygienic practices, and have inadequate conditions for food production and storage, all of which are linked to foodborne diseases (WHO, 2019c). The majority of African countries are faced with high poverty rates, pushing most of their population towards the informal sector both as a livelihood and as an affordable source of food-based commodities (Zheng, Silwal & Newhouse, 2019). The informal sector, however, still operates under the challenges faced by communities at large, and does so mostly without any regulations regarding food safety, thus further exposing consumers to food contamination given the conditions of such marketplaces. The burden of food safety in these regions has not only affected human health, but also continuously affects food security, the economy, and sustainable development overall (WHO, 2019c).

South Africa had an unfortunate but eye opening Listeriosis outbreak in 2018 that took the lives of 183 people, with 674 reported cases in less than six months (WHO, 2018). Although this outbreak was not linked to the informal sector, it facilitated discussions on the importance of hygiene and sanitation in food handling, amongst other food safety principles. In the USA, poor personal hygiene and weak hand washing regimes have been associated with 13.4 million cases of foodborne illness (Bhat & Gómez-López, 2014). This emphasises the need for improved food management practices seeing as children under the age of five are the most at risk of contracting foodborne sicknesses.

2.2.6.1 Dimensions of food safety

Food safety is best defined based on three dimensions: food handling, food preparation, and food storage (Payne-Palacio & Theis, 2016).

(a) Food handling

Food handling refers to the practices put in place to prevent microbial growth and cross-contamination when preparing food for sale or consumption (Payne-Palacio & Theis, 2016). It

is mostly concerned with the food handler's hygiene (personal, kitchen and food hygiene) and sanitation practices to prevent cross-contamination. Gregoire (2013) defines cross-contamination as the transfer of microorganisms from one food product to another or from surfaces or equipment to food due to improper food handling practices.

During food handling, the biggest concern regarding food handlers' hygienic practices, along with other practices, is how well they observe hand hygiene considering that hands are essential in food preparation. If not properly washed and sanitised, hands can become a carrier for harmful bacterial contaminants (pathogens) that are mostly implicated in foodborne outbreaks such as *E. coli*, *Salmonella* and *Staphylococcus aureus* (Machado-Moreira, Richards, Brennan, Abram & Burgess). Emphasis must therefore be put on proper hand hygiene (including proper handwashing regimes) and regular medical screening to avoid food contamination (Asogwa, Okechukwu, Esther, Chinedu & Nzubechukwu, 2015; McKay *et al.*, 2016). Pang *et al.* (2015) state that sick food handlers should refrain from handling food due to the high risk of them contaminating food. Unlike formal establishments, it has been reported that most informal traders rarely make time to get medical attention whenever they show symptoms of sickness due to the lack of assistance in running the business; hence they often choose business over getting medical attention (Iwu *et al.*, 2017a). This practice, although feasible for street vendors, exposes consumers to food contamination due to cross-contamination. In terms of clientele, this is a serious concern as these vendors often provide services to more vulnerable groups who themselves often have limited access to medical care should they contract a foodborne illness and consequently become sick. This therefore highlights the need to train street vendors in terms of proper food handling.

(b) Food preparation

Food preparation is defined as a variety of practices involved in obtaining raw materials and changing them into something ready to be consumed or used for consumption purposes (Poti, Mendez, Ng & Popkin, 2015). Food may be prepared at various stages along the farm to fork chain, beginning immediately after harvest (e.g. the washing and coring of vegetables after harvesting) (Gil *et al.*, 2015). The USDA highlights that preparing food follows four steps, namely: **clean, separate** (avoiding cross-contamination between raw and cooked), **cook and chill**, whose precedence may vary with different foods and products (USDA, 2015). Some

products may require chilling before being cleaned and packaged, while others may require cleaning first. Poor hygiene during food preparation poses the highest food safety risk, increasing the chance of cross-contamination either from food to surfaces or visa-versa (Fallon, Rios & Fonseca, 2009).

Changing food from its raw state requires peeling, chopping, or trimming, an exercise that involves the increased contact of food with surfaces and equipment such as chopping boards and knives. Equipment such as cutting boards, countertops and knives, among other utensils in the kitchen, present a chance for cross-contamination to occur due to their diversity in use (USDA, 2015). To reduce the microbial load on these surfaces and utensils, cleaning and washing using soapy, food-grade water is advised, followed by a sanitising plan, especially in big food processing plants (Murray, Wu, Shi, Jun Xue & Warriner, 2017). Proper cleaning and sanitation have proven to be a significant challenge in the informal sector (i.e. for street vendors) where there is a gap in infrastructure. Most street vendors do not have access to reliable sources of water, which makes it hard for them to observe proper hygienic practices, thus unnecessarily exposing their customers to cross-contamination of food.

It is often advised that fresh produce be washed under running water before preparation and consumption, however, in the absence of sustainable water sources in the informal sector, food safety remains the greatest concern (Uhlig, Olsson, He, Stark, Sadowska, Molin, Ahrné, Alsanius & Håkansson, 2017). Cutting, trimming or peeling is usually the second step in preparation following washing; however, this activity could present a chance for food to be contaminated. Gil *et al.* (2015) argue that the use of blunt knives could also increase the chances of food contamination as blunt knives damage the food's tissues, thus increasing the risk of contamination from microorganisms. Once the food is cut, the surface area and moisture levels necessary for bacterial growth are increased, hence promoting their growth and internalisation. Moreover, if exposed to unsanitary environments such as dirty holding equipment, dirty surfaces, equipment or even unhygienic handlers (places that have a high microbial load), the microorganisms can multiply quickly (Alegbeleye, Singleton & Sant'Ana, 2018; Gil *et al.*, 2015).

(c) Food storage

Storing food is a practice mainly aimed at slowing down the maturing and deterioration process to extend the shelf life of food products while avoiding microbial contamination (Brown, 2015; Gong, Li, Liu, Yue & Fu, 2008). It is further a food handling practice that involves correct temperature control, and checking labels for expiry and sell-by dates while adhering to the first in-first out rule (Brown, 2015; Payne-Palacio & Theis, 2016). All storage initiatives seek to slow down the process of transpiration in fresh produce, which leads to the loss of firmness, shrivelling, wilting and all components related to the loss of freshness of foods, as well as slowing down spoilage in other food substances, cooked or uncooked (Aindongo, Caleb, Mahajan, Manley & Opara, 2014).

During cold storage or refrigeration, it is often essential to maintain the correct temperatures and relative humidity levels based on the different produce's characteristics (James & Zikankuba, 2017). Inappropriate storage temperatures have been associated with chilling damage such as freezer burn, irregular ripening, pits on the skin surface and sometimes increased susceptibility to decay or spoilage. At the same time, high exposure to sunlight and heat could cause sun scalds and the bleaching of fresh produce (Kusumaningrum, Lee, Lee, Mo & Cho, 2015). To achieve the correct levels of humidity, the use of proper packaging material should be used during storage (Caleb, Mahajan, Al-Said & Opara, 2013). The packaging material should never accumulate water vapour inside as this serves as a hazard and is an indication of increased respiration, especially in fruits. This gives microorganisms a conducive environment in which to grow and multiply due to sufficient levels of moisture, which could lead to the produce becoming slimy and later spoiling (Aindongo *et al.*, 2014).

It is important to note that the shelf life of food is primarily determined by how food is handled before being stored. Contact surfaces and equipment used for storage have been reported to be significant contamination sources that also enormously reduce the shelf life of food commodities (Murray *et al.*, 2017). It is crucial to keep the storage facility clear of other contaminants such as human or animal faecal matter that could be introduced through dirty storage bins, contaminated storage racks or by human traffic (Commission, 2003). Storage rules (separating meats from fresh produce, separating cooked foods from uncooked, storing meats in the bottom shelves) must always be observed to prevent cross-contamination. External contaminants, such as the presence of animals within the proximity of the cold storage facilities, could also serve as a hazard (Brown, 2015).

Food storage challenges tend to differ between formal and informal food retailers. With formal retail, the main challenges comprise following standard operating procedures/guidelines on how different produce should be stored, what needs to be separated from what and at which temperature food should be kept (Seaman & Eves, 2006; Trafialek *et al.*, 2017). Usually, food handlers in the formal sector undergo food safety instruction before they can be entrusted with the role of storing food. In the informal sector, however, besides a lack of exposure to training, street vendors do not have access to proper storage spaces for their produce (Masonganye, 2010). Skinner (2020) finds that street vendors stock fruits and vegetables that will sell in a few days to avoid the stress associated with storage space and the theft of their merchandise. Some are even forced to leave their produce in their stalls out in the street overnight, possibly only covered by boxes (Skinner, 2008b; Wills, 2009). These challenges could subject fresh produce not only to damage, but also to contamination, which puts consumers at risk for foodborne diseases (Hazards, Ricci, Allende, Bolton, Chemaly, Davies, Fernández Escámez, Girones, Herman & Koutsoumanis, 2018).

2.2.7 Food safety regulations and reported outbreaks in South Africa

The Food and Agriculture Organisation (FAO) defines food safety regulations as food laws governing food production, trade, and handling, thus protecting consumers from unsanitary practices that could lead to food contamination (Marías & Glasauer, 2014). Food safety in South Africa is regulated under the Department of Health (DOH) and the Department of Agriculture, Forestry and Fisheries (DAFF) in collaboration with the Department of Trade and Industry, which holds the jurisdiction over the South African Bureau of Standards (SABS) (Gordon-Davis, 2010; Khuluse, 2016:32). The DAFF department is responsible for the production, marketing, and distribution of agricultural (fresh produce) and animal products (meat, poultry, dairy and products). In contrast, the Department of Health is responsible for ensuring that all foodstuffs are safe for human consumption with regard to food cosmetics and disinfection. At the same time, the Department of Trade and Industry controls the trade of canned foods (Gordon-Davis, 2010). These three departments work in collaboration to ensure that the public is protected by reducing foodborne disease incidences, protecting consumers from food adulterations and providing strong regulatory support for domestic and international trade (Gordon-Davis, 2010).

Currently, Regulation 638 (R638) of June 2018 is used to regulate general hygiene and food premises (as shown in Table 2.1), the transport of food, and related areas as provided under the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act no.54 of 1972) (Jackson, 2018). These regulations apply to more informal establishments such as supermarkets, grocery stores or restaurants. Street vendors (as part of the informal sector), however, are governed using city trading bylaws⁷ in South Africa, which unfortunately do not regulate food hygiene, but rather the manner of trade and related activities, prohibiting trade outside demarcated areas (Bénit-Gbaffou, 2015; Pieterse, 2017). Despite these laws highlighting how street vendors should conduct their businesses in the open street (how they should observe reasonable distances between pavements and individual buildings or businesses, and that street vendors are always responsible for cleaning and keeping the streets hygienic), it neglects to stipulate or regulate street vendors' hygiene and compliance to general food safety standards (City of Johannesburg, 2012).

The Municipality of Gauteng, however, seems to have identified a gap regarding the absence of food safety regulations in informal trading and, as a result, has engaged in means to decentralise information on the regulations governing hygiene and sanitation in food handling through training (Von Holy & Makhoane, 2006). Similar to other countries, mobilising vendors to get training is always a challenging (sometimes impossible) activity, thus limiting efforts to those with permanent trading locations such as those working from municipal vending markets (Bénit-Gbaffou, 2018; Masonganye, 2010).

⁷ Bylaws are defined as regulations that are usually put in place by local authorities, such as a community or a municipality (Pieterse, 2017).

Table 2.1: Food Hygiene Regulation R638

REGULATION NO: R638 FOODSTUFFS, COSMETICS AND DISINFECTANTS ACT, 1972 (ACT NO.54 OF 1972)	
Standards and requirements of food premises	<p>*These standards state that food may not be handled anywhere else than the food premises that have been approved to meet the regulations.</p> <p>*Food premises must be of a location (dust-free, non-toxic), design, construction (not have open seams and joints), finish (easy to clean, smooth) and furniture in a way that supports the purpose that it was intended for.</p> <p>*Premises must have a wash-up facility with the option of hot and cold water and a few latrines and urinal stalls.</p> <p>*It must be pest and insect-proof.</p> <p>*It must have storage space for hygienic storage and the cleaning of refuse containers.</p> <p>*A room where food is handled may not have a direct connection to any areas where gas, fumes, dust, offensive odours, or any impurities that may lead to contamination are present.</p>
Standards and requirements for facilities on food premises	<p>*The surfaces of table counters or food-handling surfaces, utensils or basin of unwrapped foods should be made of rust-proof, non-toxic and non-absorbent material.</p> <p>*Food handling utensils and equipment must not be used if they are not clean and sanitized, or are cracked or chipped.</p> <p>*Utensils must be stored under hygienic conditions and must always be cleaned before and after handling food.</p> <p>*Refrigerators, freezers, and cold storage must always be provided with a thermometer to detect the storage temperature of perishables.</p>
Standards and requirements for display, storage, and temperature of food	<p>*Food that is displayed or stored must not be in direct contact with the floor, ceiling, wall or any ground surface.</p> <p>*Shelves used for displaying or storing food must always be kept clean and free of dust and any other impurities.</p> <p>*Food that is not packed before storage must be protected by following the best available method against droplets, insects, dust, or bare hands contamination.</p>
Standards and requirements for protective clothing	<p>*A person may not handle or be allowed to handle food without wearing proper protective clothing.</p> <p>*Protective clothing must always be clean and neat before and during food handling and must never touch the food being handled to prevent cross-contamination.</p> <p>*People visiting food premises must always be in protective clothing.</p>
Duties/standards and requirements of a food handler	<p>*Food must not be handled by a person</p> <ul style="list-style-type: none"> ✓ Whose hands or clothes are not clean (hands must be washed thoroughly with soap and water after blowing their nose, visiting latrine or after touching a handkerchief, refuse container or money). ✓ Whose fingernails are not short, trimmed, and free from any decoration. ✓ Who have sores, cuts, abrasions, or any infected skin lacerations. ✓ Who have reported suffering from a contagious disease or condition that may be transmitted through food.

2.2.8 Reported outbreaks in South Africa

In South Africa, foodborne outbreaks are generally under-reported, leading to a lack of documentation (Bisholo, Ghuman & Haffejee, 2018; Smith, Gouws, Hoyland, Sooka & Keddy, 2007). It was indicated in a review of reported outbreaks from the National Institute for Communicable Diseases (NICD) that between January 2013 and December 2017, South Africa experienced 327 foodborne outbreaks, causing 11,155 illnesses, 8,680 hospital visits, 494 hospital admissions and 49 deaths (Shonhiwa, Ntshoe, Essel, Thomas & McCarthy, 2019). Most of these outbreaks occurred during the warmer seasons of the year in all the provinces of the country, with pathogens such as *Salmonella* species, *Escherichia Coli* species, *Clostridium Perfringens* and *Listeria monocytogenes* being the most implicated. In February 2018, South Africa experienced the most endemic outbreak, which was due to *Listeria Monocytogenes*, that claimed the lives of 183 South Africans within a few months (WHO, 2018). Although unfortunate, this outbreak has probably changed the way in which consumers, and the country at large, view the importance of food safety, leading to them being a more alert and involved consumer base.

It is unfortunate, however, that since the implicated food products were mostly sold in the formal sector, nothing much changed in the informal sector concerning food safety regulations. Food safety regulations were reviewed for the formal sector after the outbreak, emphasising hygiene and sanitation (Jackson, 2018). The biggest concern was that although informal traders use cold meats the most when preparing meals for their consumers, they were not treated as a possible food safety hazard and relevant awareness in the sector was not created (Wilkinson, 2018). Overlooking the significance of street food in foodborne outbreaks continues to leave consumers vulnerable to food poisoning/foodborne illness.

Looking at past documented outbreaks (Bisholo *et al.*, 2018; Niehaus, Apalata, Coovadia, Smith & Moodley, 2011; Ntshiqqa, Mpangane, Mpambane & Moshime, 2016; Sekwadi, Ravhuhali, Mosam, Essel, Ntshoe, Shonhiwa, McCarthy, Mans, Taylor & Page, 2018), one would argue that perhaps the informal sector is not a food safety concern since most outbreaks in the country are associated with the formal sector. It is unfortunate that unless there is an outbreak (e.g. listeriosis) associated with a sector, not much attention is paid hence the neglect of the informal sector. This sector poses a significant food safety hazard due to the conditions

of the environments where food is prepared, which tends to lack the proper infrastructure that would support hygiene and sanitation (Gamielien & Van Niekerk, 2017).

2.2.9 Fresh produce and its perishable characteristics

The consumption of fresh produce is highly recommended to curb the health issues associated with processed foods (Lucan, Maroko, Shanker & Jordan, 2011). In many countries, several health campaigns ('go for 2&5' in Australia, 'go for 5' in the US, '6 a day' in Denmark; 'food dudes' in the UK and '5-A-DAY' in South Africa) have been run to promote the consumption of fruits and vegetables over the past decades, which have effectively changed how consumers respond to healthy eating (Heaton & Jones, 2008; Rekhy & McConchie, 2014). The term 'fresh produce' is a common word for fruits and vegetables, which are defined as herbaceous plants whose leaves, stems, roots, tubers, seeds, and flowers can be partially or wholly eaten (Labensky *et al.*, 2015:566). Vegetables can be classified into nine groups, namely: cabbages or the *Brassica* family, fruit-vegetables, gourds and squashes, greens, mushrooms and truffles, onions, pods and seeds, roots, and stalks. Fruits, alternatively, can be divided into eight groups, namely: berries, citrus, exotics, grapes, melons, pomes, stone fruits and tropical (Labensky *et al.*, 2015). Fresh produce is often promoted, mostly because of its indigestible substances such as cellulose and fibre (which aids in the reduction of chances of heart-related diseases and Type 2 Diabetes among other health benefits) and the high percentage of water, which accounts for fewer calories as associated with healthy diets (Dhall, 2013; Labensky *et al.*, 2015). Despite the health benefits gained from the characteristics such as high water percentage, it is also unfortunate to note that these same characteristics (and in particular the water content) contribute towards fresh produce's limited shelf life, i.e. perishability and ultimate susceptibility in terms of food safety issues.

2.2.9.1 Perishability of fresh produce

It is believed that fresh produce is at its peak quality when harvested. Unfortunately, what happens next not only greatly influences the shelf-life of the product but also its susceptibility in terms of food safety concerns. Mahajan *et al.* (2013) note that harvested produce is metabolically active, undergoing ripening and senescence processes that must be controlled to prolong the quality. It can therefore be deduced that inadequate management (i.e. storage, handling and preparation) of these processes can result in not only losses in nutritional and

quality attributes but also outbreaks of foodborne pathogens and financial loss for all players along the supply chain, i.e. farm to fork. The following section will briefly discuss three main aspects (water content, respiration, and ethylene) that were identified as relevant within the scope of this study.

(a) Water content

Fresh produce is made up of a significant amount of water (between 60 - 95%) and other related water-soluble materials cushioned by a semi-permeable membrane and cell wall. Together, these determine the appearance of produce in terms of size and shape (mainly in fruits) and gives most vegetables their crisp and fibrous texture (Barrett, Beaulieu & Shewfelt, 2010; Labensky *et al.*, 2015). The water content in fresh produce determines its freshness, serving as its selling point. The more fruits and vegetables lose their water content, the faster they deteriorate, thus reducing the market value.

Naturally, most fresh produce has a waxy cuticle that resists the loss of moisture; however, this cuticle is often disturbed during post-harvest practices, thus exposing the produce to moisture loss (Yeoshua, 2005). For this reason, moisture loss becomes inevitable as the produce goes through the metabolic processes (such as ripening in fruits) that prepares them for consumption (Becker & Fricke, 1996).

(b) Transpiration and respiration

The process in which fresh produce loses its water content is referred to as transpiration (Hawladar, Perera & Tian, 2006; Nunes & Emond, 2007). This process is usually due to respiration where the carbohydrates (i.e. sugars) in fruits and vegetables oxidise to produce carbon dioxide, water and heat (Tano, Kamenan & Arul, 2005). This happens post-harvest where mature fruits, for instance, start ripening. In vegetables, unfortunately, this process initiates their deterioration if not stored at controlled temperatures (Becker & Fricke, 1996). Depending on the type of produce, transpiration and respiration will result in visible changes in colour, texture, turgidity, firmness and reduced weight in fresh produce, which in fruits will be indicated by shrinking or wrinkling and wilting in leafy vegetables (Kang & Lee, 1998). These changes sometimes lead to reduced market value and may contribute to food waste, especially in instances where fresh produce spoils (Adams & Brown, 2007; Opara & Pathare,

2014). To avoid losses due to these essential processes, Becker, and Fricke (1996) instruct that respiration in fresh produce must occur under controlled conditions, such as in temperature-controlled rooms. These will allow suppliers and retailers to have control over which produce is ready to be released to the market based on demand and availability (Wani, Gul & Singh, 2018; Yeoshua, 2005). These smart food storage systems ensure that we have food all year round.

Fresh produce, if not correctly handled, can be subjected to several defects such as bruising and cuts. These encourage the growth and multiplication of foodborne-causing microorganisms, raising food safety concerns. Controlled storage that discourages the growth of such organisms is therefore advised. It is unfortunate, however, that only formal retailers can afford to incur such costs, something that may not be possible for street vendors (Ghatak & Chatterjee, 2018; Maseko, Mabhaudhi, Tesfay, Araya, Fezzehazion & Plooy, 2018). This shortfall makes fresh produce sold in the street vulnerable, not only to sped up transpiration and respiration, but also to food safety-related issues that could arise from uncontrolled storage temperatures (Louw, Geysler, Madevu & Ndanga, 2006).

(c) Ethylene

Ethylene, a natural plant hormone that is released in the form of gas by some fruits and vegetables, has also been noted as a contributing factor towards fresh produce perishability (Brecht, 2019). While other fruits and vegetables are high producers of ethylene, some are sensitive to it (see Table 2.3 below). The goal in the management of fresh produce is to extend its shelf life as far as possible, thus it is vital to understand which crops are ethylene producers in order to separate them from other crops during storage (Harrison, Critzer & Wszelaki, 2015; Silva, 2008).

While ethylene is richly known for its disadvantages, this gas can be used to speed up the ripening process of other crops such as avocados (Silva, 2008). If the goal is not to ripen other crops, mindful storage arrangements must be made to avoid ethylene-induced ripening, senescence and other undesirable effects (Brecht, 2019).

Table 2.2: Ethylene producers VS Ethylene foods (Nutritionyoucantrust, 2020)

Ethylene - Producing fresh produce	Ethylene - Sensitive foods
Apples	Asparagus
Ripe bananas	Bananas (unripe)
Figs	Broccoli
Grapes	Blackberries
Green onions	Brussel sprouts
Mango	Cabbage
Nectarines	Carrots
Peaches	Cauliflower
Passion fruit	Chard
Pear	Cucumbers
Plums	Eggplant
Potatoes	Garlic
Tomatoes	Green beans
kiwi	Kale
	Lettuce
	Onions
	Peas
	Peppers
	Raspberries
	Spinach
	Squash
	Strawberries
	Sweet potatoes
	Watermelon

While the separation of ethylene producing crops from those sensitive to ethylene may be relatively easy for formal traders, it might not be a simple task for street vendors. Apart from low educational levels, street vendors do not have access to a large amount of storage space, both in their stalls during business hours and at home. Vendors are forced to keep their merchandise under their tables, which automatically means that some products will be in close enough proximity to be affected. If produce ripens faster, it becomes vulnerable to spoilage, which, if it has affected a high number of fruits and vegetables, street vendors will inevitably sell at lower costs. Since the clientele of vendors is vulnerable, they are most likely going to buy and consume foods that could put them at risk for foodborne illnesses.

2.2.10 Food safety concerns in fresh produce trading

Fresh produce's implication in foodborne illnesses has increased over the years globally (Gregoire, 2013). In the United States, it was reported that 23% of all foodborne outbreaks between 1996 and 2010 were produce related, 10% in Europe between 2007 and 2011, and 4% in Australia between 2001 and 2005 (Alegbeleye *et al.*, 2018). Besides its vulnerability due to its highly perishable nature, fresh produce is subject to different types of contamination throughout the trading cycle. According to Gregoire (2013), contamination is the presence of harmful substances in food that may be naturally present, caused by humans or the environment.

Leafy vegetables, for instance, are subjected to the highest risk during production over other vegetables such as roots and bulbs due to their edible leaves' exposure to direct contact with the soil and irrigation water. The ability to peel and core root and bulb vegetables before preparation and consumption reduces their chances of being implicated in outbreaks, an advantage that leafy vegetables do not have. Concerning fruits, soft fruits (such as plums, nectarines and peaches), together with those from the berry family are also considered a high contamination risk since they are not suitable for rigorous washing or cleaning for fear of losing visual quality (Quansah, Gazula, Holland, Scherm, Li, Takeda & Chen, 2019). In a study that consolidated the results of peer-reviewed articles on fresh produce-related outbreaks in developed countries, leafy green vegetables were reported to have caused 51.7% (295 out of 571 outbreaks) produce-related outbreaks between 1980 and 2016, while berries accounted for 27.8% of all reported disease cases (20,260 out of 72,855). The remaining cases were divided between other fruits and vegetables such as tomatoes, onions, celery, melons and mangoes, amongst others (Machado-Moreira, Richards, Brennan, Abram & Burgess, 2019).

Several causes might have contributed to the implication of fresh produce in foodborne outbreaks in trade, some that could be produce-related and others trade-related. The next section will discuss in detail the possible contaminants regarding product and trade.

2.2.10.1 Produce-related concerns

Naturally, fresh produce is susceptible to three different types of contamination throughout its life cycle (biological, chemical and physical) (Payne-Palacio & Theis, 2016). Regardless of the

nutritional value associated with fresh produce, if contaminated, it poses a hazard to its consumers. Contamination is inevitable in environments with fewer food safety control measures put in place, such as in street vending. This could come about in the following ways:

- **Biological contamination:** this refers to a hazard introduced to food through living creatures or organisms such as human beings, animals, pests, and microorganisms (Payne-Palacio & Theis, 2016:97). This includes viral contamination, bacterial contamination and/or parasite contamination that could be transferred through any human body excretions, e.g. saliva or faecal matter, pest droppings and/or blood. Contamination can occur at any stage in the farm to fork chain, i.e. cultivation/production, harvesting, washing/processing, distribution, retail or in the consumer's kitchen (Murray *et al.*, 2017). During production, possible biological contaminants may include the use of organic fertilisers such as animal manures and slurries, irrigation water that may be contaminated by sewage effluent, or the use of untreated wastewater and soil, which naturally contain pathogens (Heaton & Jones, 2008). Leafy vegetables such as lettuce, spinach, and cabbages, among others, are the most affected crops from the farm, especially during the irrigation process or through soil deposits splashed onto the crop during rainy days (Machado-Moreira *et al.*). A lack of hygienic practices that include reducing the microbial load through the washing of hands and the produce itself has propagated the problem, hence the implication of most food handlers in foodborne outbreaks as vehicles of contamination (Bartz, Lickness, Heredia, de Aceituno, Newman, Hodge, Jaykus, García & Leon, 2017). It is therefore not a surprise to learn that fresh-cut produce has a higher microbial risk compared to whole produce due to the improper handling and storage practices to which they are usually subjected (Hussain & Gooneratne, 2017).
- **Chemical contamination:** this may be defined as the deliberate or non-deliberate addition of chemicals to food either as a measure to protect food from microbial infestation, prolong the shelf life or add value, e.g. additives meant to improve the appearance of food (Hussain & Gooneratne, 2017; Rather, Koh, Paek & Lim, 2017). In production, for instance, the use of chemicals is mandatory to ensure the growth of healthy crops in a microbially controlled environment (Rajwar, Srivastava & Sahgal, 2016). Chemical contaminants in fresh produce are sometimes naturally occurring, e.g.

allergens (weeds), mycotoxins, alkaloids, and mushroom toxins. However, the most harmful ones are those that are usually associated with agricultural productions (e.g. pesticide sprays) and post-harvesting handling (contact with metals in transportation, contact with sanitisers and other chemicals, car fumes and air pollution) (Beharielal, Thamaga-Chitja & Schmidt, 2018; Kaczmarek, Avery & Singleton, 2019). Fresh produce that may be contaminated by chemicals instantly puts consumers at risk for foodborne illnesses (Kaczmarek *et al.*, 2019; Payne-Palacio & Theis, 2016).

- **Physical contamination:** this is contamination that occurs when foreign material is physically introduced into the food, such as glass chips, enamel dish chips, staples from packaging materials or shavings from cans, dust, hair and nails, amongst many others (Gregoire, 2013; Payne-Palacio & Theis, 2016). Food is likely contaminated in this way during the post-harvest handling of fresh produce, e.g. packaging, processing, and preparation (Kotzekidou, 2016).

Fresh produce sold in the open air by street vendors is subjected to all the contaminants mentioned above. Street vendors may biologically contaminate fresh produce immediately after sourcing them from their suppliers. This could be as a result of poor hygiene and sanitation. Most fruits and vegetables (depending on the source) do not come pre-packaged, which means that street vendors have to sort and package them before selling to their clientele. This process could present chances for both biological (poor hand washing regimes may result in faecal contamination) and physical contamination (things such as dust, hair, dirt may come into contact with the produce) to occur (Bartz *et al.*, 2017). Chemical contamination could occur through car fumes, considering that street vending is predominantly in proximity to high levels of traffic, and not all produce is sold in packaging that could keep produce clear of fumes (Beharielal *et al.*, 2018). It is therefore vital that street vendors be capacitated with knowledge before venturing into business so that they are well-informed and equipped to protect their consumers from these aspects, which could result in foodborne illnesses.

2.2.10.2 Trade-related concerns

It is important to note that despite the above-mentioned product-related attributes and concerns, the quality of fresh produce is quintessentially affected by the knowledge, attitudes and

ultimate practices (i.e. handling, preparation and storage) presented by supply chain stakeholders, in this case, street vendors.

(i) Knowledge

Knowledge refers to the synthesis of factual information and the capacity to practice through routine, habits and behaviours in light of a phenomenon (which in this study relates to food safety) (Nickols, 2000; O'Malley, 2009). For individuals to be capacitated with knowledge, traditionally, they have to undergo training (Bolisani & Bratianu, 2018). This means that in order for street vendors to be capacitated with expert knowledge on food safety issues relating to the trade of fresh produce, they must undergo training. In the literature, street vendors are generally reported to discredit the value of training programmes, mostly treating it as an option, not a necessity (Nkrumah-Abebrese & Schachtebeck, 2017). This, therefore, raises trade-related concerns, as the lack of knowledge on how to keep fresh produce safe for human consumption has resulted in an increase in foodborne outbreaks associated with produce (Machado-Moreira *et al.*, 2019).

Street vendors are often reported to present a lack of knowledge on issues relating to the safe storage of food, an aspect that is very important in the fresh produce trade (Haileselassie *et al.*, 2013; Mukherjee *et al.*, 2018). The most significant gap is in terms of temperature control during storage, with most foods being held in ambient temperatures (Rane, 2011). Concerning fresh produce, ambient temperatures could present the perfect conditions for respiration and transpiration, which, if allowed to occur uncontrolled, will devalue the produce and possibly lead to spoilage if not consumed immediately. In scenarios where fresh produce is accidentally damaged, e.g. with bruises or slight cuts, ambient temperatures can allow microorganisms to grow and multiply, deeming that fruit or vegetable a hazard. The lack of knowledge regarding these topics when selling fresh produce thus serves as a huge concern.

(ii) Attitudes

As learnt in the literature, the type and amount of knowledge an individual has are likely to determine the type of attitudes towards and their practices relating to food safety. Attitudes are defined as the thought process that individuals go through regarding a phenomenon, which leads to feelings of favour or disfavour towards the subject matter (Bohte *et al.*, 2009). It is essential to ascertain the types of attitudes individuals have when dealing with fresh produce

to predict their practices. Street vendors seem to *think* that food safety is not their responsibility, regardless of them preparing and selling food to a significant number of consumers daily (Baş, Ersun & Kıvanç, 2006; Mjoka & Selepe, 2017). This assumption (Khairuzzaman, Chowdhury, Zaman, Al Mamun & Bari, 2014) implies that food safety is not likely considered a priority by most street vendors. One could conclude that perhaps the lack of resources directed into street vending in developing countries could have exacerbated such feelings for street vendors; however, their failure to recognise themselves and their practices (which result in a negative attitude) as a hazard say otherwise (Aluh & Aluh, 2017; Ayub *et al.*, 2017; Mukherjee *et al.*, 2018). Practices, therefore, usually result from feelings of favour or disfavour, which may lead to either positive or negative results depending on the amount and type of knowledge and attitudes an individual has relating to a phenomenon (Chaudhary *et al.*, 2010).

(iii) Practices

Improper practices could result from a lack of resources and infrastructure in the informal sector, as discussed in earlier sections. Regardless of the source, these can affect the trade of fresh produce. With a lack of knowledge of food safety (which includes handling, preparation, and storage), fresh produce remains vulnerable to different sources of contamination (Khairuzzaman *et al.*, 2014). Most reports from the literature have identified the lack of hygiene and sanitation as the most prevalent factor amongst all street vendors (Abdalla *et al.*, 2009; Chukuezi, 2010; Trafialek *et al.*, 2017). Proper hygiene reduces the occurrence of diarrheal diseases in general. Diarrhoea may occur due to the faecal contamination of foods, which is mainly brought about by poor personal hygiene, which includes but is not limited to hand washing regimes. In street vending, the trade of fresh produce involves a lot of sorting and packaging to enable competitive and value-based pricing. This essential exercise serves as a window for cross-contamination, especially in the absence of reliable water sources that would encourage frequent hand washing and cleaning of holding and display utensils (Steyn & Labadarios, 2011).

Another issue in the trade of fresh produce in street vending is the lack of proper storage infrastructure, which leads to poor storage practices (Willemse, 2011). As mentioned earlier, the perishability of fresh produce is dependent on how it is stored. Due to the remote nature of street vending (especially since it is a business run by people of poor capital and investment

backgrounds), produce that is not on display is usually stored on crates or boxes in the stalls and are thus exposed to high temperatures during the day (Aluh & Aluh, 2017; Lubos, 2014; Samapundo *et al.*, 2016). This is because few vendors have access to temperature-controlled storage spaces during business hours, and some even leave their produce exposed to the external environment overnight (Masonganye, 2010). During this time, fresh produce goes through a lot of changes, some of which involve metabolic changes that could potentially ruin the quality of the produce despite the good state it arrived in from the supplier (Mahajan, Caleb, Singh, Watkins & Geyer, 2014). The lack of storage space means fresh produce can also be exposed to physical damage such as bruising, which may initiate the rapid growth of microorganisms, exposing consumers to foodborne illnesses.

It is therefore evident that paying attention to knowledge, attitudes and practices is essential to curb hazards in the trade of fruits and vegetables.

2.3 CONCLUSION

This chapter aimed to introduce the theoretical model used to guide the discussion in this study (the KAP Model). A brief overview of street vending as a global and local phenomenon was provided, as well as a discussion regarding the types of vendors and their profiles in South Africa. The literature on the South African food trade was explored, including the trade of fresh produce in street vending. Food safety was extensively addressed in terms of its definition, regulations and outbreaks in South Africa. Food safety concerns in the trade of fresh produce, especially in street vending was also discussed in this chapter.

In the following chapter, the conceptual framework, research objectives and methodology will be presented and examined.

CHAPTER 3 CONCEPTUAL FRAMEWORK, RESEARCH OBJECTIVES, AND METHODOLOGY

In this chapter, the research design, aim, and objectives of the study are presented. The methods that were followed and the conceptual framework of the study are further explored.

3.1 INTRODUCTION

In this chapter, the research design followed in this study and the methodology are presented and explained. The conceptual framework, which was developed based on the theory that guided discussions of this study (KAP) is discussed in terms of the aim, objectives, and operationalisation thereof. The sampling method, which includes the study area, unit of analysis, sampling technique, measuring instrument and data collection process is discussed. In order for a study to be deemed valid and reliable, certain measures need to be taken. The steps taken to ensure validity, reliability, and ethical adherence in this study are also discussed in this chapter.

3.2 RESEARCH DESIGN

The research design of a study is defined as the framework of methods executed by the researcher to give a logic flow towards responding and handling a research problem (Sileyew, 2019). It provides a guide on how to conduct research, highlighting the type of data that needs to be collected, the sampling plan, the method of collecting data and how the data will be analysed (Wiid & Diggins, 2009). The objectives of the study usually determine which research design is best suited for each study (Kumar, 2014), thus making explorative-descriptive the most suitable design for this study. Using both exploratory and descriptive research designs is inevitable when little information is available on a specific phenomenon, as was the case in this study.

To date, street vendors' food safety knowledge, attitudes, and practices have received limited attention (yet they remain a weak link in foodborne outbreaks), highlighting the need for this research (Ma, Chen, Yan, Wu & Zhang, 2019b). Due to the lack of information pertaining to this topic, this investigation was empirical in nature. Empirical research generally measures a

phenomenon's information from definite experience rather than theory, beliefs or speculations. It further aims to understand the phenomenon from data obtained through the participants' senses, either directly (through observation) or indirectly (through their behaviour, practices or experiences) (Wagner, Kawulich, Garner & Botha, 2012). As a result, the KAP model was identified as a possible instrument to aid the investigations in this study. This model, as discussed in the literature review, is a quantitative method usually used in situational analysis which provides access to the characteristic traits of a sample and explains relationships in numerical form (Christensen, Johnson & Turner, 2015:46; du Monde, 2016; Salkind, 2010).

Descriptive research can be conducted in a longitudinal or cross-sectional manner. Longitudinal research involves repetitive measurement of the same sample on different occasions over a predetermined period (Kumar, 2014). The data collection in this study, however, focused on a specific sample at a given point in time, thus making the study cross-sectional. This approach allowed the researcher to gain a snapshot of the sample, reflecting on the street vendor's current food safety knowledge, attitudes and practices when managing fresh produce.

Cross-sectional research, as stated by Salkind, (2010), is usually richly used in studies that make use of surveys, which is typical for most KAP studies. This study followed a quantitative approach. The primary data were collected using a semi-structured questionnaire that was administered face-to-face with the assistance of data enumerators (Gumucio *et al.*, 2011; Lavrakas, 2008).

3.3 CONCEPTUAL FRAMEWORK

A conceptual framework is a researcher's synthesis of the main concepts and variables of the literature guiding the study, which seeks to explain the interrelations between the main concepts (Regoniel, 2015). It gives a pictorial map of how the investigations of a study can be pursued to reach the main aim and objectives. Regarding the KAP (Knowledge, Attitudes and Practices) Model, the conceptual framework in this study, as shown in Figure 3.1, was drawn.

This framework assumes that knowledge, attitudes, and practices are interrelated and work together to achieve food safety.

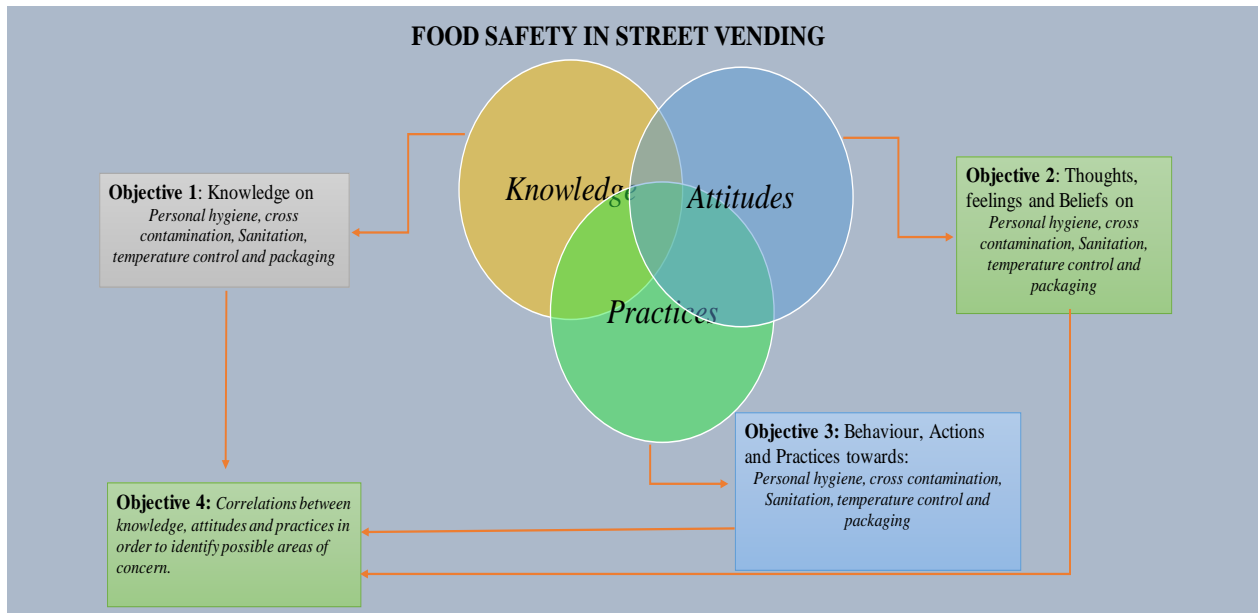


Figure 3.1: Conceptual Framework (Baser *et al.*, 2017)

In the absence of proper knowledge on food safety, street vendors are likely to have negative or less than favourable attitudes, which could result in improper practices (Baş *et al.*, 2006; Nee & Sani, 2011). It can also be assumed that adequate food safety knowledge that is not translated into positive attitudes and practices is irrelevant, thus exposing consumers to food contamination, possibly leading to foodborne illnesses. In some instances, the street vendor may have a positive attitude towards food safety, however, without the appropriate knowledge on the phenomenon they may not be able to translate it into positive practices that could potentially prevent food contamination (Abdullah Sani & Siow, 2014).

Knowledge, attitude and practices together determine the degree to which food safety can and is achieved, driving the need for Objective 4. This objective seeks to determine the strength of the relationship among the three dimensions of this model (KAP), if there is any. This was done to give us a clear perspective on properly defining food safety in the context of street vendors in Tshwane.

3.4 RESEARCH AIM AND OBJECTIVES

This study aimed to investigate the food safety knowledge, attitudes, and practices of street vendors in Tshwane when managing fresh produce. The objectives set out in this research are as follows.

1. To investigate and describe street vendors' knowledge pertaining to fresh produce.

- 1.1. To investigate and describe street vendors' food safety knowledge pertaining to fresh produce handling.
- 1.2. To investigate and describe street vendors' food safety knowledge pertaining to fresh produce preparation.
- 1.3. To investigate and describe street vendors' food safety knowledge pertaining to fresh produce storage.

2. To investigate and describe Tshwane street vendors' attitudes towards food safety.

- 2.1. To investigate and describe street vendors' attitudes towards food safety when handling fresh produce.
- 2.2. To investigate and describe street vendors' attitudes towards food safety when preparing fresh produce.
- 2.3. To investigate and describe street vendors' attitudes towards food safety when storing fresh produce.

3. To investigate and describe Tshwane street vendors' current food safety practices when managing fresh produce.

- 3.1. To investigate and describe Tshwane street vendors' current food handling practices when managing fresh produce.
- 3.2. To investigate and describe Tshwane street vendors' current food preparation practices when managing fresh produce.

4. To integrate empirical evidence pertaining to street vendors' KAPs in order to set an evidence-based scene for practical and policy-related recommendations that aim to enhance current food safety protocols amongst street vendors.

3.5 Conceptualisation of main concepts

The conceptualisation of main concepts refers to the breaking down of research concepts into common meanings to clarify what they are being used for in the research (Sequeira, 2014). This section highlights the definitions of the common concepts used in this study.

Food safety

Food safety can be defined as the practices that ensure that food does not cause any harm to the consumer (Lawley *et al.*, 2012; Motarjemi & Lelieveld, 2014). According to Lawley *et al.* (2012), food safety can be achieved by protecting the food supply from harmful contamination, preventing the development and spread of harmful contaminants, and the effective removal of contamination. This may be achieved through proper food handling practices to prevent contamination (Gregoire, 2013). In this study, the WHO meaning will be adopted, which defines food safety as the handling, preparation and storing of food to prevent foodborne infections.

Food handling practices

Food handling practices refers to hygienic practices put in place to prevent food's microbial growth and cross-contamination (Payne-Palacio & Theis, 2016). It involves hygiene practices, e.g. personal cleanliness, wearing proper work attire, and following hand hygiene practices and sanitation (Gregoire, 2010; Gregoire, 2013). According to Payne-Palacio and Theis (2016), sanitation is the process of reducing potentially harmful microorganisms to the same level on food contact surfaces, while cleaning refers to the removal of visible dirt from food contact surfaces and utensils.

Cross-contamination

Gregoire (2013) defines cross-contamination as the transferral of microorganisms from one food product to another or from the surface to food due to improper food handling practices. Examples may include the chopping boards used for raw meats being used to prepare fresh produce or using dirty chopping boards or food holding utensils.

Food preparation practices

Food preparation practices refers to food handling practices that include ensuring that fresh produce is clean before preparation and that the methods used in the preparation of fresh produce do not promote contamination (Payne-Palacio & Theis, 2016). This may include the pre-cutting of fresh produce before selling it, the packaging of fresh produce, the use of chopping boards for cutting, and the temperature at which the fresh produce is cooked.

Food storage practices

These are food handling practices that involve correct temperature controls, checking labels for expiry and sell-by dates, and keeping raw food separate from cooked food in refrigerators (Payne-Palacio & Theis, 2016). Proper storage practices should avoid cross-contamination and should be mindful of time and the packaging material used, as well as pest control (Gregoire, 2010).

Contamination

According to Gregoire (2013), contamination is the presence of harmful substances in food that may be naturally present, caused by humans or the environment. These can be categorised into biological, physical, or chemical.

Foodborne pathogens

This refers to virus, microorganisms or other substances that cause disease (Gregoire, 2013).

Foodborne infection

This is an infection caused by high loads of bacterial cells carried by food into the gastrointestinal tract (Gregoire, 2013). This can be caused by microorganisms such as bacteria, moulds, viruses, parasites, and algae (McWilliams, 2009). It is thus recommended to wash hands after handling meats and before handling fresh produce or ready-to-eat food.

3.5 METHODOLOGY

The methodology described in this section explicitly encompasses the study area, unit of analysis, sampling technique, and how the measuring instrument was formulated for this study.

3.5.1 Study areas and unit of analysis and sampling

The unit of analysis refers to who the study seeks to investigate, and it is usually the first thing the topic identifies. In this study, the unit of analysis was street vendors. This study only focused on street vendors who sold a variety of commonly consumed fruits and vegetables (fresh produce) in Tshwane who were above the age of 18. The study was inclusive of both male and female respondents/participants of diverse nationalities trading around Tshwane. In

terms of merchandise, this study excluded street vendors whose main commodities in their stalls were freshly cooked meals, ready-to-eat meals or beverages. Hence, the participants were restricted to vendors who mainly sold fresh produce commonly consumed in South Africa.

As mentioned in the literature review, street vendors are divided into mobile and stationary vendors; both groups were approached to participate in this study. A sample size of at least 150 street vendors was set for this study; however, after seeking consent from 250 street vendors to participate in the study, by the end of the study, the researcher only managed to reach and successfully collect data from 183 street vendors within the Tshwane municipality.

3.5.2 Sampling technique

Convenience sampling was used to reach the respondents that participated in this study. This sampling technique involved the selection of convenient, easily accessible, and available individuals that suited the description of the target population (De Vos, 2011). Convenience sampling was used together with snowballing, a selection approach that involves the identification of those who meet the criteria of the target group, and referrals of others alike are thereafter sought and approached for participation in the study (De Vos, 2011).

Although both these sampling techniques may be considered biased and not inclusive of the rest of the population, they are deemed best suited for complicated and sensitive studies such as this one where participation is not guaranteed. For the purposes of this study, five areas that are considered street vending hotspots around Tshwane were visited for sampling, with the entry point being Marabastad. This area was considered a convenient and reliable place where street vendors with diverse languages and personalities were to be reached, hence it was also used to pilot the study.

Most of the street vendors in this area (Marabastad) were eager to participate in the study. Still, unfortunately, some did not meet the inclusion criteria but were able to help with referrals in terms of possible participants that did meet the selection criteria. Subsequently, this resulted in approaching street vendors from Atteridgeville, Sunnyside, Bosman, Pretoria's Central Business District (CBD), and Mamelodi. The Pretoria CBD was found to have the highest number of street vendors, as shown in Figure 3.2, thus quite a number of participants were sampled from there.



Figure 3.2: Map of Tshwane

3.5.3 The measuring instrument

The process of formulating a measuring instrument for a KAP study involves defining objectives; selecting appropriate and essential scale items/questions; and adapting questions to fit the study's objectives and local context (Marías & Glasauer, 2014). Appropriate measuring scales are mandatory. To measure knowledge in a KAP study, open/close-ended questions may be used with response options designed using relevant Likert-type scales (Flynn & Goldsmith, 1999; Marías & Glasauer, 2014). Attitudes can be measured using four methods, namely: single-item measure; evaluative semantic differentials; Likert scaling; and measures of attributes of importance (Bohte *et al.*, 2009). To measure practices, yes or no questions and Likert-type frequency scales may be used (Rebouças, Santiago, Martins, Menezes, Araújo & de Castro Almeida, 2017; Samapundo *et al.*, 2016; Webb & Morancie, 2015).

A semi-structured questionnaire made up of close-ended, three-point, Likert-type scales was used to collect data for this study (level of agreement (to measure knowledge), level of feelings (to measure attitude) and level of frequency (to measure practices). Kumar (2014) highlights that quantitative studies are usually prearranged and organised in terms of what data needs to be collected and how, while qualitative does not have to be so specific but must have a framework encompassing the issues to be discussed. The questionnaire used in this study was designed to collect quantitative data.

To develop the measuring instrument based on the KAP survey' requirements, relevant and established studies were consulted to select appropriate and suitable scale items. These studies included those of Campbell, (2011), Foluke (2015), Lin and Sneed (2003), Majowicz, Hammond, Dubin, Diplock, Jones-Bitton and Re (2017), Mjoka and Selepe (2017), Mukherjee, Mondal, De, Misa and Pal (2018), Pivarnik, Richard, Patnod and Gable (2012), Thanh (2015) and WM (2015). The selection and elimination of scale items for inclusion in the measuring instrument were subject to the dimensions highlighted to be relevant to this study (food handling, preparation, and storage). Not all of the scale items that were previously used in food safety studies are a good fit for all studies; thus, great care was taken in the choice of adaptable scale items that best addressed the objectives of this study (Fautsch Macías *et al.*, 2014). The structure and phrasing of questions pertaining to the respective KAP sections (knowledge, attitudes and practices) were also carefully considered in order to enhance and simplify data collection and the ultimate comparison of results. Please refer to Table 3.1 for a presentation of the general layout of the questionnaire, and Table 3.2 for more detail on the operationalisation thereof.

A cover letter was attached to the final draft of the questionnaire, which stated the purpose of conducting the study and elaborated on the definition of voluntary participation. The participants were asked to sign the cover letter as a sign of consented participation.

Table 3.1: Sections of the measuring instrument

SECTIONS	DESCRIPTION
Section A	This section collected general demographic data that helped in characterising street vendors who sold fresh produce. It sought to investigate the gender of the participants, their age, country of origin, level of education, profit made from street vending and the kinds of produce they sold.
Section B	This section investigated the street vendors' knowledge pertaining to fresh produce. A three-point Likert-type scale measuring the level of agreement was used, and statements were coded from one to three where one indicated 'definitely true' and three indicated 'Definitely False'. The relevant studies (Campbell, 2011; Foluke, 2015; Lin & Sneed, 2003; Majowicz, Hammond, Dubin, Diplock, Jones-Bitton, Rebellato & Leatherdale, 2017; Mjoka & Selepe, 2017; Mukherjee <i>et al.</i> , 2018; Pivarnik, Richard, Patnoad & Gable, 2012; Thanh, 2015; WM, 2015) were consulted when formulating the scale items for this section, and those that addressed the aim and objectives of this study were adapted and utilised.
Section C	This section investigated street vendors' attitudes towards food safety, using a three-point Likert type scale measuring the level of feeling. The responses were coded from one to three, where one indicated 'does not describe my feelings' and three indicated 'clearly describes my feelings'. The same studies that were consulted when formulating the scale items to measure knowledge were used to select scale items for attitudes. The questions used in these sections were almost the same, however, they were phrased differently in order to measure the KAP.
Section D	This section investigated the street vendors' current food safety practices when managing fresh produce. This was done using a three-point Likert type scale measuring the level of frequency where one indicated 'never' and three indicated 'always'. As with attitudes, the scale items used to measure practices in this study were kept similar to those used to measure knowledge. This was done so as to best determine the correlations between the street vendors' knowledge, attitudes, and practices.

Table 3.2: Operationalisation table in terms of objectives, concepts, dimensions, and statistical methods

Objectives	Construct	Dimensions	Indicators	Data collection	Measurement	Data Analysis
Objective 1 1. To investigate and describe street vendors' knowledge pertaining to fresh produce.	Food safety knowledge	Food handling knowledge.	Knowledge on: Personal hygiene, cross-contamination, sanitation, washing fresh produce, cutting fresh food, cooking temperatures, temperature control, expired produce, produce separation, refrigeration, and animal control.	Structured interview	Section B Questions 1.1-1.18	Descriptive statistics ANOVA
Food preparation knowledge.						
Food storage knowledge.						
Sub-objective 1.1 To investigate and describe street vendors' food safety knowledge pertaining to fresh produce handling.		Food handling Knowledge	Knowledge on: Personal hygiene; Cross-contamination; and Sanitation.	Structured interview	Section B Questions 1.1-1.6	Descriptive statistics ANOVA
Sub-objective 1.2 To investigate and describe street vendors' food safety knowledge pertaining to fresh produce preparation.		Food Preparation knowledge	Knowledge on: Washing fresh produce; Cutting fresh produce; Fresh produce packaging; Cross-contamination; and Cooking temperatures.	Structured interview	Section B Questions 1.7-1.12	Descriptive statistics ANOVA
Sub-objective 1.3 To investigate and describe street vendors' food safety knowledge pertaining to fresh produce storage.		Food storage knowledge	Knowledge on: Temperature; Expired produce; Produce separation; Refrigeration; Animal control.		Section B Questions 1.13-1.18	



Objectives	Construct	Dimensions	Indicators	Data collection	Measurement	Data Analysis
Objective 2 To investigate and describe Tshwane street vendors' attitudes towards food safety.	food safety attitudes	Food handling attitudes; Food preparation attitudes; and Food storage attitudes.	Thoughts, feelings, and beliefs on: Personal hygiene, cross-contamination, sanitation, washing fresh produce, cutting fresh produce, fresh produce packaging, cooking temperatures, temperature control, expired produce, produce separation, refrigeration, and animal control.	Structured interview	Section C Questions 2.1-2.18	Descriptive statistics ANOVA
Sub-objective 2.1 To investigate and describe street vendors' attitudes towards food safety when handling fresh produce.		Food handling attitudes	Thoughts, feelings, and beliefs on: Personal hygiene; Cross-contamination; and Sanitation.	Structured interview	Section C Questions 2.1-2.6	Descriptive statistics ANOVA
Sub-objective 2.2 To explore self-reported food safety attitudes of street vendors in Tshwane regarding fresh produce.		Food preparation attitudes	Thoughts, feelings, and beliefs on: Washing fresh produce; Cutting fresh produce; Fresh produce packaging; Cross-contamination; and Cooking temperatures.	Structured interview	Section C Questions 2.7-2.12	Descriptive statistics ANOVA
Sub-objective 2.3 To investigate and describe street vendors' attitudes towards food safety when storing fresh produce.		Food storage attitudes	Thoughts, feelings, and beliefs on: Temperature; Expired produce; Produce separation; Refrigeration; and Animal control.		Section C Questions 2.13- 2.18	Descriptive statistics ANOVA



Objectives	Construct	Dimensions	Indicators	Data collection	Measurement	Data Analysis
Objective 3 To investigate and describe Tshwane street vendors' current food safety practices when managing fresh produce.	Food safety practices	Food handling practices; Food preparation practices; and Food storage practices.	Practices towards: Personal hygiene, cross-contamination, sanitation, washing fresh produce, cutting fresh produce, fresh produce packaging, cooking temperatures, temperature control, expired produce, produce separation, refrigeration, and animal control.		Section D Questions 3.1-3.18	Descriptive statistics ANOVA
Sub-objective 3.1 To investigate and describe Tshwane street vendors' current food handling practices when managing fresh produce.		Food handling practices	Practices towards: Personal hygiene; Cross-contamination; and Sanitation.		Section D Questions 3.1-3.6	Descriptive statistics ANOVA
Sub-objective 3.2 To investigate and describe Tshwane street vendors' current food preparation practices when managing fresh produce.		Food preparation practices	Practices towards: Washing fresh produce; Cutting fresh produce; Fresh produce packaging; Cross-contamination; and Cooking temperatures.		Section D Questions 3.7-3.12	Descriptive statistics ANOVA
Sub-objective 3.3 To investigate and describe Tshwane street vendors' current food storage practices when managing fresh produce.		Food storage practices	Practices towards: Temperature; Expired produce; Produce separation; Refrigeration; and Animal control.		Section D Questions 3.13-3.18	Descriptive statistics ANOVA
Objective 4 To identify underlying correlations between street vendors' Knowledge, Attitudes, And Practices (KAP) in order to present possible areas of concern.						

3.6 DATA COLLECTION

Globally, KAP studies have been widely used in the health sector to either measure the extent of a situation; enhance knowledge, attitudes, and practices around specific health areas (e.g. HIV, Diabetics and others); establish a baseline to use in future assessments; or to suggest intervention strategies that are specific to local settings (du Monde, 2011, 2016; Mariás & Glasauer, 2014). In this study, the KAP data were used to gather information on a topic that has not been sufficiently presented and studied in this country (street vendors' food safety knowledge, attitudes, and practices). This was done with the purpose of identifying gaps and areas of concern. Data collection in KAP studies is most appropriate before the start of any activity to help describe the context of a predetermined intervention; during the implementation in order to identify a way forward; and at the end of a programme to monitor changes in behaviour (du Monde, 2016:9; Fautsch Macías *et al.*, 2014).

The data collection process usually involves the training of surveyors or field workers and assigning qualified supervisors. Thereafter, the identification of the sample (which most of time involves non-random sampling techniques) and the documentation of all interviewed households and individuals to allow for follow up interviews or monitoring is carried out (Fautsch Macías *et al.*, 2014:39-45; Mariás & Glasauer, 2014). Most of these studies follow the longitudinal approach (du Monde, 2011, 2016). However, this study slightly differed from what has been done previously in most KAP studies

Data collection in this study was done in a single phase using structured face-to-face interviews. A structured interview, according to Kumar (2014), involves face-to-face interactions with the participant guided by prearranged questions. Structured interviews were used to maintain the objectivity of the study by avoiding leading explanations because, unlike unstructured interviews, this method maintains uniformity and does not require much interviewing expertise. This method also helps the researcher to gain insight into the participants' feelings and attitudes, something which directs and guides the discussion of results (Salkind, 2010).

Eight field workers were recruited to support the data collection process in this study and were supervised by the primary researcher. When selecting data enumerators or field workers for a KAP study, it is essential to give preference to those who can read, write and speak carefully,

people who have experience in a similar line of work, have excellent listening skills and are sensitive to cultural issues (Fautsch Macías *et al.*, 2014). The field workers selected for this study were second- and third-year students at the University of Pretoria and were native speakers of the different South African languages. The representation of all the languages helped encompass the diversity of street vendors and meant that there were no communication barriers. These underwent a two-day training session facilitated by the primary researcher. During this training, the field workers were introduced to the objectives of the study, the content of the questionnaire (highlighting food safety principles, the study's dimensions, and the types of street vendors), and administering the questionnaire. They were made aware of the importance of the manner of approach employed since studies conducted on street vendors are usually culturally sensitive and unpredictable.

Pilot testing of the instrument was done on the second day of training. Although field workers role-played face-to-face interviews during the first day of training, pilot testing the questionnaire exposed them to the reality of the work they were expected to do. This exercise was done on 20 respondents where each field worker selected and interviewed at least two respondents. This exercise also enabled the researcher to identify questions that needed revision and simplifying. After attending to the glitches detected during this (piloting) exercise, the researcher and the field workers set out to resume the data collection, which took a week.

Data collection commenced on the 19th of November 2018 and was concluded on the 23rd of the same month. This exercise began the morning of each day. The participants were conveniently sampled and introduced to the aim and objectives of the study. The field workers were first tasked with seeking informed consent from potential participants to participate in the study. Some of the street vendors who met the selection criteria were hesitant to participate (especially those from outside South Africa), while others were generally distracted and busy with setting up for the day. The field workers' dress code (University of Pretoria printed shirts) assured the prospective participants that the study was purely for educational purposes and could not be associated with any formal authority. The word spread across the sampled area about the ongoing study, thus facilitating voluntary participation in other areas.

To adhere to cultural ethics, the respondents were requested to identify their native language from the 11 official languages in South Africa. A field worker with the relevant language sets

was then assigned to those interviews. Each field worker asked the questions as they were written, however, since the study instrument was semi-structured, the field workers had the option of offering explanations of what each question required while guarding against leading the participants to certain responses. The field workers were responsible for recording the participants' responses to the paper-based questionnaires, which had designated response options (see addendum A). Although the instrument consisted of only closed-ended questions that measured quantifiable data, the field workers were requested to write down next to the questions any helpful explanations, discussion, or further comments made by the participants during the interviews. This was done in an attempt to understand the sample and their responses better.

The challenge experienced during the data collection process was the time set for the daily interviews to commence. The team preferred to start in the morning (between 7:00-8:00 am) to avoid busy trading hours. Although the respondents did not have to attend to a lot of customers during that time, they were busy setting up their stalls for the day and between 11:00 and 13:00 they had to attend to their customers. To avoid uncompleted interviews, the field workers sometimes found themselves helping vendors set up their stalls or pausing interviews to allow them to attend to their customers. This act of kindness established a good rapport and caused the respondents to appreciate the value of the study, and were thus patient enough to finish the interviews.

3.7 DATA ANALYSIS

The data collected through paper-based questionnaires were captured electronically via the online survey database Qualtrics. The questionnaire was re-designed in this database and the responses of each physically completed questionnaire were entered electronically by the primary researcher. This database makes it easy for researchers to conduct and share surveys, track response progress and can (together with SPSS) be used for analysis. Through Qualtrics, it was easy for the researcher to track response frequencies regarding scale items of interest, which made drawing preliminary conclusions effortless. After the data entry exercise was completed, the data were cleaned and made ready to use for analysis in SPSS. The data were later cleaned (by checking for errors, spelling mistakes, identifying missing variables and

assigning precise labels to scale items) and used to run descriptive statistics in the Statistical Package for the Social Sciences (IBM SPSS, version 25). Frequencies were used to analyse categorical variables like demographics, and the results are presented in terms of graphs, histograms, and pie-charts.

The data analysis on section B (food safety knowledge), C (food safety attitudes) and D (food safety practices) involved the summing up of responses to get mean scores that would allow for the interpretation of the results based on the set objectives. For section B, a sum of responses was established by calculating individual means in percentage values where a mean <50% indicated poor food safety knowledge, 50 to < 60 % average; 60 to <70% above average; 70 to < 80% good; 80 to = < 90% very good; and $\geq 90\%$ excellent food safety knowledge. To analyse the respondents' attitudes (section C), individual responses were assigned codes (1-3), and the codes were used to calculate the means for each scale item. These means were thereafter interpreted in the following manner: a mean value that was $\leq 1 - 1.8$ indicated negative food safety attitudes; $\geq 1.9 - 2.4$ indicated moderate attitude and $\geq 2.5 - 3$ indicated positive food safety attitudes. The same method was used to analyse practices, where means $\leq 1 - 1.8$ indicated that the respondents 'never' applied the practice, $\geq 1.9 - 2.4$ indicated that they 'seldom' practiced, while $\geq 2.5 - 3$ indicated that the respondents 'always' applied those practices.

This was then followed by Analysis of Variance tests (ANOVAs) and respective post-hoc tests to identify possibly significant differences within the sample. Furthermore, t-tests were used to determine significant differences within gender groups. In order to complete the one-way ANOVAs, each respondent was assigned an average score for Knowledge, based on all the scale items pertaining to knowledge, an Attitude score based on all the scale items linked to attitude, and a Practices score based on all the scale items linked to practices. These scores ranged between one to three, where one was indicative of the lowest level of knowledge, attitude, or practice. However, a higher numeric score was indicative of a high or good level of knowledge, poorer attitude or inferior practices. The data were subjected to several tests to first establish whether all the assumptions for the ANOVA analysis were met.

In terms of Objective 4 (to identify underlying correlations between street vendors' knowledge, attitudes, and practices in order to present possible areas of concern), a Pearson's Correlation was used to analyse potential relationships amongst food safety knowledge, attitudes and practices (KAP) using SPSS (version25).

3.8 DATA QUALITY VALIDITY AND RELIABILITY

3.8.1 Validity

Validity, according to Kumar (2014), is the ability to establish that an instrument measures what the researcher has set it to measure, as stated in the aims and objectives of the study. Ivankora (2014) explains it as the degree to which an instrument can measure what it has been predetermined to measure for appropriate analysis. In this study, validity was measured through construct and content validity.

3.8.1.1 Construct validity

Construct validity is a measure of whether the instrument makes sense in terms of its underlying theory. It involves a review of the relevant literature and choosing relatable variables (De Vos, Delpont, Fouché & Strydom, 2011). In this study, construct validity was achieved through an extensive review of the literature, and scale items were adapted from other published studies that presented similar characteristics.

3.8.1.2 Content and face validity

Content validity is mostly concerned with how adequate the content or scale items are. It seeks to evaluate if the content in the instrument best represents the meanings of the concepts as per conceptual definitions. In contrast, face validity has to do with the mere appearance or face value of the measuring instrument. It can be achieved by superficial face judgement of whether the instrument looks right. Content validity, alternatively, can be achieved through the judgements of other researchers and experts in the field being investigated (De Vos *et al.*, 2011). Content validity involves a critical review of the content and the scale items, while face validity is concerned with whether it looks like it can measure what it sets out to measure. Content validity and face validity can be done in one go.

Content and face validity in this study were achieved using an academic panel and food safety experts from the Faculty of Agriculture and Natural Sciences at the University of Pretoria who reviewed the instrument before application for ethical clearance. This panel of experts validated the content and adjustments were made where needed until consensus was reached.

3.9 RELIABILITY

Reliability is defined as the capacity of a research tool to produce the same results or responses from different respondents. “If a research tool is consistent and stable, hence predictable and accurate, it is said to be reliable” (Kumar, 2014:168). Stability in a research tool can be achieved by giving the same questionnaire or interview to different groups of people to complete (Fox & Bayat, 2007). To obtain reliability in this study, a pilot test was conducted on a small sample of respondents prior to the performance of the full-scale research. This was done to identify any problems such as unclear statements and wording, evaluate the feasibility of the study, as well as the duration, cost and avoid adverse events before officially conducting the research (Fox & Bayat, 2007).

3.10 ETHICS

The participants involved in a study must be protected, thus an evaluation of the study needs to be conducted to make sure it complies with the set ethics. De Vos (2011) defines ethics as an acceptable set of principles and morals expected from a researcher towards study respondents. They seek to make sure that the research is carried out acceptably, and that the respondents are not violated in any way. Ethics further seek to make sure that the study participants are protected from harm, and are aware of the expectations of the study and the intentions associated with their participation. They must be assured of the researcher(s)’ discretion and that they can always choose to withdraw from the study at any time.

This study sought and was granted ethical clearance by the University of Pretoria’ Ethics Committee (**EC 180327-172**). The participants’ confidentiality and anonymity were considered and respected in this study. A consent form explaining the aims and purposes of this study was attached to the questionnaire. The participants’ rights were communicated to them, and they were aware that they could discontinue their participation at any time they felt

uncomfortable. They were given the platform to ask for clarification wherever they deemed fit to do so. Their names were kept anonymous and were not requested for identification in the instrument. The participants were asked for their signature as part of their consent to participate.

3.11 CONCLUSION

In this study, suitable research and data collection methods were carefully chosen, and the execution thereof was successful within the allocated budget. The study was conducted cross-sectionally using 183 conveniently snowballed respondents from five areas around Tshwane. A semi-structured questionnaire was used for data collection, which aimed to quantify responses using a three-point Likert-type scale (level of agreement to measure knowledge, level of feelings to measure attitudes, and level of frequency to measure practices). Varying educational backgrounds among vendors were considered and provided for using field workers who natively spoke the different South African languages during the data collection process.

The data collection was conducted in a way that ensured the quality of the data, observing the implementation of reliability and validity throughout all the processes of the study. Ethical clearance was sought from the Ethics Committee at the University of Pretoria. Moreover, ethical guidelines were implemented to ensure the quality of the study. Chapter 4 presents the results and discussions of the study in light of the objectives set for the investigation.

CHAPTER 4 RESULTS AND DISCUSSIONS

This chapter presents the demographic characteristics of the sample, followed by an interpretation of the results obtained.

4.1 INTRODUCTION

A discussion of the results is provided in accordance with the research objectives formulated. The demographics presented in this chapter not only assisted in profiling the sample, but were also used in furthering the interpretation of the results based on the objectives set. Discussions of the results will commence with street vendors' knowledge of food safety in terms of food handling, food preparation, and food storage. This will be followed by a discussion of the street vendors' attitudes towards food safety, concluding with the street vendors' actual food safety practices. For the purposes of this study, 183 (N=183) interviews were conducted on the selected street vendors. These interviews were guided by a semi-structured questionnaire that was administered by a team of bilingual field workers.

4.2 DEMOGRAPHICS AND ADDITIONAL DESCRIPTORS OF THE SAMPLE

This study had a total sample of 183 (N= 183) street vendors. In this section, components such as the demographics and related attributes are explored and delineated in order to interpret and set the unique characteristics for the sample. The participants' gender, age, level of education, and country of origin formed part of the demographics of this study. These were accompanied by other questions that aimed to understand and describe the sample. These included questions such as asking if the participants had vending stalls, the amount of profit they made monthly and if they had a second source of income. Figure 4.1 below summarises the profile of the sample in this study.

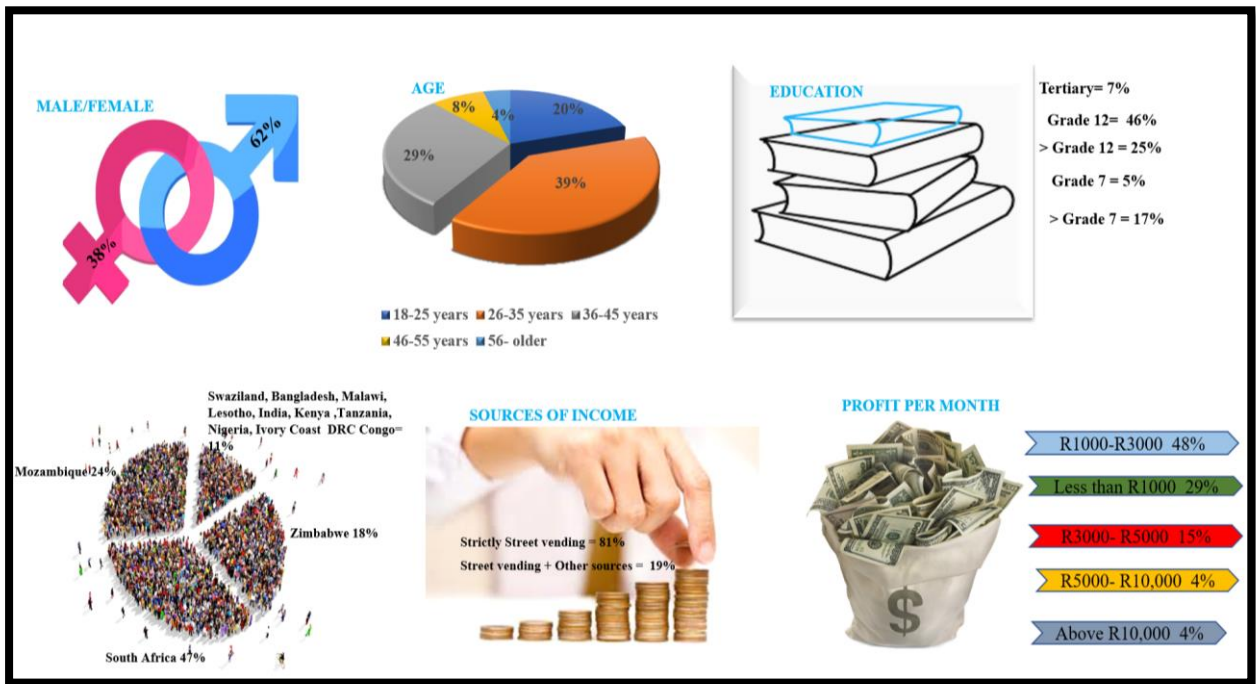


Figure 4.1: Visual summary of the demographics of the sample

4.2.1 Gender distribution

The findings regarding gender distribution indicated that more than half of the sample 62.0% (n = 113) were males, while females made up 38.0% (n = 70) of the total sample. These results were quite surprising as street vending has been widely reported in the literature as a female-dominated sector (Abdalla *et al.*, 2009; Apanga *et al.*, 2014; da Silva, Cardoso, Góes, Santos, Ramos, de Jesus, do Vale & da Silva, 2014). Street vending is often reported as a sector that enables women to juggle between family life and the generation of an income that provides for their family's needs (Thakur, Narula, Rathi, Midha, Sharma, Rehman, Verma, Kesar, Vinay & Baweja). This might be a result of gender equality initiatives put in place not only in South Africa, but in Africa as a whole which has afforded women equal chances to compete with their counterparts for other employment opportunities besides street vending and domestic work, as was the case in the past. It was therefore fascinating to realise that this study indicated that in Tshwane, it was mostly men who identified street vending as not only a lucrative business opportunity, but also often as their main source of income. While we celebrate gender equality and mainstreaming, these results do raise some concern as a study done in Kenya reports that women as street vendors tend to be much more careful when it comes to ensuring

food safety as compared to men (e.g. 68% of the women were more concerned about food safety while the majority of men were not) (Muinde & Kuria, 2005).

4.2.2 Age distribution

In order to participate in the study, the participants had to be 18 years and older. All of the participants were asked to specify their age as per their last birthday in an open-ended question. These were then grouped into five categories for the purpose of statistical analysis (see Figure 4.2). The results indicated that most of the participants (39%) were between the age of 26 and 35, followed by 36-45 years (29%), 18-25 years (20%), 46-55 (8%) years and the minority being 56 and older (4%).

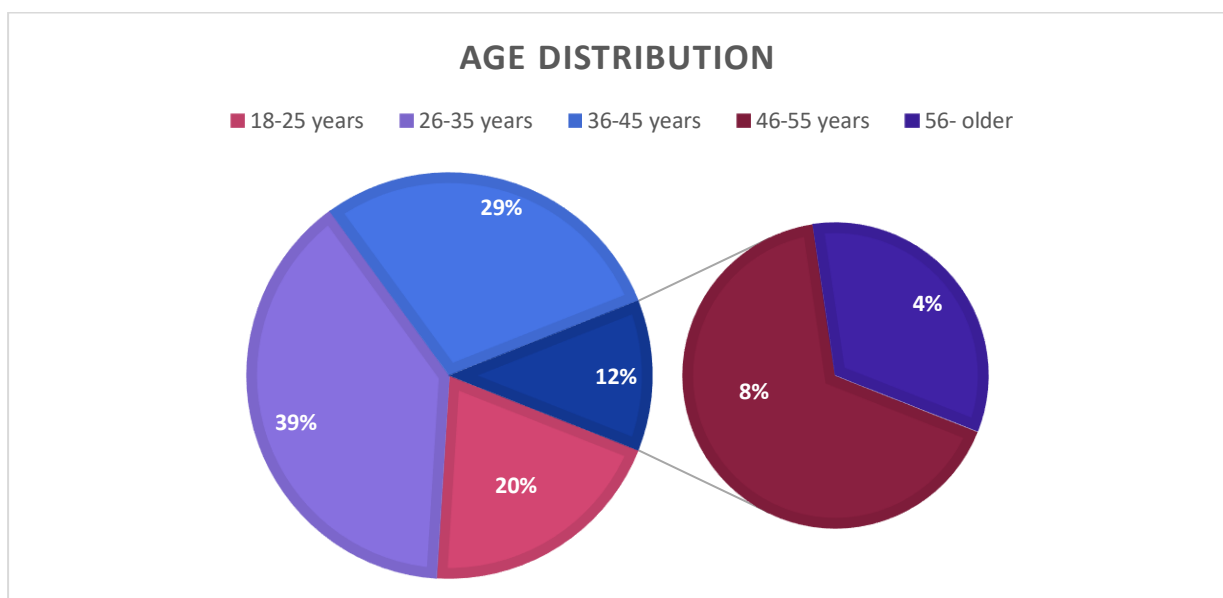


Figure 4.2: Age distribution of the participating street vendors

These results suggest a mean of 34.5 years, which indicates that in Tshwane, the younger population (18-35 years) is mostly involved in street vending as compared to older generations. These results are in line with reports made by Stats SA in 2019 that unemployment in South Africa is most prevalent between the ages of 15 and 34, hence leading the youth to temporal income generation strategies, with street vending being one of those opportunities (Stats SA, 2019).

4.2.3 Country of origin

It has been reported that the increase in street vending is due to migration and urbanisation both in developed and developing countries (Sariffuddin, Wahyono & Brotosunaryo, 2017). The participants were therefore requested to indicate their countries of origin in an open-ended question. The findings suggest that the respondents originated from 13 different countries with less than half of the sample (47%) originating from South Africa (see Table 4.1 below).

Table 4.1: Participants' country of origin

Country of Origin	N	Percentages %
South Africa	86	47 %
Zimbabwe	32	18%
Mozambique	43	24 %
Congo	1	0.5%
Malawi	8	4.4%
Swaziland	1	0.5%
Lesotho	1	0.5%
India	1	0.5%
Bangladesh	2	1.1%
Tanzania	3	2 %
Ivory coast	1	0.5%
Kenya	1	0.5%
Nigeria	1	0.5%

The intensity of urbanisation is thus quite well supported with reference to the results above. This was furthermore highlighted by the results collected through conversation, which revealed that of the 47% that are South African citizens, only a few of the respondents were natively from Tshwane. Further investigation revealed that most moved to Tshwane from other provinces in the hope of better chances and employment. These results support those found in other studies such as that of Skinner (2008), which note that urbanisation has contributed profusely to street vending in Africa and globally.

4.2.4 Level of education

The results from the level of education question (as shown in Figure 4.3) indicated that 46.4% of the sample were matriculants (successfully graduated Grade 12), 25% had high school education but did not reach Matric/Grade 12, 17% had Grade 7 certificates, 17% had not

finished their primary school education, and only 7% of the sample had gone to college or university.

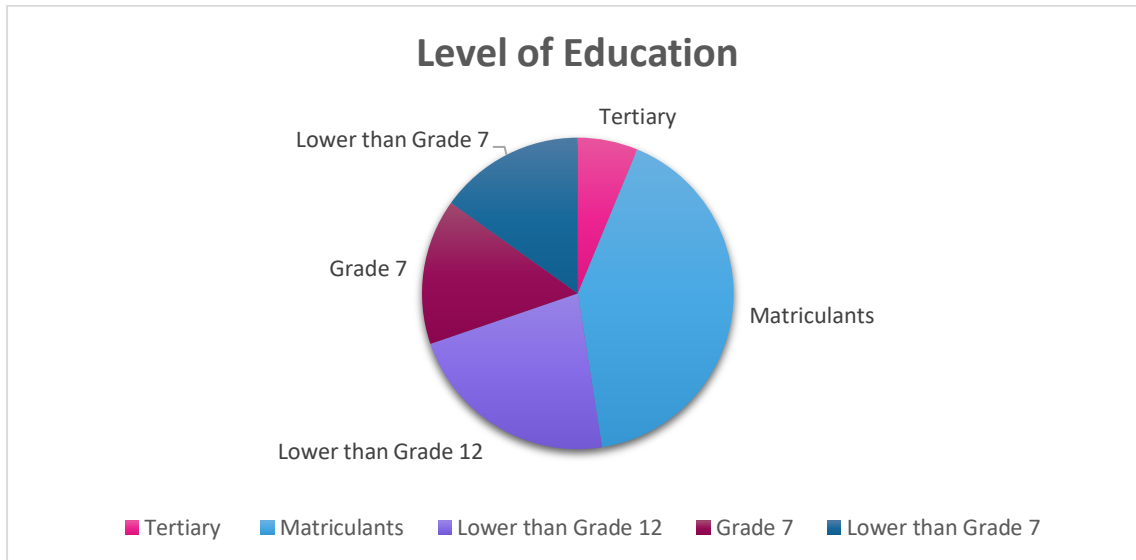


Figure 4.3: Level of knowledge

These results support the results of a study done Nkrumah-Abrese and Schachteck (2017) where they profiled street vendors in Tshwane. They reported that 67% of their participants had matriculated, while 30% had a tertiary qualification, with only 3% who had no form of education. Although the percentages in the current study are slightly lower than theirs, this shows that most Tshwane street vendors have basic education, unlike the reports from other countries. It is therefore assumed that a lack of education is perhaps not the primary factor contributing to street vending, but rather a lack of lucrative employment opportunities. It is important to acknowledge that these results (i.e. level of education) could assist in interpreting the data on the respondents' food safety knowledge, attitudes and practices. The researcher was thus interested to observe whether the respondents' level of education had significance in terms of their food safety KAP, i.e. does one's level of education determine one's understanding of food safety issues? This would highlight the need for efforts to be directed towards specifically training people in food safety practices no matter their educational background.

4.2.5 Vending location in Tshwane

Street vending in Tshwane, as indicated by the results of this study, is concentrated in the Central Business District (CBD) of Pretoria, accounting for 40% of the participants. This was followed by Marabastad (16%), Bosman (15.8%), and Sunnyside (14%). These results clearly show the effects of urbanisation in the country. When people move from rural settlements, they usually move to the centre of a chosen town in the hopes of better employment opportunities. Since urbanisation is high in South Africa (65%) compared to other countries such as China (54%), India (32%) and Nigeria (47%) (Plecher 2019), the majority of people who have moved to urban areas to get work find themselves unemployed, thus reverting to street vending.

4.2.6 Street vending as a profitable income

To find out how much profit is made from street vending monthly, the participants were asked to indicate the amount they made from three profit ranges (less than R1000, between R1000 - R3000, R3000 - R 5000, R 5000 - R10,000 or above R10,000). As indicated in Figure 4.4, 29% of the sample made less than R 1000 in profits monthly from street vending, less than half (48%) of the respondents managed to make between R1000 - R 3000 per month on average, 15% between R3000 and R5000, 4% between R5000 - R10,000 and 4% above R10,000.

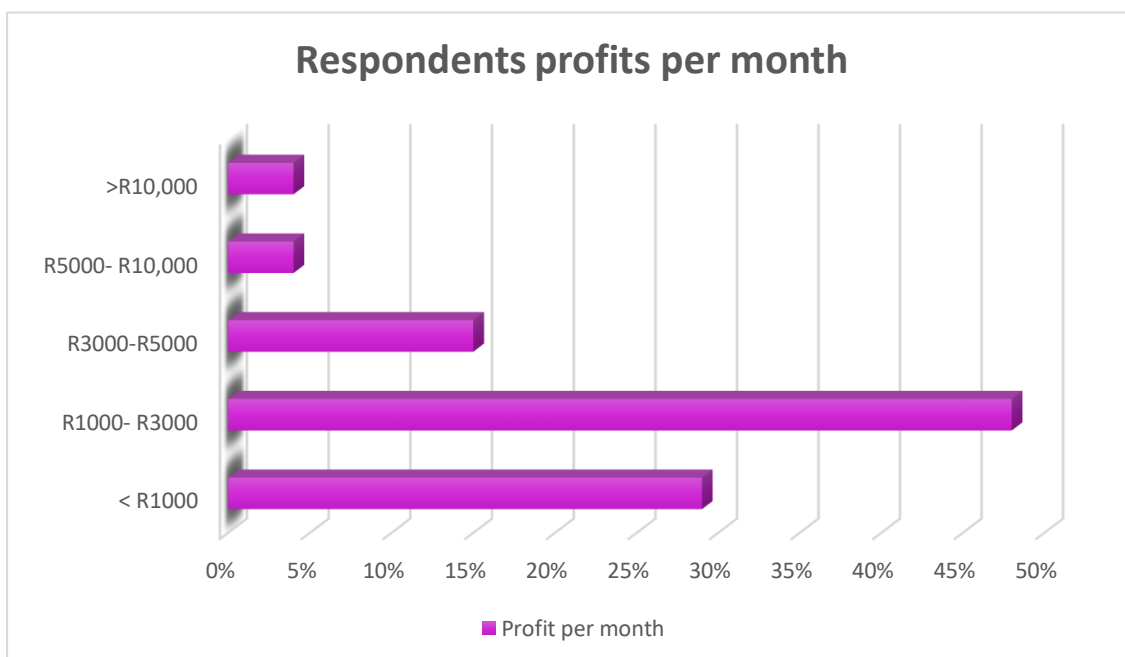


Figure 4.4: Monthly income generated from street vending

4.2.2 Other sources of income

To find out if street vendors had other sources of income other than street vending, they were asked to respond to a yes/no question on whether they had a second source of income. The results for this question indicated that 81% of the respondents relied solely on street vending as a main source of income, while 19% had an alternative/complementary source of income. These results may be used to support the assumptions made about street vending being a temporary financial solution until a more desired employment opportunity is available. It was, however, interesting to note that some (less than 5%) respondents stated that they were pursuing street vending as a primary career as it was their dream job.

4.2.3 Type of street vendor (stationary or mobile)

Street vending is often defined in terms of its mobility (Bhowmik, 2005). In order to determine the category in which the vendors fell under, the respondents were asked if they had a fixed or mobile stall. Owning a stall indicates sustainability and compliance with the municipal bylaws (Masonganye, 2010). Street vendors that have a designated area where they work daily are less likely to have unwanted issues like those experienced by mobile street vendors, e.g. eviction or having their goods confiscated. The findings revealed that 80% of the participants met the criteria of being stationary vendors compared to the rest (20%) who were therefore defined as mobile.

4.2.7 Fresh produce sold by street vendors

Over the years, fruits and vegetables have been implicated in several foodborne illness outbreaks globally (Callejón *et al.*, 2015b; Herman *et al.*, 2015; Sivapalasingam, Friedman, Cohen & Tauxe, 2004). This has come as a result of improper production and post-harvest handling and preparation practices (Beharielal *et al.*, 2018; Duvenage & Korsten, 2017; Newman, Bartz, Johnston, Moe, Jaykus & Leon, 2017). It is also true that different types of fruits and vegetables have been implicated in these outbreaks. Thus, in order to not only investigate food safety knowledge, attitudes, and practices, but also the types of fruits and vegetables sold in street vending, as an area of concern, the respondents were asked to list the types of fresh produce they predominately had in their stalls daily. Seasonality, as a factor in

the fresh produce market, raised some concern as it influenced the products available at the time of data collection and, ultimately, the results. Nonetheless, the participants were provided with a detailed list of possible fresh produce options irrespective of their seasonality. They were then asked to tick what they had available in their stalls at the time of data collection (between the 26th of November and 7th of December 2018).

With regard to the popularity of fruits sold by street vendors, the results, as presented in Figure 4.5, revealed that out of 183 street vendors who participated in this study, most of them sold bananas (n=84), apples (n=82), tomatoes (n=67), pears (n=61) and oranges (n=56) respectively, among others. These results indicate that most of the participants took advantage of the crops in season, which could potentially explain how street vendors always manage to sell affordable commodities (Lucan, Maroko, Bumol, Varona, Torrens & Schechter, 2014). Other crops, such as those from the citrus family and bananas are somehow available almost throughout all seasons in the country, helping street vendors to maintain their affordable service delivery. Labaniya and Labaniya (2010) mention that South Africa is one the biggest exporters of traditional ‘winter’ fruits such as Valencia oranges, star rubies and grapefruits, which could potentially explain the year-round availability of citrus fruits in the country (Ladaniya & Ladaniya, 2010).

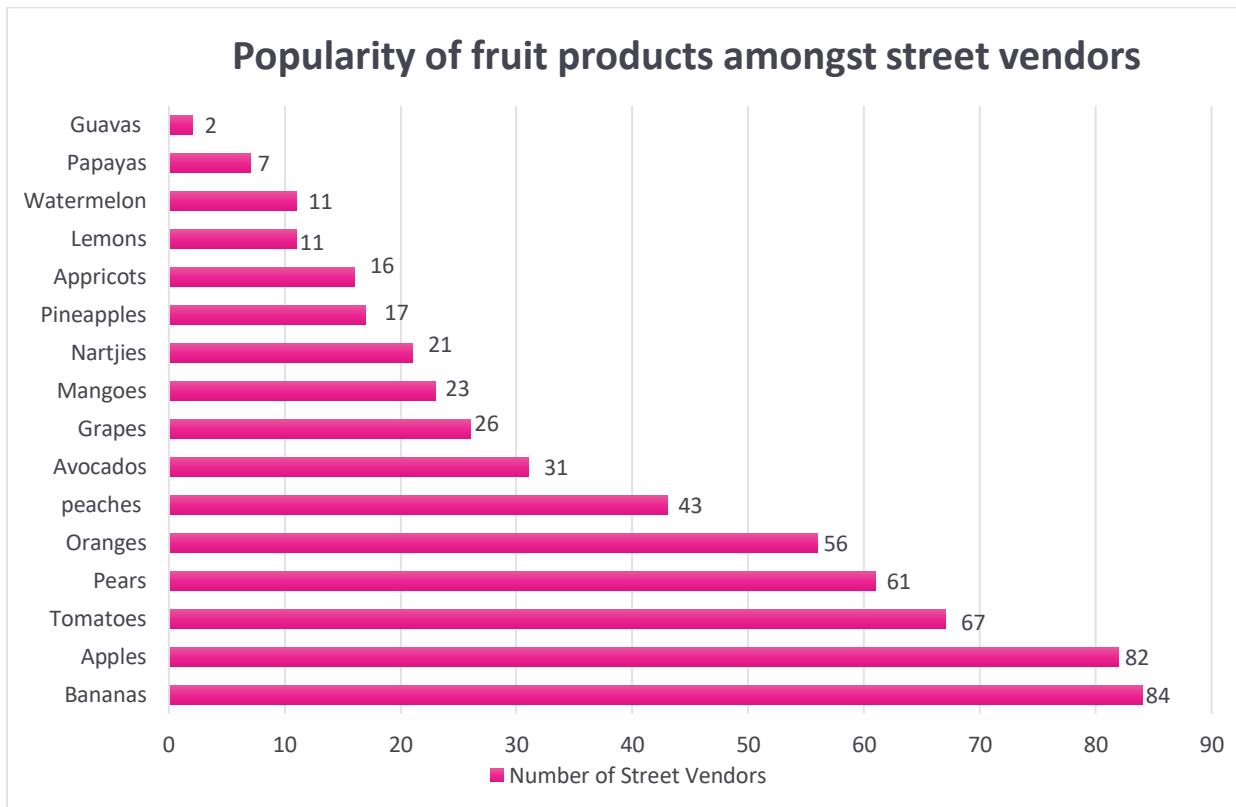


Figure 4.5: Number of street vendors selling type of fruit

With regard to vegetables, the most popular products sold by the respondents included the following: cabbages (n=82), carrots (n=81), onions (n=77), potatoes (n=57) and green beans (n=55) respectively. It must be noted that most of these vegetables (including tomatoes, which are considered as fruits) are generally used in salads, which somehow raises food safety concerns since the literature indicates that salad greens have become one of the highest contributors to foodborne illnesses. In countries such as the United States of America, it was reported that between the years 2004 and 2012, fresh produce contributed to 375 foodborne outbreaks experienced in the country; 124 were due to salads, 98 from leafy vegetables and 24 from tomatoes alone (Callejón *et al.*, 2015b). It is unfortunate that there is still a huge gap in the documentation of foodborne outbreaks caused by fresh produce in African countries. However, scholarly efforts are being made to investigate the microbial safety of fresh produce sold in the country through research conducted in South African universities (du Plessis, Korsten, Pillay & Taylor, 2015). Reports were made by the Centre of Excellence, South Africa in June 2019 that spinach was found to be the most hazardous leafy vegetables based on the

results of an ongoing study. Figure 4.6 indicates that in this study, spinach was amongst the top eight vegetables that was sold by the respective vendors. These results indicate an area of concern considering the lack of contamination preventative measures set in place amongst South African street vendors (Skinner, 2008b; Willemse, 2011).

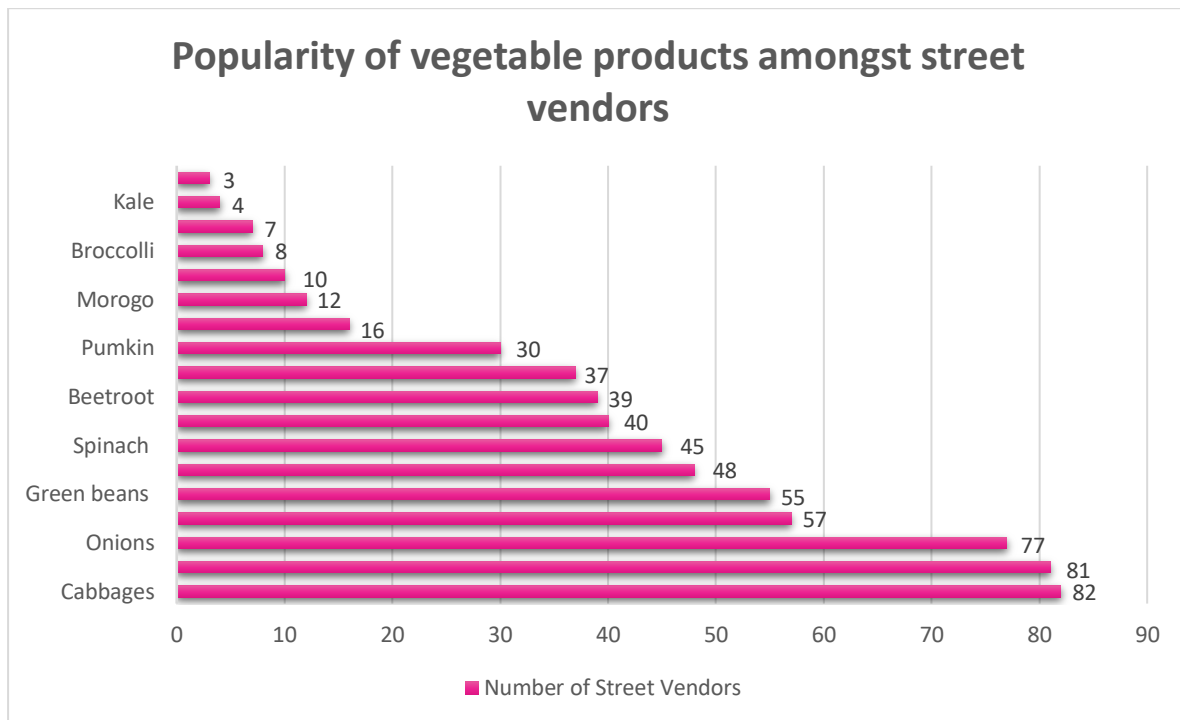


Figure 4.6 : Number of street vendors selling each type of vegetable

4.3 RESULTS AND DISCUSSION

The previous section discussed the demographic profile of the sample. Below, the results of the study are presented and discussed in terms of the objectives formulated for the study.

4.3.1 Objective 1: Tshwane street vendors' knowledge when managing fresh produce

Knowledge measures the intensity of one's understanding of a phenomenon and has the biggest potential to influence attitudes and behaviours/practices related to that phenomenon (Gumucio *et al.*, 2011). In order to understand the possible influence that street vendors' knowledge may exert on their food safety practices pertaining to fresh produce, the respondents had to respond to a combination of 18 questions that sought to measure their knowledge of three food safety dimensions (food handling, food preparation, and food storage) (see Addendum 1). A three-

point Likert-type true/false scale was used where one indicated ‘definitely false’, two indicated ‘neither true nor false’ and three indicated ‘definitely true’. Questions 1.1 - 1.6 (yellow) reflected on food safety handling, questions 1.7 – 1.12 reflected on food safety preparation (green), and questions 1.13 – 1.18 reflected on food safety storage (blue).

In order to interpret the results, a sum of responses was established by calculating the participants’ individual means, expressed in percentage value. The means for the level of knowledge test are interpreted as follows: $\geq 90\%$ excellent; 80 to $< 90\%$ very good; 70 to $< 80\%$ good; 50 to $< 60\%$ average; $< 50\%$ poor. The results, as presented in Table 4.2 below, indicate that overall, the respondents’ level of knowledge on food safety was above average (M=61.1%). These results are in accordance with other studies that have found that street vendors do indeed have some knowledge on issues relating to food safety, although a knowledge deficit was noted in terms of food safety issues such as correct food holding and storage temperatures (Haileselassie *et al.*, 2013; Mukherjee *et al.*, 2018).

Table 4.2 Food safety knowledge of Tshwane street vendors

Knowledge	Scale item	Correct %	Incorrect %
Very Good 80 - <90	Food handlers with abrasions and sores on their hands must cover their hands with a bandage, glove or avoid touching fresh produce.	82.3%	17.7%
	Hands should be washed vigorously with soap and water before working with fresh produce.	76.4%	23.6%
Good 70 - <80%	Keeping your hair covered and keeping short nails reduces the risk of food contamination.	74.7%	25.3%
	Work surfaces and utensils should be cleaned and sanitised after every task when handling fresh produce	71.4%	28.6%
Above Average 60- >70	Vegetables should be separated from meats during storage.	77%	23%
	Fresh fruits and vegetables that have wilted or are starting to show signs of rotting should be discarded.	72.5%	27.5%
	The presence of rodents in a storage space serves as a major possible contaminant.	69%	31%
	Fresh produce should be packaged to protect them from dust and car fumes before the display.	66.5%	33.5%

Knowledge	Scale item	Correct %	Incorrect %
	It is necessary for food handlers to take leave and not handle fresh produce when suffering from infectious diseases like diarrhoea, colds and skin rashes.	66.5%	33.5%
	The use of separate cleaned and sanitised cutting boards for raw meat and fresh produce minimises the risk of cross-contamination during food preparation.	61%	39%
Average 50 - < 60	Pre-cutting fresh produce before displaying it for sale encourages the growth and multiplication of microorganisms that can result in food contamination.	59%	41%
	Cooler boxes can be used in the absence of refrigerators to control temperatures in fresh produce storage.	58%	42%
	Storing fresh produce in a wheelbarrow exposes fresh produce to chemical contamination.	57%	43%
	Fruits and vegetables are washed in running water to prevent the spread of microorganisms	57.5%	42.5%
	Cross-contamination is the passing of harmful substances or bacteria to food from dirty equipment, utensils or hands.	55%	44.5%
Poor < 50	Cleaning and pest control chemicals should not be stored with fresh produce if they are in their original containers.	40%	60%
	Vegetables should be cooked in high temperatures for a short period of time.	34%	66%
	If a bowl or bucket is used for washing fresh produce, water should be discarded before they become sticky and viscous.	22%	78%
	Total Sample (N= 182)	61.1%	39%

The findings of this study revealed that the respondents did not have an excellent level of knowledge ($\geq 90\%$) pertaining to any of the individual scale items. The results did, however, reveal that the respondents were especially well informed (good – very good) on the issues pertaining to the food safety dimensions namely:

- **food handling (shaded in yellow)**, i.e. personal hygiene and sanitation (e.g. covering hands with sores or abrasions with a bandage or glove before handling fresh produce)

is important (M= 82.3%); and cross-contamination (e.g. work surfaces and utensils should be cleaned and sanitised after every task when handling fresh produce (M=71.4%). These results support those of Abdalla *et al.* (2009) and Ghatak and Chatterjee (2018) where the street vendors answered positively to personal hygiene and sanitation questions. However, their observations revealed that the respondents seldom put their knowledge to practice, hence raising suspicions that they were more aware of what is socially acceptable rather than actually practicing food safety principles (e.g. they understood that socially, it is important for them to wash their hands before touching food).

- **preparation (shaded in green)** (e.g. fresh fruits and vegetables that have wilted or starting to show signs of rotting should be discarded (M= 72.5%) and
- **storage (shaded in blue)** (e.g. Vegetables should be separated from meats during storage (M=77%).

With regard to the areas of concern, **preparation** (e.g. washing fresh produce during preparation or if a bowl or bucket is used for washing fresh produce, water should be discarded before it becomes sticky and viscous) (M=22%), and **Storage** (e.g. cleaning and pest control chemicals should not be stored with fresh produce if they are in their original containers) (M= 40%) scored less favourably (i.e. **Poor < 50**). These results supports the results of studies conducted in Nigeria and South Africa respectively (Campbell, 2011; Iwu *et al.*, 2017a), where the respondents were reported to be confused about when to discard washing water. In Nigeria, the respondents thought the washing water should only be discarded once it changes colour (Iwu *et al.*, 2017a), while in South Africa, the participants thought observation is always the best dictator of when it needs to be changed (Campbell, 2011).

ANOVA

In order to seek significant differences pertaining to the sample's knowledge in terms of age groups, level of education, country of origin and monthly profits, a one-way analysis of variance (ANOVA) was conducted, while a t-test was only done amongst gender groups. The findings of these tests are presented in Table 4.3 below.

Table 4.3: Summary of the food safety knowledge ANOVAs per demographic category

		Age groups	Level of education	Country of origin	Profits/month	Gender
Sum of squares	Between Groups	27.791	19.587	66.765	21.812	.481
	Within Groups	158.009	142.613	634.855	157.938	24.381
Df	Between Groups	28	28	28	28	1
	Within Groups	151	151	150	151	178
	Total	179	179	178	179	179
Mean Squares	Between Groups	.993	0.700	2.384	0.779	.481
	Within Groups	1.046	.944	4.232	1.046	.137
F	Between Groups	.949	0.741	0.563	0.745	3.510
P-Value		.545	0.823	0.962	0.818	0.063

No significant differences could be confirmed ($p > 0.05$) amongst the subsets in the data in any of the demographic categories mentioned in the table above. Thus, one can conclude that neither age, gender, level of education, nor the country of origin can be used to predict food safety knowledge.

4.3.2 Objective 2: Tshwane street vendors' food safety attitudes when managing fresh produce

In order to understand the possible influence that street vendors' attitudes may exert on their food safety practices pertaining to fresh produce, the respondents had to respond to a combination of 18 questions where questions 2.1 - 2.6 reflected on food handling, questions 2.7 - 2.13 reflected on food preparation, while questions 2.13 - 2.18 reflected on food storage (please refer to Addendum A). A three-point Likert-type agreement scale was used where one indicated 'does not describe my feelings', two indicated 'moderately describes my feelings' and three indicated 'clearly describes my feelings'. A lower mean score was therefore interpreted as negative in terms of the respondents' attitudes towards food safety practices pertaining to fresh produce. This meant that those vendors were, therefore, more liable to perceive and ultimately manage fresh produce in an unsafe manner. The means were interpreted in the following manner: $1 - \leq 1.8$ = negative attitude; $\geq 1.9 - 2.4$ = moderate

attitude and $\geq 2.5 - 3$ = positive attitude. The respective Cronbach's Alpha values extracted for the 18 items used to measure the respondents' attitudes was above 0.879, which indicated an acceptable internal consistency. Thus, the instrument used can be considered reliable.

Table 4.4 presents the findings. The overall mean (M= 2.4) suggests that the respondents seemed to present a moderately positive attitude towards food safety. Reviewing the individual scale items, in terms of the respective dimensions on food safety (handling, preparation and storage), the results indicated that the respondents' attitudes were more positive towards handling (M=2.53) as compared to preparation (M=2.3).

Table 4.4: Tshwane street vendors' food safety attitudes

<i>Attitude Questions</i>	<i>N</i>	<i>Mean</i>	<i>Standard deviation</i>	
<i>2.1. I feel that cross-contamination is the passing of harmful substances or bacteria to food from dirty equipment, utensils or hands.</i>	183	2.31	.054	
<i>2.2. I believe that hands should be washed vigorously with soap and water before working with fresh produce.</i>	183	2.61	.048	
<i>2.3. I think that food handlers with abrasions and sores on their hands must cover their hands with a bandage, glove or avoid touching fresh produce.</i>	183	2.63	.048	
<i>2.4. I believe keeping your hair covered and keeping short nails reduces the risk of food contamination.</i>	183	2.58	.052	
<i>2.5. I think work surfaces and utensils should be cleaned and sanitised after every task when handling fresh produce.</i>	183	2.57	.048	
<i>2.6. I feel it is necessary for food handlers to take leave and not handle fresh produce when suffering from infectious diseases like diarrhoea, colds and skin rashes.</i>	183	2.50	.054	
Overall food handling attitudes mean				2.53
<i>2.7. I think fruits and vegetables should be washed in running water to prevent the spread of microorganisms.</i>	182	2.38	.055	
<i>2.8. I believe that the use of separate cleaned and sanitised cutting boards for raw meat and fresh produce minimises the risk of cross-contamination during food preparation.</i>	183	2.35	.057	
<i>2.9. I feel that if a bowl or bucket is used for washing fresh produce, water should be discarded before it becomes viscous and sticky.</i>	183	2.31	.058	
<i>2.10. I think that pre-cutting fresh produce before displaying it for sale encourages the growth and multiplication of microorganisms that may result in food contamination.</i>	183	2.34	.057	
<i>2.11. I believe that fresh fruits and vegetables that have wilted or starting to show signs of rotting should be discarded.</i>	183	2.60	.051	
<i>2.12. I feel that vegetables should be cooked in high temperatures for a short period of time.</i>	183	2.03	.057	
Overall food preparation attitudes' mean				2.3
<i>2.13. believe that vegetables should be separated from meats during storage.</i>	182	2.74	.039	

<i>2.14. I think that fresh produce should be packaged to protect it from dust and car fumes before the display.</i>	183	2.56	.049	
<i>2.15. I feel that the presence of rodents in a storage space serves as a major possible contaminant.</i>	183	2.49	.052	
<i>2.16. I think cleaning and pest control chemicals should not be stored with fresh produce.</i>	183	2.37	.060	
<i>2.17. I believe storing fresh produce in a wheelbarrow exposes fresh produce to chemical contamination.</i>	183	2.25	.059	
<i>2.18. I feel that cooler boxes can be used in the absence of refrigerators to control temperatures in fresh produce storage.</i>	183	2.26	.060	
<i>Overall food storage attitude mean</i>				2.4
<i>Overall Food safety attitude mean</i>		2.40		

In terms of specific scale items within the respective dimensions, the results revealed that the respondents did not show a negative attitude towards any of the specific scale items presented to them.

In terms of **food handling** (shaded in yellow), it was interesting to note that the respondents demonstrated positive attitudes that corresponded with their very good knowledge of food safety, as discussed in the previous section (particularly in terms of personal hygiene and sanitation) the same could not be said about their attitude in terms of the following statements: I think that food handlers with abrasions and sores on their hands must cover their hands with a bandage, glove or avoid touching fresh produce (**M= 2.63**), I believe that hands should be washed vigorously with soap and water before working with fresh produce (**M= 2.61**), I think work surfaces and utensils should be cleaned and sanitized after every task when handling fresh produce; **M = 2.57**). These results are furthermore similar to studies where the respondents showed a positive attitude towards aspects relating to hygiene and sanitation (Abdullah Sani & Siow, 2014; Akabanda, Hlortsi & Owusu-Kwarteng, 2017; Aluh & Aluh, 2017). The results indicate that attitudes between vendors in the same country may differ based on location and regions. For instance, the respondents in this study (located in Tshwane) demonstrated positive attitudes towards the use of gloves and hair nets during food preparation compared to the street vendors in KwaZulu-Natal (Mjoka & Selepe, 2017).

While other studies reports that street vendors do not associate food safety as being part of their job and refute that they may be a source of contamination (Baş *et al.*, 2006; Mukherjee *et al.*,

2018), the positive attitudes recorded in this study may imply that the respondents appreciated the importance of food safety in their work.

With regard to **preparation** (shaded in green), the findings revealed that although the respondents had an overall moderate attitude ($M = 2.30$), positive attitudes were recorded on issues relating to discarding rotten produce (discarding of vegetables that have wilted or showing signs of rotting; $M = 2.60$). It was revealed upon further investigation that the respondents gave their old stock to the less fortunate before it reached the stage where it started to show signs of rotting. These results indicate that the respondents in this study were aware of issues around the dangers of selling rotten foods and issues relating to food waste. Further investigation may need to be done regarding these results to find out whether these vendors gave away old stock due to food safety concerns or merely due to reduced appearance qualities.

The results pertaining to the respondents' **storage practices** (shaded in blue) suggest that regardless of scoring a modest attitude rating ($M = 2.4$), the respondents displayed positive attitudes towards areas addressing **cross-contamination** during storage (e.g. I believe that vegetables should be separated from meats during storage ($M = 2.74$), I think that fresh produce should be packaged to protect them from dust and car fumes before the display ($M = 2.56$) and I feel that the presence of mice and rodents in a storage space serves as a major possible contaminant ($M = 2.49$). These results are similar to other studies done in China and Vietnam, respectively, where it was concluded that positive attitudes towards correct storage are essential to food safety (Ma, Chen, Yan, Wu & Zhang, 2019a; Samapundo, Climat, Xhaferi & Devlieghere, 2015).

A one-way analysis of variance (ANOVA)

In order to seek significant differences in attitudes within the sample in terms of age groups, level of education, country of origin and monthly profits, a one-way analysis of variance (ANOVA) was done, while a t-test was conducted to explore possibly significant differences between gender groups. The findings of these tests are presented in Table 4.5, where significant differences are evident, thus the relevant posthoc tests were done to specify these differences. The identified significant differences are presented and discussed per demographic category in the following sections.

Table 4.5: Summary of ANOVAs for food safety attitudes

		Age groups	Level of education	Country of origin	Profits/month	Gender
Sum of squares	Between Groups	38.570	26.132	108.354	26.382	0.268
	Within Groups	147.230	136.070	593.266	153.368	25.935
Df	Between Groups	26	26	26	26	1
	Within Groups	153	153	152	153	178
	Total	179	179	178	179	179
Mean Squares	Between Groups	1.483	1.005	4.167	1.015	0.268
	Within Groups	0.962	0.889	3.903	1.002	0.146
F	Between Groups	1.542	1.130	1.068	1.012	1.837
P-Value		0.057*	0.315	0.386	0.456	0.177

No significant differences could be confirmed ($p > 0.05$) amongst the subsets in the data in any of the demographic categories mentioned in the table above. Thus, one can conclude that neither level of education, the country of origin, profit nor gender can be used to predict food safety attitudes.

Age groups: the findings derived from an ANOVA (Table 4.5) indicated a significant difference amongst different age groups ($p=0.057$). A Bonferroni Posthoc Test was subsequently done (see Table 4.6 below) to identify which groups were significantly different. Mean scores that were between a minimum of one to three were used to interpret the results, where a score of one was indicative of a poor/negative attitude, while a higher numeric score was indicative of a positive attitude.

The results in Table 4.6 revealed that the age group 46 -55 was significantly ($p=0.044$) more inclined to display positive attitudes towards food safety compared to the age group 26-35.

Table 4.6: Post-hoc test results for food safety attitudes amongst age group

Dependent Variable	Age	Age groups	Mean score	Mean differences	SEM	P-Value
Food Safety Attitudes Score	<= 25 M=2.3765	26 – 35	2.3670	0.00956	0.07571	1.000
		36 – 45	2.5545	-0.17792	0.08055	0.285
		46 – 55	2.6704	-0.29383	0.11372	0.106
		56+	2.6508	-0.27425	0.15286	0.745
	26 – 35 M= 2.3670	<= 25	2.3765	-0.00956	0.07571	1.000
		36 – 45	2.5545	-0.18749	0.06793	0.064
		46 – 55	2.6704	-.30339*	0.10516	0.044
		56+	2.6508	-0.28381	0.14660	0.545

Dependent Variable	Age	Age groups	Mean score	Mean differences	SEM	P-Value
	36 – 45 M = 2.5545	<= 25	2.3765	0.17792	0.08055	0.285
		26 – 35	2.3670	0.18749	0.06793	0.064
		46 – 55	2.6704	-0.11590	0.10869	1.000
		56+	2.6508	-0.09633	0.14916	1.000
	46 – 55 M = 2.6704	<= 25	2.3765	0.29383	0.11372	0.106
		26 – 35	2.3670	.30339*	0.10516	0.044
		36 – 45	2.5545	0.11590	0.10869	1.000
		56+	2.6508	0.01958	0.16939	1.000
	56+ M= 2.6508	<= 25	2.3765	0.27425	0.15286	0.745
		26 – 35	2.3670	0.28381	0.14660	0.545
		36 – 45	2.5545	0.09633	0.14916	1.000
		46 – 55	2.6704	-0.01958	0.16939	1.000

These results confirm that the older street vendors (ages 46-55) had better attitudes (M=2.670) compared to their younger counterparts (ages 26-35) (M=2.367). Similar studies, such as the one conducted by Ma, Chen, Yan, Wu and Zhang (2019), report different results from those obtained in this study. Their findings indicated that younger street vendors had better attitude scores with corresponding food safety knowledge scores compared to their older counterparts. However, experience is usually associated with age and growth (Laureiro-Martinez, Trujillo & Unda, 2017), which in this case could be associated with a better understanding of food safety issues, hence yielding positive attitudes regarding the matter. In a study done on university students on the effects of food safety education and work experience on knowledge, attitudes and practices, it was found that experience affected knowledge more than it did attitudes (Hertzman, Kitterlin, Farrish & Stefanelli, 2011). It can therefore be concluded that higher knowledge scores are more likely to yield better attitude scores.

4.3.3 Objective 3: Tshwane street vendors' food safety practices

Practices are natively a product of other inputs, and in this study, they are linked to the respondents' food safety knowledge and food safety attitudes (Chaudhary *et al.*, 2010). To assess the respondents' current food safety practices, they were presented with 18 sets of questions similar to those used to measure knowledge and attitudes. These questions explored the three main dimensions of food safety, namely, handling practices (questions 3.1 – 3.6), preparation practices (questions 3.7 – 3.12), and storage practices (questions 3.13 – 3.1) (see Addendum 1). A three-point Likert-type frequency scale was used, where a score of one indicated 'never', two 'seldom', and three indicated 'always'. Table 4.6 below presents the

participants' responses in the form of means per individual scale item, where $\leq 1 - 1.8$ indicates that the respondents 'never' applied the practice, $\geq 1.9 - 2.4$ indicates they 'seldom' practiced it, while $\geq 2.5 - 3$ indicated that they 'always' applied those practices.

Based on the findings, as presented in Table 4.7, the overall mean (M= 2.1) suggests that the respondents tended to seldom practice the identified food safety practices. This could result from the lack of mandatory resources (such as running water, ablution facilities and refrigerated storages) that support food safety in street vending (Akabanda *et al.*, 2017).

Table 4.7: Tshwane street vendors' current food safety practices

<i>Questions</i>	N	Mean	Std. Deviation	
<i>3.1. I prevent cross-contamination from dirty equipment, utensils or hands when working with fresh produce.</i>	182	2.41	.054	
<i>3.2. I wash hands vigorously with soap and water before working with fresh produce.</i>	182	2.14	.060	
<i>3.3. I cover my hands with a bandage, glove or avoid touching fresh produce when I have abrasions and sores.</i>	182	2.50	.054	
<i>3.4. I keep my hair covered and keep my nails short to reduce the risk of food contamination.</i>	181	2.29	.062	
<i>3.5. I clean and sanitise work surfaces and utensils after every task when handling fresh produce.</i>	182	2.25	.057	
<i>3.6. I take leave and do not handle fresh produce when suffering from infectious diseases like diarrhoea, colds, and skin rashes.</i>	182	2.24	.058	
Food handling practices overall mean				2.3
<i>3.7. I wash fruits and vegetables in running water to prevent the spread of microorganisms.</i>	183	1.89	.063	
<i>3.8. I use separate cleaned and sanitised cutting boards for raw meat and fresh produce to minimise the risk of cross-contamination during fresh produce preparation.</i>	183	2.13	.062	
<i>3.9. I discard the water before it becomes viscous and sticky when washing fresh produce in a bowl or bucket.</i>	183	2.21	.062	
<i>3.10. I pre-cut fresh produce like cabbages or watermelons before I display them for sale to increase affordability.</i>	183	1.99	.065	
<i>3.11. I discard off fresh fruits and vegetables that have wilted or starting to show signs of rotting.</i>	182	2.42	.056	
<i>3.12. I cook vegetables at high temperatures for a short period of time.</i>	183	1.95	.057	
Food preparation practices overall mean				2.1
<i>3.13. I separate fruits and vegetables from meats during storage.</i>	182	2.80	.034	
<i>3.14. I package fresh produce to protect from dust and car fumes before the display.</i>	183	2.50	.054	
<i>3.15. I control the presence of rodents in proximity to my fresh produce storage area.</i>	182	2.32	.061	

<i>Questions</i>	N	Mean	Std. Deviation	
<i>3.16. I store cleaning and pest control chemicals with fresh produce if they are in their original containers.</i>	181	1.85	.065	
<i>3.17. I store fresh produce in a wheelbarrow during the day in my stall.</i>	183	1.73	.063	
<i>3.18. I use cooler boxes to store fresh produce in the absence of a refrigerator to control the temperature.</i>	182	1.74	.065	
Food storage practices overall mean				2.12
Total Food safety Practices overall mean		2.1		

The results in terms of the respective dimensions (food safety handling, preparation and storage), indicated that the respondents were more inclined to have better food safety handling practices (M=2.3) compared to storage (M=2.13) and preparation (M=2.1). The findings pertaining to **food safety handling** revealed that the respondents not nearly as often applied hygienic practices (e.g. I wash hands vigorously with soap and water before working with fresh produce (M=2.14), I take leave and do not handle fresh produce when suffering from infectious diseases like diarrhoea, colds and skin rashes (M= 2.24)). Inadequacies in handwashing may be attributed to the lack of running water supply at the locations where the street vendors worked, making it difficult for sustainable practice of this habit (Abdalla *et al.*, 2009). Although the respondents in this sample were prone to responding better regarding taking leave when they were sick (compared to other handling scale items) it should be noted that it was mentioned that this was not really a luxury that they could afford due to the nature of their business. Due to the odd hours worked by street vendors to capitalise on daily sales globally, a day dedicated to medical care is a luxury (Willemse, 2011). Most vendors are self-employed with no assistance, making it hard for them to attend to their medical needs regularly, hence they are forced to work without seeking medical attention, a practice that compromises the safety of the different food commodities they sell (Iwu *et al.*, 2017a; McKay *et al.*, 2016). A study in Ghana highlighted the importance of regulating medical care as the participants in their study reported attending to their medical needs promptly as per the country's regulations (Apanga *et al.*, 2014).

With regard to **food preparation**, the results in Table 4.6 indicate that the participants in this study seldom executed food safety practices when preparing fresh produce (e.g. I wash fruits and vegetables in running water to prevent the spread of microorganisms; M=1.89). Better but still concerning results were revealed in terms of the preparation water and discarding of old

produce (I discard the water before it becomes viscous and sticky when washing fresh produce in a bowl or bucket ($M=2.21$), I discard off fresh fruits and vegetables that have wilted or starting to show signs of rotting; $M=2.4$). These inconsistent practices across the food safety dimensions, according to Akabanda et al. (2017), may be attributed to a lack of knowledge regarding food safety. For instance, in a study conducted in South Africa, Campbell, (2011) reported that street vendors did not have any knowledge on how often water used for washing fresh produce and dishes should be changed. Some claimed that the change in colour is the best dictator of contaminated water.

In terms of **food safety storage** practices, it was a welcome relief to find that the respondents in this study tended to ‘always’ ($\geq 2.5 - 3$) apply food **safety storage practices** (e.g. I separate fruits and vegetables from meats during storage ($M= 2.80$), I package fresh produce to protect them from dust and car fumes before displaying for sale; $M= 2.50$). These results were similar to those reported by Trafialek et al. (2017) where the participants were observed to proficiently separate cooked foods from raw ones during storage. It was, however, captivating to learn that regardless of not having refrigeration systems or cold room facilities in public storages (Von Holy & Makhoane, 2006), the respondents always managed to apply good storage practices. This compliance with regard to this study could have been the result of exclusively selling fresh produce, which could possibly allow the participants to apply good storage practices.

4.3.3.1 Descriptive and inferential statistics results

A one-way analysis of variance (ANOVA)

In order to seek significant differences in practices within the sample in terms of age, education, country of origin and monthly profits, a one-way analysis of variance (ANOVA) was done. Moreover, a t-test among gender groups was performed to explore possibly significant differences between these demographic categories. The mean scores were between a minimum of one and three, where a score of one was indicative of poor/negative practice, while a higher numeric score was indicative of positive/good practice.

The findings of these tests are presented in Table 4.8 below. Where the significant differences were evident, the relevant posthoc tests were done to specify the differences. The identified significant differences are presented and discussed in the following sections.

Table 4.8: Summary of the ANOVAs on food safety practices

		Age groups	Level of education	Country of origin	Profits/month	Gender
Sum of squares	Between Groups	0.585	0.555	1.240	1.606	0.665
	Within Groups	20.428	20.458	19.742	19.407	20.013
Df	Between Groups	4	4	4	4	1
	Within Groups	175	175	174	175	178
	Total	179	179	178	179	179
Mean Squares	Between Groups	0.146	0.139	0.310	0.402	0.665
	Within Groups	0.117	0.117	0.113	0.111	20.349
F	Between Groups	1.253	1.187	2.733	3.621	5.815
P-Value		0.291	0.318	0.031*	0.007*	0.017*

No significant difference could be confirmed ($p > 0.05$) amongst the subsets in the data in any of the demographic categories mentioned in the table above. Thus, one can conclude that neither age, nor level of education can be used to predict **food safety practices**.

Country of origin: the findings derived from the ANOVA (see Table 4.8) indicated a significant difference ($p=0.031$) amongst the countries of origin category. The subsequent post-hoc Bonferoni test (see Table 4.9) revealed that vendors from South Africa tend to score better ($M=2.233$) in terms of food safety practices compared to vendors from Mozambique, who scored lower ($M=2.054$). These results could be attributed to the difference in cultures and exposure to street vending in South Africa and Mozambique. The informal sector in South Africa has vigour compared to other countries in the Southern African region (Béni-Gbaffou, 2016; Béni-Gbaffou, 2018; Pieterse, 2017). As part of a popular sector, street vendors often make an effort to adhere to what their consumers expect of them (which may include good hygiene practices). Other vendors have the opportunity of learning about the business before venturing into it. This may be made possible by helping family or relatives into the same line of work. This gives them exposure to what the business entails, consumers' expectations, and how to deliver quality service, which may include exploring ways to ensure food safety. With that background information, South African vendors may be in a better position to apply safe practices when selling fresh produce in the street. Street vendors originating from Mozambique and other countries, however, could take time to learn the South African culture regarding street vending. This adjustment could subject consumers to unsafe practices, and because of the

language barrier it could also take longer for the vendors to understand the needs of their customers.

Table 4.9: Posthoc test for practices per country of origin

Country of origin	Countries of origin (J)	Mean	Mean difference (I-J)	SEM	Sig.
Malawi M=2.111	Mozambique	2.054	.0569	.1297	1.000
	South Africa	2.233	-.1215	.1245	1.000
	Zimbabwe	2.154	-.0426	.1340	1.000
	Other	2.329	-.2176	.1537	1.000
Mozambique M=2.054	Malawi	2.111	-.0569	.1297	1.000
	South Africa	2.233	-.1783	.0629	.051
	Zimbabwe	2.154	-.0994	.0801	1.000
	Other	2.329	-.2744	.1099	.135
South Africa M=2.233	Malawi	2.111	.1215	.1245	1.000
	Mozambique	2.054	.1783	.0629	.051
	Zimbabwe	2.154	.0789	.0714	1.000
	Other	2.329	-.0962	.1038	1.000
Zimbabwe M=2.154	Malawi	2.111	.0426	.1340	1.000
	Mozambique	2.054	.0994	.0801	1.000
	South Africa	2.233	-.0789	.0714	1.000
	Other	2.329	-.1750	.1151	1.000
Other M=2.329	Malawi	2.111	.2176	.1537	1.000
	Mozambique	2.054	.2744	.1099	.135
	South Africa	2.233	.0962	.1038	1.000

Monthly profits from street vending: the findings derived from the ANOVA (see Table 4.8) indicated a significant difference ($p=0.007$) amongst household incomes derived from street vending. The Bonferroni Posthoc test that was subsequently done (see Table 4.10 below) revealed that street vendors who earn between R3000 - R5000 are significantly more inclined to portray positive ($M = 2.380$) food safety practices compared to those who earn less than R1000 ($M = 2.087$). An assumption can be made from these results that participants who earn better profits from street vending invest more into ensuring food safety for their customers, which could likely result in loyal customers. Financial gains are said to be the best motivator (Bagshawe, 2011), it is thus possible that as these vendors earn more, they continue to learn more about the importance of a brand and reputation, hence gaining the motivation to improve their service, especially in food safety assurance.

Table 4.10: Post-hoc test for practices per income group

Income	Income groups	Mean	Mean differences	SEM	P-Value
M= 2.0871	R1000- R3000	2.1801	-.09293	.05873	1.000
	R3000 - R5000	2.3803	-.29320*	.08025	.003
	R5000- R10000	2.1667	-.07952	.12664	1.000
	Above R10000	2.0556	.03159	.12664	1.000
M= 2.1801	Less than R1000	2.0871	.09293	.05873	1.000
	R3000 - R5000	2.3803	-.20027	.07443	.078
	R5000- R10000	2.1667	.01341	.12303	1.000
	Above R10000	2.0556	.12452	.12303	1.000
M=2.3803	Less than R1000	2.0871	.29320*	.08025	.003
	R1000- R3000	2.1801	.20027	.07443	.078
	R5000- R10000	2.1667	.21368	.13464	1.000
	Above R10000	2.0556	.32479	.13464	.169
M= 2.1667	Less than R1000	2.0871	.07952	.12664	1.000
	R1000- R3000	2.1801	-.01341	.12303	1.000
	R3000 - R5000	2.3802	-.21368	.13464	1.000
	Above R10000	37.0000	.11111	.16651	1.000
M=37.0000	Less than R1000	2.0871	-.03159	.12664	1.000
	R1000- R3000	2.1801	-.12452	.12303	1.000
	R3000 - R5000	2.3802	-.32479	.13464	.169
	R5000- R10000	2.1667	-.11111	.16651	1.000

Gender: the Findings derived from the t-test indicated a significant difference ($p=0.017$). Descriptive statistics, as shown in Table 4.11 below, indicate that females present significantly better food safety practices ($M=2.279$) compared to their male counterparts ($M=2.167$).

Table 4.11: Descriptive statistics for food safety practices per gender

Gender	N	Mean	Std. Deviation
Male	111	2.167	0.325
Female	69	2.279	0.359
Total	180	2.167	0.343

These results could possibly be attributed to the fact that women are usually involved in selling cooked and/or processed foods in street vending, which requires a certain level of skill that is usually accompanied by proper food safety practices. This automatically puts females two steps ahead of males in the street food business with regard to food handling practices and hygiene in general. While men take advantage of the fresh produce business, they, however, lack in the hygiene and sanitation aspect of the business. Cortese, Veiros, Feldman and Cavalli (2016) report that, in their study, female vendors were found to be more concerned about cross-contamination and the safe transportation of food, while male vendors were more concerned with checking the expiry date and separating cleaning products from food. These reports suggest that men are more technical in nature, which might be something that does not apply as much to selling fresh produce, e.g. there are no expiry dates to check when buying fresh produce to sell, but rather freshness and absence of defects that might lead to deterioration, hence care must be taken in choosing and ensuring that cross-contaminate does not occur. This is something that women seem to do well (Kaczmarek *et al.*, 2019). The high volume of men in the fresh produce industry could potentially suggest a food safety hazard, especially since street vendors have minimal resources (Wills, 2009).

4.3.4 Objective 4: Correlation between knowledge, attitudes and practices

In order to gather evidence on whether there is any relationship between knowledge, attitudes and practices, an analysis of possible correlations was conducted using SPSS ($P= 0.01$). The results in Table 4.12 indicate positive correlations between knowledge and attitudes ($r=0.832$), knowledge and practices ($r=0.573$), and between attitudes and practices ($r=0.646$). The strongest correlation was recorded between knowledge and attitudes ($r=0.832$), which indicates that the amount and type of food safety knowledge a street vendor has are most likely to influence the way in which they feel, think and behave regarding foods safety. This means that lower levels of knowledge are likely to lead to inappropriate attitudes and, subsequently, higher levels of knowledge lead to positive attitudes. It has been argued in other studies, however, that the amount of knowledge one has may not always influence attitudes positively (Fabrigar, Petty, Smith & Crites Jr, 2006).

Table 4.12: Correlation between knowledge, attitudes, and practices

		Food Safety Knowledge	Food Safety Attitude	Food Safety Practices
Knowledge M= 44.932	Pearson Correlation	1	.832**	.573**
	Sig. (2-tailed)		.000	.000
Attitude M= 44.250	Pearson Correlation	.832**	1	.646**
	Sig. (2-tailed)	.000		.000
Practices M= 39.188	Pearson Correlation	.573**	.646**	1
	Sig. (2-tailed)	.000	.000	
**. Correlation is significant at the 0.01 level (2-tailed).				
b. Listwise N=180				

As shown in Table 4.12, moderate correlation existed between knowledge and practices ($r=0.573$), and between attitudes and practices ($r=0.646$) there was a moderately stronger correlation. Fabrigar et al. (2006) recorded similar correlations; however, their strongest correlations were between attitudes and practices. As evident in the results of this study, good and efficient knowledge yields positive attitudes, thus impacting street vendors' practices regarding food safety. These results are similar to those reported by Ko (2013) where attitudes were found to be a mediating factor between knowledge and practices.

4.4 SUMMARY

The results were gathered by implementing a quantitative research technique, which included using a semi-structured questionnaire. One hundred and eighty-three (183) respondents were interviewed face to face, the majority of whom were male (62%). Most of the respondents fell between the ages of 26-35 years (39%), followed by 36-45 (29%), 18-25 (20%), 46-55 (8%) and 56 years and older (45%). These results show that mostly younger individuals view street vending as a popular employment alternative while waiting on other opportunities. Most of the respondents reported being literate, with almost half of the respondents being matriculants (successfully completed Grade 12) (46.4%), and 7% reporting to have attended and graduated from tertiary institutions. Street vending activities were most dominant in the Pretoria CBD (40%) compared to the other areas sampled in Tshwane. The vendors originated from 13 different countries, with more than half of them originating from outside South Africa. The

respondents were solely (81%) dependent on street vending as their source of income, which predominantly brought in between R1000-R3000 in profits per month.

With regard to the popularity of the fresh produce sold by these street vendors, the results indicated that out of the 183 respondents, most of the vendors sold bananas (n=84), apples (n=82), tomatoes (n=67), pears (n=61) and oranges (n=56), among others. Regarding vegetables, most of the respondents indicated that they sold cabbages (n=82), carrots (n=81), onions (n=77), potatoes (n=57) and green beans (n=55), among others. The results regarding how much the respondents knew about food safety while managing different types of fresh produce indicated a moderate level of knowledge (M= 61%). With regard to the different dimensions (handling, preparation and storage), the respondents demonstrated a high level of knowledge on issues relating to food handling, with areas of concerns noted on issues relating to food preparation and storage. The ANOVA and t-test results did not indicate any significant differences in terms of the demographics (age, gender, level of education and country of origin), which indicates that none of these demographic factors can be used to predict food safety knowledge.

The respondents demonstrated moderate overall attitudes towards food safety. In relation to food handling attitudes, the respondents demonstrated positive attitudes (M=2.53), which corresponded with their knowledge scores. The results indicated moderate attitudes regarding food storage and preparation, however, the responses to scale items, such as addressing separating raw meats from vegetables (M=2.74), displayed positive attitudes. This highlighted that the respondents understood the dangers associated with cross contamination regardless of their lack of proper storage facilities. The results from the ANOVAs indicated that older respondents (ages 46-55) were more inclined to have positive attitudes compared to those between the age of 26-35.

The results on practices indicated that the respondents seldom practiced safe food handling, preparation, and storage (M=2.3, M=2.1 and M=2.1, respectively). They did, however, report that they always separated fresh produce from raw meats (M=2.80) and covered their abrasions and cuts with bandages (M=2.50) before touching food. The t-test results indicated a significant difference between males and females, which implied that regardless of having majority of

male respondents in this study, females ($M=2.253$) presented better food safety practices over their counterparts ($M=2.129$).

The relationship between knowledge, attitudes and practices was also investigated and the results indicated a strong correlation between knowledge and attitudes ($r=0.832$), moderate correlation between knowledge and practices ($r=0.573$) and between attitudes and practices ($r=0.646$). In conclusion, knowledge proves to be the most important element in achieving food safety, thus training initiatives ought to be strengthened.

The following chapter brings the study to a close with a summary of the study, the conclusions reached for each objective, the limitations of the study, and recommendations for further research.

CHAPTER 5 CONCLUSION OF THE STUDY

This chapter presents the conclusions of the study in terms of the aim and objectives that were set for the investigation. The methodology that was used in the study is reviewed and its limitations discussed. Recommendations for future research are made thereafter.

5.1 INTRODUCTION

Foodborne diseases continue to affect the masses globally (Akabanda *et al.*, 2017). The World Health Organisation estimates that foodborne diseases affect approximately 600 million people per year, which leads to approximately two million dying from ingesting contaminated foods, 30% of whom are children under the age of 5. The increase in urbanisation exacerbates the problem since most consumers are desperate for affordable sources of fresh produce, which includes sourcing them from unregulated establishments such as street vendors (Rahman *et al.*, 2016).

The sale of fresh produce through street vendors has raised food safety concerns, and it is noted in the literature that vendors' deficit in terms of knowledge, attitudes and practices is not conducive to ensuring safe food (Alimi, 2016). Unlike fresh meals, fresh produce is most likely used and consumed in its raw state in food preparation, which highlights the need for tight food safety measures from farm to fork to reduce the occurrence of foodborne diseases (Callejón, Rodriguez-Naranjo, Ubeda, Hornedo-Ortega, Garcia-Parrilla & Troncoso, 2015a). Street vendors, however, are associated with illiteracy and/or poor educational backgrounds, making their knowledge of food safety a controversial topic (Ma *et al.*, 2019b). It has been stated that due to their educational background, street vendors tend to lack basic food safety knowledge. This has resulted in them unknowingly disregarding food safety principles when dealing with food, thus exposing consumers (who are often more vulnerable compared to consumers targeted by formal/higher-end retailers) to foodborne illnesses (Aluh & Aluh, 2017; Aluko *et al.*, 2014; Asiegbu *et al.*, 2016).

Since little is known on how much street vendors really know about food safety, scholars usually generalise discussions to other relevant studies from other countries, not necessarily to South Africa. Many speculations have been made that could result in uninformed mitigation

strategies. It is with these gaps in mind that the researcher aimed to investigate Tshwane street vendors' knowledge, attitudes and practices when managing fresh produce. This not only enabled the analysis of street vendors' knowledge, attitudes and practices, but also assisted in setting an evidence-based scene for practical and policy-related recommendations.

5.2 CONCLUSIONS REACHED FOR EACH OF THE OBJECTIVES

5.2.1 Objective 1

Street vendor's food safety knowledge pertaining to fresh produce

In light of the topic under discussion, knowledge is a body of factual instructions or information that enables individuals to make intelligent decisions regarding food safety (Alba & Hutchinson, 1987). Its impact is demonstrated by the way in which people act, thus even though it can be investigated as a component on its own, knowledge only comes into effect or is demonstrated through individuals' attitudes and practices (Nickols, 2000; O'Malley, 2009). Prior to conducting this study, street vendors' food safety knowledge had been given little attention globally, but even more so in South Africa. This has led to increased chances of relying on assumptions when investigating street vendors' implication/association with foodborne illnesses and outbreaks. This research therefore explored the level of knowledge of street vendors who predominately sell fresh produce in and around Tshwane.

The findings indicated that the participating street vendors' knowledge pertaining to food safety was average at best (M=61%). In terms of specific food safety dimensions, it was interesting to note that the respondents scored better on aspects pertaining to food handling (M= 71%) compared to aspects that related to preparation (M= 45.33%) and storage (M= 44.58%). It has been noted that in terms of food handling, more emphasis is often placed on hygiene and sanitation, which are topics that are usually introduced early on in childhood developmental stages as principles of living. Thus, keeping good hygiene could be considered as general knowledge amongst most adults as it has been instilled from a very young age. This, therefore, could possibly explain the respondents' source of information in this regard. Food preparation and storage knowledge, unlike hygiene and sanitation (handling), do not reside in the subconscious unless previously taught or instructed to them. As indicated by the results,

the respondents did not have sufficient or 'good' knowledge of these dimensions, which could denote poor food safety training backgrounds. It is therefore suggested that perhaps more emphasis needs to be placed on developing relevant, easy to understand and all-encompassing educational material that will introduce food safety principles to vendors in Tshwane. This will ensure that vendors acquire absolute knowledge about the theory of food safety so that they can best apply it as deemed fit for their business.

5.1.1 Objective 2

Street vendors' food safety attitudes pertaining to fresh produce

An attitude is defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1993:1). It involves how people feel, their thoughts and, ultimately, their behaviour towards that phenomenon (De Meuse & Hostager, 2001; Vereecken *et al.*, 2005). Attitudes are an important element to study in individuals as they help understand why people behave the way in which they do, or explain people's practices (Ajzen, 2001). Attitudes were therefore investigated in this study in order to figure out what the respondents thought and felt about food safety and if there was any correlation in terms of their ultimate behaviour.

The findings in this study revealed that overall, street vendors attitude towards food safety tend to be neutral (M= 2.40). With regard to specific dimensions, the vendors displayed much better attitudes regarding food handling (M= 2.53) compared to preparation (M= 2.3) and storage (M= 2.4). These findings are thus indicative and support the underlying relationship ($r=0.832$) between respondents' attitudes and their level of knowledge pertaining to food safety (M= 61.1%). These results are comparable to findings reported from other relevant studies where respondents who had higher scores in food handling knowledge also demonstrated positive attitudes towards the same dimension (Abdullah Sani & Siow, 2014; Akabanda *et al.*, 2017; Aluh & Aluh, 2017). Attitudes are a big influencer of practices or behaviour (Vereecken *et al.*, 2005), therefore the positive attitudes displayed by the respondents in this study could denote an increased likelihood of positive food safety practices when handling fresh produce.

Further investigations using the ANOVA results indicated a significant difference in attitudes between age groups, where the older respondents (ages 46-55) were more inclined to portray

positive attitudes compared to the younger vendors (ages 26-35). These results oppose findings from a study conducted in China where younger vendors displayed positive attitudes regarding food safety (Ma *et al.*, 2019b). Initiatives that aim to capacitate the youth with good food safety principles are therefore encouraged for better and improved food safety attitudes that could, in turn, ensure a future generation of vendors who display positive attitudes towards food safety.

5.1.2 Objective 3

Street vendors' current food safety practices when managing fresh produce

People apply their thoughts, ideas or beliefs through practices (Chaudhary *et al.*, 2010). These are usually directed by the type and level of knowledge that have been acquired, either through formal education or experience. In this study, the findings indicated that perhaps knowledge does not always lead to positive practices. Overall, the respondents were found to inconsistently engage in food safety practices (M=2.1). Although the results indicated that the respondents had acceptable food storage practices, they did, however, highlight a lack in food handling and preparation practices. For instance, based on the results, it was learnt that street vendors in Tshwane rarely washed their hands with warm soapy water before handling fresh produce (M=2.14), and they never washed fresh produce under running water to reduce the microbial load (M=1.89). Moreover, they rarely used separate chopping boards for meats and fresh produce to minimise the risk of cross-contamination (M=2.13).

Similar studies have reported that usually, negative practices are influenced by a lack of resources in street vending rather than being influenced by vendors' knowledge base (Iwu, Uwakwe, Duru, Diwe, Chineke, Merenu, Oluoha, Madubueze, Ndukwu & Ohale, 2017b; McKay *et al.*, 2016; Willemse, 2011). Looking at the practices reported in the current study, the vendors seemed to be dependent on the availability of water as a resource, which is not available at most street vending sites. It was noted during the data collection exercise that some street vendors did not use any chopping boards when chopping or slicing their fresh produce for sale, but rather used cartons, or cut from the ground (see Figure 5). When questioned, the street vendors mentioned that their business necessitated the use of what is available and since they did not have such structures (that support food safety) to work on, they always had to come up with a plan on-site, where not many resources are available. It can therefore be

concluded that perhaps efforts towards improving the conditions under which street vendors operate could possibly change their attitudes and, in turn, their practices. These results indicate that no matter how much knowledge vendors may be equipped with, if nothing is done towards changing the situation (in terms of making the mandatory resources available), neutral attitudes will prevail, leading to inconsistent practices.



Figure 5.1: Picture of a respondent cutting and packaging fresh produce on-site

The ANOVA results highlighted that those respondents who gained higher monthly profits from street vending demonstrated positive food safety practices. This could imply that higher returns and customer loyalty could possibly motivate vendors to improve their service delivery, which fortunately involves protecting consumers from contamination.

Regarding the results for practices by gender, female vendors were found to demonstrate significantly better practices compared to their male counterparts. Although these results make social sense as women are known to be predominately well-equipped in food preparation knowledge as compared to males, these results present enormous food safety concerns. The high participation of males in this study highlights a need for behavioural change with regard to this gender (e.g. male vendors need to be made aware that unsanitary behaviours such as urinating in public spaces where handwashing is not possible poses an enormous food

contamination hazard). In terms of the ANOVA findings regarding country of origin, the findings indicated that street vendors from Mozambique were found to have significantly poor food safety practices compared to those of South African origin. These results highlight the role played by cultural backgrounds in food safety practices. This raises the need for introductory training that will lay the standards and principles of food safety regardless of cultural backgrounds.

5.1.3 Objective 4

Underlying correlations between street vendors' food safety knowledge, attitudes, and practices and possible areas of concern

Studying correlations aids in determining the degree of relationships between variables in order to make decisions on how to develop future mitigation strategies (Gagne, 2014). In order to tackle this objective, correlation tests were conducted to identify the relationships between street vendors' knowledge, attitudes, and practices. The findings, as presented in Chapter 4 and shown in Figure 5.2 below, indicate a stronger correlation between knowledge and attitudes ($r=0.832$), a moderate correlation ($r=0.646$) between attitudes and practices, and a moderate correlation between knowledge and practices ($r=0.573$).

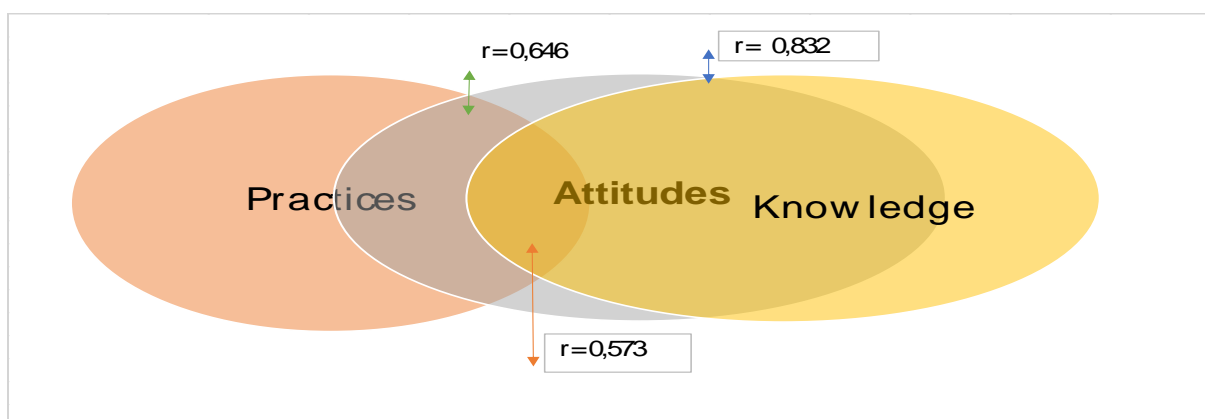


Figure 5.2: Correlations between knowledge, attitudes and practices

These results can be used to support the notion in other relevant studies that knowledge influences attitudes and practices. These results indicate that although other researchers found that knowledge is highly influential in people's practices, attitudes in this study proved to be most reliant on the type and level of knowledge. These results are similar to a study conducted

in Northern Kuching City (Rahman *et al.*, 2016). These findings imply that the street vendors who demonstrated negative knowledge on a certain dimension (e.g. food preparation and storage) are most likely to portray negative attitudes towards it and visa-versa. In terms of this study, in order to enhance the current situation pertaining to food safety knowledge (as an influencer of both attitudes and practices), it was noted that vendors need to be sensitised to and trained on all food safety dimensions (food handling, food preparation and food storage).

5.2 THE RESEARCH IN RETROSPECT

An objective evaluation of the research is important after every investigation in order to ascertain that all of the objectives have been addressed and met reliably within the appropriate research methods.

Good health and well-being for all remains one of the most important focuses in the world to date, especially during these hard times as the world faces the COVID-19 pandemic. This includes putting more emphasis on food safety (which feeds into a few of the Sustainable Development Goals, such as Goal 2 and 3). Foodborne diseases continue to be a burden globally, affecting over 600 million people per year globally, killing an estimate of two million, the majority being children under the age of 5. This suggests the necessity of strengthened efforts towards food safety, especially in developing countries, including South Africa (Akabanda *et al.*, 2017; Ayub *et al.*, 2017). Although an effort is made to update the regulations set in place to ensure food safety, it is often unfortunately restricted to the formal sector. This, therefore, leaves food safety in the informal sector to chance, something which exposes consumers who enjoy affordable services to foodborne diseases.

Since the Listeriosis outbreak in 2018, food safety has been an area of great interest in South Africa; however, research that has focused on the informal sector is limited. This sparked an interest to know more about the sector; the reason for the specific problem statement, objectives and conceptual framework in this study.

The methods used in Chapter 3 ensured the study's reliability and validity. The KAP model, which was chosen as the theoretical perspective, assisted the researcher to properly structure the study and aided in the interpretation of the findings. This study was quantitative in nature

as the data were collected using a semi-structured questionnaire, which was administered through face-to-face interviews in order to ensure that the respondents understood the questions in their home languages. Prior to conducting the interviews, prospective respondents were provided with a letter of consent that explained the aim and objectives of the study, the researcher's association with the University, and provided a guarantee of anonymity. This was used to ensure that the data collected were reliable. The use of scale items that were previously used in other similar studies further ensured that the instrument was valid and measuring what it was set to measure.

The findings of the study provided adequate information on food safety gaps in the informal sector, which can be used to create a tool that would possibly drive governmental initiatives on food safety assurance in the informal sector.

5.3 ACHIEVEMENT OF THE OBJECTIVES SET OUT FOR THIS RESEARCH

The researcher is confident that all of the objectives were attended to and addressed satisfactorily. The respondents did not encounter any problems regarding the structure and content of the questionnaire, which made data collection an easy and successful exercise. It is believed that the findings reported, and conclusions drawn will add to the body of literature pertaining to street vendors' food safety knowledge, attitudes, and practices in South Africa.

5.4 LIMITATIONS OF THE STUDY

While conducting the study, the researcher ensured that the investigation obtained accurate results in a reliable and ethical manner. Regardless of all efforts employed to conduct the study in the best possible manner, the study was still restricted to certain limitations, which are detailed below:

1. One of the biggest problems encountered while conducting this research was the lack of statistics on street vendors in South Africa, which made sampling difficult. It is therefore suggested that future research should focus on investigating the number of street vendors and their enterprises in Gauteng. The studies conducted in Cape Town in efforts to map informal traders could be used as a benchmark for future research (Charman & Petersen, 2015; Charman *et al.*, 2017).

2. A prerequisite for inclusion in this study was that the respondents had to be 18 years or older and involved in the vending of locally consumed fresh produce. This prerequisite assumed that all those who sold fresh produce were involved in all processes of the business (e.g. purchasing, handling, preparation and storage). However, during the face-to-face interviews, it was discovered that not all vendors (those who were selling in the stalls) were involved in the background operations of the business. In some instances, the owner of the business delivered produce for sale that had already been prepared (e.g. packaged) every morning and ready for sale, and collected all remaining produce at the end of the day for storage. This was noted as a limiting factor in terms of informed responses regarding preparation and storage. Thus, for future studies, it is advised that two sets of questionnaires be designed, one targeted at the business owners (those who purchase stock and prepare the produce for sale) and one for the person who visibly sells the fresh produce to the public.
3. Convenience-snowballing was used to sample the respondents for this study based on who was easily accessible; however, a convenient sample is not necessarily always representative of the population (Salkind, 2010). This method limited sampling to only the busy streets in Tshwane and excluded townships. Mamelodi, as a representation of townships, was scheduled as one of the areas to be visited for data collection; however, an unforeseen strike disturbed these plans, redirecting the exercise to a much safer and easily accessible location.
4. The language barrier was also a limitation in this study. Since the researcher is not a South African citizen, this limited her communication abilities to English and Siswati, languages that are not richly used by street vendors. For these reasons, she had to recruit field workers with the relevant language sets, however, due to limited resources, not all languages were well represented, which led to communication gaps in cases where the respondents could not clearly understand the language in which the questions were posed.

5.5 RECOMMENDATIONS FOR FURTHER RESEARCH

This study aimed to investigate the food safety knowledge, attitudes, and practices of street vendors in Tshwane when managing fresh produce. This was done to identify gaps and to create an empirical evidence-based scene for practical and policy-related recommendations that aim to enhance current food safety protocols amongst street vendors. Based on the results found in this study, the following recommendations are therefore made:

- The government could explore regulations or bylaws for street vendors that put emphasis on the importance of proper food handling, preparations, and storage to ensure food safety practices in their sector.
- Future studies can be done to investigate where street vendors source their information regarding food safety in order to evaluate the quality of the content relayed to them.
- It is easy to assume that the lack of positive practices in street vending is due to a lack of resources; however, this is not evidence-based. Perhaps a study should be conducted to investigate the underlying factors that lead street vendors to engage in poor food safety practices, regardless of possessing adequate knowledge.

5.6 IMPLICATIONS OF THE FINDINGS

5.6.1 Implications for street vendors

Over the years, South African consumers have become greatly aware of food safety issues. The Listeriosis outbreak in 2018, combined with the latest COVID-19 pandemic that highlighted the disastrous effect that street vending (wet markets) could have on global health, raised the awareness of most consumers on the importance of food safety, regardless of their educational background (Skinner, 2020). It is true that consumers are still in need of affordable sources of fresh produce; however, they are greatly aware of food safety standards (especially during purchasing) and can easily reject poor service (Jevšnik, Hlebec & Raspor, 2008). This therefore means that if street vendors continue disregarding the importance of food safety practices, as highlighted by the findings of this study, they will suffer the consequences through a reduced customer base.

5.6.2 Implications for government

Currently, in South Africa, there is no foodborne outbreak (known to the researcher) that has resulted directly from street food, thus the lack of attention given to the matter (Hunter-Adams, Battersby & Oni, 2018). The results of this study have demonstrated the importance of food safety knowledge in street vending. Its strong correlation with attitudes served as an eye-opener and should not be taken lightly. Attitudes, as proven in this study, have a stronger potential to influence practices as compared to knowledge. This implies that the South African government has the responsibility of developing training material and creating campaigns aimed at improving street vendors' attitudes. It must be noted, however, that for these campaigns to be effective, they should be time conscious and follow the latest communication trends. For instance, the results indicated that only younger street vendors felt inclined to present positive attitudes compared to the older generation. Perhaps initiatives that are inclusive of both the youth and the older generation may be explored to raise awareness on the importance and implications of food safety. In current times, social media is the best platform for education, demonstration and creating habits that could include influencing peoples' attitudes towards a phenomenon, however, this may not reach the older generation at the same rate it reaches the youth. There should be a balance in the use of media platforms that will cut across all generations, for instance, while the youth are into social media, the older generation still depend on radio and television as their source of information.

It is important, however, to acknowledge that training street vendors might not be a simple task due to their diverse demographic backgrounds. These include their varying language base and level of education, which may initiate added efforts in adjusting programmes to suit the whole sample. Training programmes must also be delivered continuously and not treated as a once-off job since the sector is highly mobile.

5.7 CONCLUDING REMARKS

From the research conducted, it becomes evident that food safety knowledge is related to attitudes and practices, thus they should be treated as a whole. It is therefore believed that if food safety issues are dealt with using a holistic approach, safe practices will inevitably follow suit. With the help of the South African government and municipalities, street vendors may

realise that although most practices require proper resources and infrastructure to be executed, coming up with alternative measures that best fit the informal sector could help protect consumers from foodborne diseases. It is important to recognise, however, that without investing in educating street vendors in the country, this may not be possible. Local governments need to put emphasis on relevant training programmes that work towards ensuring a positive attitude and the behavioural change of street vendors. This will not be an easy task in a country such as South Africa (a rainbow nation), as initiatives need to be mindful of the different cultures, languages, and varying educational backgrounds of the vendors. However, investment and encouragement in this regard would greatly contribute to ensuring food safety for all.

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ADDENDUM A: QUESTIONNAIRE



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Faculty of Natural and Agricultural Sciences



DST-NRF
Centre of Excellence
in Food Security

DEPARTMENT OF FOOD AND CONSUMER SCIENCE

Food safety knowledge, attitudes and practices of Tshwane street vendors when managing fresh produce.

Section A

PLEASE TELL US MORE ABOUT YOURSELF

Answer every question and mark only the most relevant answer with an

X

Respondent number

1. What is your gender?							Male
Female							1
2. What was your age at your last birthday							
Years							
3. What is your highest level of education	Grade7	Lower than grade 7	Lower than grade 12	Grade 12	Degree /Diploma	Postgraduate	
	1	2	3	4	5	6	
4. Which country do you come from?							
5. Where around Tshwane do you sell your Produce?							
6. Do you have a stall?					Yes	No	
					1	2	
7. Approximately how much profit do you make in a month?	Less than R1000		1				
	R1000- R3000		2				
	R3000- R5000		3				
	R5000- R10000		4				
	Above R10000		5				
8. Do you have another source of income					Yes	No	
					1	2	

Please follow the instructions for each question very carefully. Your responses will be treated confidentially, and you will remain anonymous as your identity can not be retrieved or disclosed in any way.

fresh produce of choice Which Fruits and vegetables from the list below do you typically buy to sell in your stall?	
Cabbage	1
Carrots	2
Green beans	3
Spinach	4
Morogo/ African leafy vegetable	5
Lettuce	6
Kale	7
Cucumber	8
Sweetcorn	9
Peas	10
Onions	11
Butternut	12
Beetroot	13
Pumpkin	14
Sweet potato	15
Potatoes	16
Cauliflower	17
Broccoli	18
Green pepper	19
Tomato	20
Apple	21
Apricot	22
Avocado	23
Banana	24
Grape	25
Guava	26
Lemon	27
Mango	28
Nartjie	29
Orange	30
Papaya	31
Peach	32
Pear	33
Plum	34
Pineapple	35
Watermelon	36

SECTION B KNOWLEDGE

What do you know about food safety?

Please indicate your agreement with the following statements and mark only the most relevant with a X in the relevant column.

1. Please answer the following statements using a rating of 1 to 3, where 1 would indicate that you think the statement is "definitely true" and 3 indicating that you think it is "definitely false".

	DEFINITELY FALSE	NEITHER TRUE OR FALSE	DEFINITELY TRUE
Food Handling Knowledge			
1.1. Cross contamination is the passing of harmful substances or bacteria to food from dirty equipment, utensils or hands.	1	2	3
1.2. Hands should be washed vigorously with soap and water before working with fresh produce.	1	2	3
1.3. Food handlers with abrasions and sores on their hands must cover their hands with a bandage, glove or avoid touching fresh produce.	1	2	3
1.4. Keeping your hair covered and keeping short nails reduces the risk of food contamination.	1	2	3
1.5. Work surfaces and utensils should be cleaned and sanitised after every task when handling fresh produce.	1	2	3
1.6. It is necessary for food handlers to take leave and not handle fresh produce when suffering from infectious diseases like diarrhoea, colds and skin rashes.	1	2	3
Food Preparation knowledge			
1.7. Fruits and vegetables are washed in running water to prevent the spread of microorganisms.	1	2	3
1.8. The use of separate cleaned and sanitized cutting boards for raw meat and fresh produce minimizes the risk of cross contamination during food preparation.	1	2	3
1.9. If a bowl or bucket is used for washing fresh produce, water should not be discarded until they become viscous and sticky.	1	2	3
1.10. Pre-cutting fresh produce before display for sale encourages the growth and multiplication of microorganisms that may result to food contamination.	1	2	3
1.11. Fresh fruits and vegetables that have wilted or starting to show signs of rot should be discarded.	1	2	3
1.12. Vegetables should be cooked in high temperatures for a short period of time.	1	2	3
Food storage knowledge			
1.13. Vegetables should be separated from meats during storage.	1	2	3
1.14. Fresh produce should be packaged to protect them from dust and car fumes before display.	1	2	3
1.15. The presence of mice and rodents in a storage space serve as a major possible contaminant.	1	2	3
1.16. Cleaning and pest control chemicals should be stored with fresh produce if they are in their original containers.	1	2	3
1.17. Storing fresh produce in a wheelbarrow exposes fresh produce to chemical contamination.	1	2	3



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1.18. Cooler boxes can be used in the absence of refrigerators to control temperatures in fresh produce storage.	1	2	3
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SECTION C ATTITUDES			
2. How do you feel about the following? <i>Please answer the following statements using a rating of 1 to 3, to rate your feelings where "1" would indicate "clearly describe my feelings" and "3" would indicate "does not describe my feelings".</i>	DOES NOT DESCRIBE MY FEELINGS	MODERATELY DESCRIBES MY FEELINGS	CLEARLY DESCRIBES MY FEELINGS
Food Handling Attitudes			
2.1. I feel that cross contamination is the passing of harmful substances or bacteria to food from dirty equipment, utensils or hands.	1	2	3
2.2. I believe that hands should be washed vigorously with soap and water before working with fresh produce.	1	2	3
2.3. I think that food handlers with abrasions and sores on their hands must cover their hands with a bandage, glove or avoid touching fresh produce.	1	2	3
2.4. I believe keeping your hair covered and keeping short nails reduces the risk of food contamination.	1	2	3
2.5. I think work surfaces and utensils should be cleaned and sanitised after every task when handling fresh produce.	1	2	3
2.6. I feel it is necessary for food handlers to take leave and not handle fresh produce when suffering from infectious diseases like diarrhoea, colds and skin rashes.	1	2	3
Food Preparation Attitudes			
2.7. I think fruits and vegetables should be washed in running water to prevent the spread of microorganisms.	1	2	3
2.8. I believe that the use of separate cleaned and sanitized cutting boards for raw meat and fresh produce minimizes the risk of cross contamination during food preparation.	1	2	3
2.9. I feel that if a bowl or bucket is used for washing fresh produce, water should be discarded before it becomes viscous and sticky.	1	2	3
2.10. I think that pre-cutting fresh produce before display for sale encourages the growth and multiplication of microorganisms that may result to food contamination.	1	2	3
2.11. I believe that fresh fruits and vegetables that have wilted or starting to show signs of rot should be discarded.	1	2	3
2.12. I feel that vegetables should be cooked in high temperatures for a short period of time.	1	2	3
Food Storage Attitudes			
2.13. I believe that vegetables should be separated from meats during storage.	1	2	3
2.14. I think that fresh produce should be packaged to protect them from dust and car fumes before display.	1	2	3
2.15. I feel that the presence of mice and rodents in a storage space serve as a major possible contaminant.	1	2	3
2.16. I think cleaning and pest control chemicals should not be stored with fresh produce.	1	2	3
2.17. I believe storing fresh produce in a wheel barrow exposes fresh produce to chemical contamination.	1	2	3

2.18. I feel that cooler boxes can be used in the absence of refrigerators to control temperatures in fresh produce storage.	1	2	3
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SECTION D PRACTICES			
3. How often do you perform these practices in your business: <i>Please answer the following statements using a rating of 1 to 3, where "1" would indicate "Never" and "3" would indicate "Always".</i>	NEVER	SELDOM	ALWAYS
Food Handling Practices			
3.1. I prevent Cross contamination from dirty equipment, utensils or hands when working with fresh produce.	1	2	3
3.2. I wash hands vigorously with soap and water before working with fresh produce.	1	2	3
3.3. I cover my hands with a bandage, glove or avoid touching fresh produce when I have abrasions and sores.	1	2	3
3.4. I Keep my hair covered and keep my nails short to reduce the risk of food contamination.	1	2	3
3.5. I clean and sanitize work surfaces and utensils after every task when handling fresh produce.	1	2	3
3.6. I take leave and not handle fresh produce when suffering from infectious diseases like diarrhoea, colds and skin rashes.	1	2	3
Food Preparation Practices			
3.7. I wash fruits and vegetables in running water to prevent the spread of microorganisms.	1	2	3
3.8. I use separate cleaned and sanitized cutting boards for raw meat and fresh produce to minimize the risk of cross contamination during fresh produce preparation.	1	2	3
3.9. I discard water before it becomes viscous and sticky when washing fresh produce in a bowl or bucket.	1	2	3
3.10. I Pre-cut fresh produce like cabbages or water melons before I display them for sale to increase affordability.	1	2	3
3.11. I discard off fresh fruits and vegetables that have wilted or starting to show signs of rot.	1	2	3
3.12. I cook vegetables in high temperatures for a short period of time.	1	2	3
Food Storage Practices			
3.13. I separate fruits and vegetables from meats during storage.	1	2	3
3.14. I package fresh produce to protect from dust and car fumes before display.	1	2	3
3.15. I control the presence of mice and rodents from the proximity of my fresh produce storage area.	1	2	3
3.16. I store cleaning and pest control chemicals with fresh produce if they are in their original containers.	1	2	3
3.17.			
3.18. I store fresh produce in a wheel barrow during day in my stall.	1	2	3

3.19. I use cooler boxes to store fresh produce in the absence of refrigerator to control temperature.	1	2	3
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Thank you for your participation and valuable contribution to this research.

Your information will remain anonymous throughout the research process.

ADDENDUM B: CONSENT LETTER



FOOD SAFETY KNOWLEDGE, ATTITUDES AND PRACTICES OF TSHWANE STREET VENDORS WHEN MANAGING FRESH PRODUCE.

Dear Participant

You are being asked to take part in a research study conducted by a University of Pretoria Masters student under the title **food safety knowledge, attitudes and practices of Tshwane street vendors when managing fresh produce**. You were selected as a possible participant because you provide consumers around Tshwane with fresh produce that is commonly consumed in the country (South Africa) and you are considered to have a wealth of knowledge that may be beneficial for this study.

The purpose of this study is to investigate the food safety knowledge, attitudes, and practices of street vendors (one of them being yourself) in Tshwane when managing fresh produce.

If you agree to be part in this study, you will be asked to respond to a few questions that may help the researcher analyse the level of food safety knowledge street vendors have, attitudes and practices towards the management of fresh produce. This study has no foreseen risks and you are assured that the information you provide will be kept anonymous as no information about your identity will be asked of you.

The decision to participate in this study is completely up to you. You have the right withdraw your participation should you not feel comfortable to continue or ask for clarity from the researcher.

Your signature below indicates your consent to take part in the study and you have understood the purpose and objectives of this study as explained to you and you are sure how your participation contributes to the study. If you have any questions, please do not hesitate to contact me at 073 9252713 or email me at zwanephephile@gmail.com

Participant's Signature..... Date.....


Thank you for your participation!!!

Student: Ms SPhephile Zwane, M Consumer Science

Study Leaders: Dr N Marx-Pienaar

Prof GE du Rand

ADDENDUM C: ETHICAL CLEARANCE LETTER



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Faculty of Natural and Agricultural Sciences
Ethics Committee

E-mail: ethics.nas@up.ac.za

7 November 2018

ETHICS SUBMISSION: LETTER OF APPROVAL - AMENDMENT

Prof L Korsten
Department of Plant and Soil Sciences
Faculty of Natural and Agricultural Sciences
University of Pretoria

Reference number: EC 180327-182
Project title: Measurement of water pollution determining the sources and changes of microbial contamination and impact on food safety from farming to retail level for fresh vegetables

Dear Prof Lise Korsten,

We are pleased to inform you that the **Amendment** conforms to the requirements of the Faculty of Natural and Agricultural Sciences Research Ethics committee.

Please note the following about your ethics approval:

- Please use your reference number (EC 180327-182) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.
- Please note that you are required to submit annual progress reports (no later than two months after the anniversary of this approval) until the project is completed. Completion will be when the data has been analysed and documented in a postgraduate student's thesis or dissertation, or in a paper or a report for publication. The progress report document is accessible off the NAS faculty's website: Research/Ethics Committee.
- The digital archiving of data is a requirement of the University of Pretoria. The data should be accessible in the event of an enquiry or further analysis of the data.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee. The Amendment document is accessible off the NAS faculty's website: Research/Ethics Committee.

We wish you the best with your research.

Yours sincerely,



Chairperson
NAS Ethics Committee

ADDENDUM D: CONFERENCE ATTENDANCE AND CONTRIBUTION

Attended: The 2nd International Conference for FOOD SAFETY and SECURITY

Venue: St George Hotel, Pretoria, South Africa

Congress theme: Next Generation Food Safety Technologies 15-17 October 2018

Poster Presented: Assessing the knowledge, attitudes, and practices of fresh produce street vendors: scale development and methodology

Attended as a delegate: FOOD NEXT AFRICA

Venue: Gallagher Convention Centre, Richard Drive, Midrand, Johannesburg, South Africa

Congress theme: Food disruption from farm to fork 24 – 25 June 2019

Attended: The South African Association for Food Science & Technology (SAAFoST)

Venue: Birchwood Hotel and Conference Centre, Johannesburg, South Africa

Congress theme: Food Science and Technology for the 21st Century technologies 1 - 4 September 2019

Poster Presented: Food safety knowledge of street vendors in Tshwane when managing fresh produce

ADDENDUM E: LANGUAGE EDITING CERTIFICATE

Exclamation Translations


To whom it may concern

The dissertation entitled, "Food safety knowledge, attitudes, and practices of Tshwane street vendors when managing fresh produce" has been edited and proofread as of 05 August 2020.

As a language practitioner, I have a Basic degree in Languages, an Honours degree in French and a Master's degree in Assessment and Quality Assurance. I have been translating, editing, proofreading and technically formatting documents for the past 10 years. Furthermore, I am a member of the South African Translators' Institute (SATI) and the Professional Editors' Guild (PEG).

Please take note that Exclamation Translations takes no responsibility for any content changes made to the document after the issuing of this certificate. Furthermore, Exclamation Translations takes no responsibility for the reversal or rejection of the changes made to this document.

Kind regards



Melissa Labuschagne

Melissa Labuschagne trading as Exclamation Translations

<http://www.exclamationtranslations.co.za>

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