PILLARS OF A SAFETY MANAGEMENT SYSTEM FOR SMALL-SCALE VENDED FOODS IN A RURAL-BASED MUNICIPALITY OF SOUTH AFRICA

By

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DECLARATION

I, Mushaisano Agnes Mathaulula, hereby declare that this thesis for the Doctor of Philosophy in Rural Development (PHDRDV) degree submitted to the Institute for Rural Development, School of Agriculture, at the University of Venda has not been submitted previously for any degree at this or another university. It is original in design and in execution, and all reference material contained therein has been duly acknowledged.

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ABSTRACT

Throughout the world, small-scale food vending forms an integral part of society, serving as a poverty buffer and a local based economy generation strategy to optimize livelihoods. However, untrustworthiness and safety concerns have been raised regarding the food handling practices and hygiene that tend to compromise the quality of the food sold in this sector. Thus, this study was conducted in order to propose the pillars of a safety management system for small-scale vended foods in Thulamela Municipality in South Africa. The pillars were proposed after assessing the level of small-scale food vendors' knowledge, attitude and handling practices. Complementary, the microbiological quality of the commonly consumed small-scale vended foods was determined.

A survey-underpinned exploratory sequentially integrated mixed methods research design was adopted. Fifty-four respondents participated in a qualitative study via administering a semi-structured interview guide to key informants and focus groups. Correspondingly, quantitative data were collected through a 5-point Likert questionnaire, administered to 136 small-scale food vendors and 272 customers. An observation checklist was used to collect data on 124 food stalls focusing on food handling practices. Microbial loads were determined through analysing 28 food samples collected from seven informal food markets. Qualitative data were analysed using ATLAS. ti version 8.0. The Statistical Package for Social Sciences version 25.0 was used to analyse quantitative data. Descriptive statistics were used to calculate frequencies and mean scores. The Spearman's rank correlation coefficient (r) was used to determine the degree of correlation among variables. Principal Component Analysis was used to isolate and deepen understanding of the main factors determining the knowledge and attitude towards food safety. Hierarchical Cluster Analysis was used to identify two cluster solutions for food handling practices. Mann-Whitney U tests were conducted to determine the relative stability of the generated two cluster solutions. Ordinal Least Square regression analysis was conducted to identify the variables which were critical in defining the state of food handling practices dynamics in the study area and their relationship with other variables. Data on the microbial counts were subjected to the Analysis of Variance. Duncan's multiple range test was used to separate means while T-test was conducted to establish if there was any difference between organisms isolated for each food type from Thohoyandou and Sibasa markets.

In general, food vendors were knowledgeable about personal ($\bar{x}$ = 1.77) and food ($\bar{x}$ = 1.75) hygiene respectively. However, they rarely considered knowledge of foodborne diseases and rules and

regulations as crucial in defining the quality and safety of small-scale vended foods. Respondents reflected positive attitude towards personal hygiene ($\bar{x}$ = 3.21), food hygiene ($\bar{x}$ = 3.55) and utensils management ($\bar{x}$ = 3.43). The highest correlation relations between variables of roadside vendors' knowledge of food safety were observed to be between "*Staphylococcus* as a germ that causes foodborne diseases" and "Hepatitis A virus that can cause foodborne disease" ($P < 0.01$). From thirty-six factors that determined the knowledge and attitude towards food safety, the Principal Component Analysis isolated eight components that accounted for 50 % of the variability. Similarly, customers were knowledgeable about food hygiene ($\bar{x}$ = 1.88) personal hygiene ($\bar{x}$ = 1.86). They also showed positive attitude towards personal ($\bar{x}$ = 3.66) hygiene, food ($\bar{x}$ = 3.72) hygiene and utensils management ($\bar{x}$ = 3.56). From thirty-six factors that determined the knowledge and attitude towards food safety, the Principal Component Analysis isolated ten components that accounted for 60. % of the variability.

The results revealed the six major determinants of the state of handling practices in Thulamela Municipality. These were stalls conditions, personal hygiene, environmental and waste management, hygiene-related behaviour, food storage and utensils management. The most significant variables defining the state of food handling practices were protective clothing ($P < 0.05$) and stalls conditions ($P < 0.05$). The microbial counts (log_{10} cfu/g) of food samples ranged from 2.0 ± 2.08 to numerous to count for total plate count, 2.0 ± 1.00 to 6.6 ± 7.57 for *Salmonella spp*, 2.0 ± 2.64 to 3.9 ± 6.03 for *S. aureus*, 2.1 ± 1.73 to numerous to count for yeast, 2.0 ± 0.00 to 3.8 ± 10.00 for coliform bacteria and 2.0 ± 1.15 to 4.9 ± 21.66 for *B. aureus*. Coliform bacteria and *B. cereus* were not found in foods sold at Thohoyandou markets while mould was not detected in foods collected at both locations. Total plate count differed significantly ($P < 0.05$) between salads and chicken stews. *Salmonella spp,* significantly differed ($P < 0.05$) between salads and beef stews. For *S. aureus*, a significant difference was found in salads ($P < 0.05$). For yeast, significant differences ($P < 0.05$) were observed between salads and beef stews.

The main objective of this study was to propose the pillars of a safety management for small-scale vended foods. Thus, the major components of pillars proposed were encored on hygiene (personal, food and handling practices), training programme, environmental management, infrastructure development and law enforcement. The training programme was scored as number one by the majority of food vendors ($\bar{x}$ = 4.7) whilst personal hygiene was ranked first by the customers ($\bar{x}$ = 4.8). The results of the study revealed the urgent need for basic training in food and personal hygiene throughout the value chain. Infrastructure development such as a decent food stalls with adequate

working space, proper washing and storage facilities to improve food safety and hygienic practices was highlighted. Adequate access to waste-water and food disposal facilities aligned to vending spaces was also considered crucial. Thus, it is recommended that Thulamela Municipality should provide extensive training programme to ensure that proper hygiene practices are in place. Suitable regulations must be crafted to ensure that safe and secure foods are sold. Lastly, Thulamela Municipality should consider providing all vending stalls with basic infrastructure to close the gap between knowledge and practices of safe small-scale food vending.

Key words: Food safety; food handling practices; management systems; microbial load; small-scale; street-vended foods.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

ATCC	American Type Culture Collection
BPW	Buffered Peptone Water
CAC	Codex Alimentarius Commission
CASE	Community Agency for Social Equity
CDCP	Centre for Disease Control and Prevention
EHP	Environmental Health Practitioners
FAO	Food and Agriculture Organization
FSQ	Food Safety and Quality
HCCP	Hazard Analysis and Critical Control Points
ICMSF	International Commission on Microbiological Specifications for Foods
ILO	International Labour Organization
ISO	International Organization for Standardization
LED	Local Economic Development
LP	Limpopo Province
NEA	National Environment Agency
NRAFF	National Restaurant Association, Education Foundation
RSA	Republic of South Africa
SABS	South African Bureau of Standards
SMMEs	Small and medium-sized enterprises
SMMEs	Small, medium and micro-enterprises
SPSS	Statistical Package for Social Sciences
StatsSA	Statistics South Africa
TM	Thulamela Municipality
USA	United State of America
VDM	Vhembe District Municipality
WHO	World Health Organization

CHAPTER 1 INTRODUCTION

1.1 Background

Small-scale vended foods are defined as ready-to-eat foods or beverages prepared and sold especially in the streets and other public places for immediate consumption or consumption at a later time without further processing or preparation (Thanh, 2015). The small-scale food sector has been growing rapidly all over the world especially in developing countries (Kok & Balkaran, 2006). In Africa, small-scale food vending and consumption have proliferated in the last three and half decades (Marras *et al*., 2016). With unprecedented urban growth especially the increase and the size of unemployed labour, the demand for small-scale vended foods have gained momentum.

In South Africa, the presence of small-scale vended foods and small-scale food vendors has become one of the viable socio-economic trade in urban and rural areas. It is one of the informal local-based socio-economic strategies that counteract the unemployment rate that is a major challenge in developing countries, including South Africa. According to Statistics South Africa (StatsSA, 2019), the unemployment rate is estimated to be 27.6 % as of the first quarter of the year 2019. Youth and women constitute the majority of the unemployed. Subsequently, self-employment has such as creation of various types of small-scale businesses such as small-scale food vending on roadsides and adjacent to workplaces, bus or taxi ranks and other open spaces has increasingly become an alternative poverty buffering system.

Makelele *et al*. (2015), further argues that small-scale vended foods contribute significantly to the diets of many people in both developed and the developing countries. Approximately, 2.5 billion people in the world consume small-scale vended foods each day (Haleegoah *et al*., 2015). In Latin America for example, small-scale vended foods account for up to 30 % of urban household purchases (Samapundo *et al.*, 2015). Studies conducted in Botswana (Chicho-Matenge & Ongori, 2013), Nigeria (Aluko *et al*., 2014) and South Africa (Ronquent-Roso *et al*., 2015) reveal that 2.5 billion of people world-wide spend their money on small-scale vended foods. In addition to offering food security, the sale of small-scale vended foods makes a sizeable contribution to the economies of developing countries. Within Limpopo Province, Thulamela Local Municipality in particular, small-scale foods make a significant component of the economy and contribute to the

livelihoods of the poor (Mukhola, 2014; Nesamvuni, 2014). This highlights the fact that there is need to protect, promote and integrate small-scale food vending into the formal local economy.

Despite the potential benefits of small-scale vended foods presented above, their safety is questionable because in most cases they are prepared under unsanitary conditions (Proietti *et al*., 2014; Kothe *et al*., 2016). As a result, small-scale vended food can become contaminated, which exposes people who consume it to the potential risk of foodborne diseases such as *Salmonellosis, listeriosis*, typhoid fever, cholera and diarrhoea, among others (Manguiat & Fang, 2013; Liu *et al*., 2014). Each year, foodborne illnesses affect up to one-third of the population of developed countries (Draeger *et al.*, 2019). It is estimated that 600 million, which is almost 1 in 10 people in the world fall ill after eating contaminated food, leading to 420 000 dying every year. Almost 33 million healthy life are lost every year (Bako, 2018). In Europe, approximately 5 196 foodborne outbreaks (including water-borne outbreaks) occurred in 2013 (Thanh, 2015). Studies on small-scale food vending in developing countries, South Africa included, have also shown that such foods cause serious food poisoning outbreaks because of contamination with pathogens (Mukhola, 2014; Thanh, 2015; Akusu *et al*., 2016). For example, a Bormann *et al*. (2016) survey carried out in Ghana reveals that there were more than 200 cases of foodborne diseases and 50 deaths. Both cases were attributed to the consumption of contaminated small-scale vended foods.

Sometimes foods are stored at improper temperatures. According to Okojie & Isa (2014), food is often prepared in unhygienic environments with waste-water and garbage disposal nearby. This provides nutrients and breeding ground for rodents and vermin. In most cases, there is no running water at the vending sites. Food handlers and their customers wash hands and utensils in bowls and buckets, accumulating dirt in the water (Lamin-Boima, 2017). The poorly regulated operations of small-scale food vendors raise serious food safety issues and put into question hygiene standards, which should be monitored and action taken by relevant authorities. In South Africa, Mafunzwaini (2013) and Mathaulula *et al.* (2015) point out that small-scale food vending is mainly informal and also has not yet received adequate attention from policy makers. Consequently, both the formal regulation of food safety and enforcement of street food hygiene are weak. The fact that food handlers are inadequately trained in safety and good hygiene practices (Mukhola, 2014) compounds the situation. Thus, it is crucial to prevent the risk of contamination of small-scale vended foods at all stages of handling food.

In South Africa, the provision of safe food to customers is the responsibility of the service provider (Murwira, 2017). However, there is an added obligation on authorities to ensure that food service establishments serving food to the general public must comply with the regulations. Also, the authorities are expected to monitor compliance. The regulations are detailed in the Health Act, No. 63 of 1977 and the Foodstuffs, Cosmetics and Disinfectants Act of 1972. Furthermore, the Codex Code of Ethics for International Trade in Food which indicates that all customers are entitled to safe, sound and wholesome food and to be protected from unfair trade practices. However, all these rules and regulations do not apply to the small-scale food vending sector because it is regarded as the informal sector of the economy.

In Limpopo Province, Thulamela Municipality in particular, the Compliance Unit officers under the Community Service Department regulate the street food sector. (Thulamela Municipality, 2015). The role of this unit is solely to register all the street food vendors in its area of jurisdiction and collect annual renewal fees. Identification of vending sites is done by the vendors themselves who then report to the Hawkers Association committee for approval. The allocation of basic facilities is currently limited.

The situation revealed above necessitated conducting of the current study in order to establish the level of small-scale vendors and customers' knowledge, attitudes and handling practices concerning food safety. This was done with the aim to propose the key pillars of a safety management system for small-scale vended foods. The inclusion of customers in the current study was based on the fact that the benefits derived from proposed pillars of safety management will depend to a large extent upon their degree of participation and support. Thus, customers who are well informed and have a better understanding of food safety are likely to insist on food vendors to comply with the requirements.

1.2 Description of the Study Area

The study was conducted in Sibasa and Thohoyandou towns which are both located in Thulamela Local Municipality (Figure 1.1), of Limpopo Province in South Africa. Sibasa is located 3 km away from Thohoyandou town. Thulamela Local Municipality is found in the north-eastern corner of the country and shares borders with Botswana, Mozambique and Zimbabwe. It is one of the four local Municipalities that make up the Vhembe District Municipality.

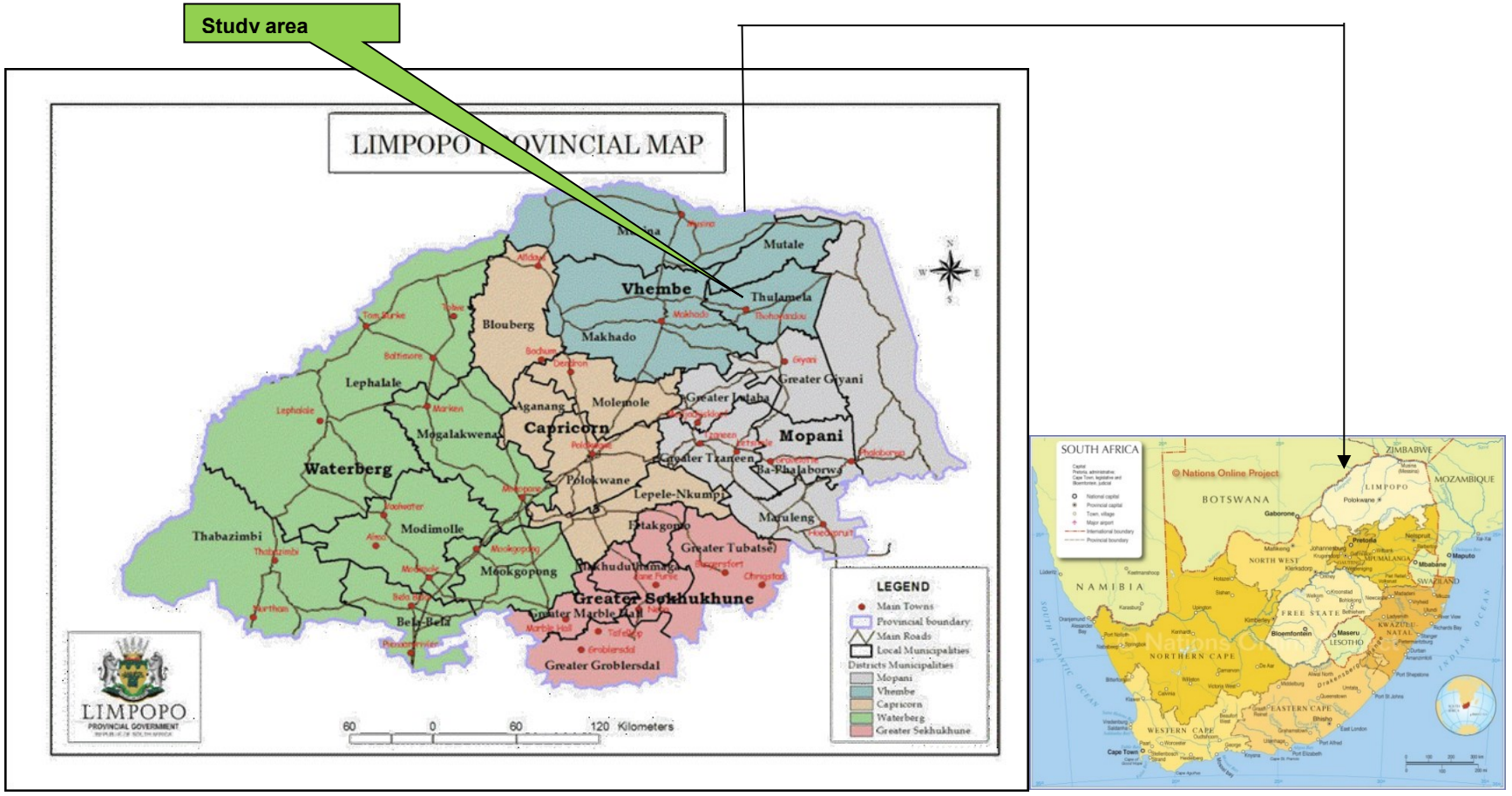

Figure 1.1: Limpopo Provincial map showing all its five constituent Districts (Left) and map of South Africa (Right)

Source: Thulamela Municipality (2017)

It is a Category B Municipality established in terms of the Municipal Structures Act number 117 of 1998. There are 40 wards in the Municipality. The Kruger National Park forms the boundary in the east. Makhado Municipality is the neighbor lying to the south and south-west. Thulamela Local Municipality covers the vast track of mainly tribal lands. Thohoyandou is its political, administrative and commercial centre. It covers an area of 2 904.55 km²: 22° 57´ S 30° 29´ E and is the home to approximately 497 237 people (StatsSA, 2016). According to StatsSA (2011), people who speak Tshivenda and Xitsonga are the dominant inhabitants of the Municipality.

Thulamela Municipality is home to two rural towns, namely Sibasa and Thohoyandou which justify they being chosen as area of the study. The community survey of StatsSA (2016) reveals that the total number of households in the Municipality is 497237 of which 84.6 % are females. The author goes on to indicate that 61.5 % of the population is between 15-64 years old while 4.6% 65 and above. 8.7 % percent of the population had no formal education, 29% had matric certificate while 13.5 % had obtained higher education qualification (StatsSA, 2016). In 2018, Thulamela Local Municipality has recorded the highest unemployment rate of 21.4%, which has decreased from 34.3% in 2008 (Vhembe District Municipality IDP, 2020). This is because job creation and poverty alleviation programmes in the District are negatively affected by the lack of business management, information regarding opportunities and transfer of indigenous skills. Nevertheless, agriculture, Small, Medium and Micro Enterprises (SMMEs), manufacturing, tourism and mining anchor the economy of Thulamela Municipality (Nkwinika & Munzhedzi, 2016). The authors further indicate that SMMEs play a significant economic and social role in the Municipality through their prominence in the economy and in job creation which is much appreciated during these times of crisis and rising unemployment.

The Municipality has various types of SMMEs that are distributed amongst different sectors within the 3 rural towns. The majority of SMMEs are a “one employee or family business” resulting in their minimal contribution to the generation of employment opportunities and income generation (Thulamela Municipality, 2015). The author further argues that SMMEs in the Municipality are negatively affected by lack of contracts with the producer, poor-skilled workforce, and poor infrastructure, lack of access to finance and lack of space amongst others.

1.3 The Statement of the Research Problem

Food safety is a contemporary topic of debate in South Africa and beyond, with foodborne diseases remaining a serious health concern. The WHO (2015) estimates that 600 million people fall ill after consuming contaminated food every year. Food vendors play a major role in the transmission of pathogens passively from contaminated sources to ready-to-eat food (Mukhola, 2014). It is argued that this situation exists because food vendors have limited knowledge and guidance on safety and handling practices (Karthikeyan & Mangalaswarn, 2014; Kok & Balkaran, 2014). Most vendors prepare their foods in unhygienic and unsanitary conditions, which fail to meet safety requirements.

In Thulamela Local Municipality of South Africa for instance, some studies on street food vending (Chauke *et al*., 2015; Mathye & Maliwichi, 2015; Mafune *et al*., 2016) have been conducted. Despite this, there is still a dearth of information on the safety management system for small-scale vended foods even though this forms part of the informal economy. Microbial quality of such foods is also known to a certain extend. Besides, literature generated through empirical studies to build an understanding of the knowledge, attitudes and handling practices of food vendors vis a vis safety is scanty. Also, there is a growing interest amongst customers to buy small-scale vended food because it is affordable and has better taste (Martin, 2006; Mensah *et al*., 2013; Lin, 2014). The findings of these studies report that safety is usually not prioritized as the fundamental aspect to influence customers purchasing decisions. It was therefore, pertinent to investigate the knowledge, attitude and handling practices of food vendors as service providers and the customers awareness of food safety as service recipients. This was done in order to develop and propose holistic context based pillars of a safety management system for small-scale vended foods. Such information is required when crafting strategies that might guarantee the safety of small-scale vended foods.

1.4 Research Objectives

The main objective of the current study was to investigate the knowledge, attitude and handling practice (KAP) of food vendors as service providers and the consumer awareness of food safety and handling practices as service recipients to develop and propose holistic context based pillars of a safety management system for small-scale vended foods in a rural-based Municipality of

South Africa.

Specific objectives that guided the study were to:

a) evaluate the depth of knowledge and attitudes of small-scale food vendors and customers on food safety;
b) assess the food handling practices of the small-scale food vendors;
c) analyze the microbiological quality of some popular small-scale vended foods; and
d) propose pillars of a safety management system for small-scale vended foods.

1.5 Research Questions and Hypotheses

The principal research questions and hypotheses that guided the study are:

a) What evidence shows that small-scale food vendors and their customers know about food safety?
   Hypothesis: small-scale food vendors and their customers do not know about food safety.
b) How do small-scale food vendors ensure food safety?
   Hypothesis: food vendors and their customers do not have positive attitudes towards food safety.
c) What are the good and bad food handling practices that the food vendors display?
   Hypothesis: food vendors do not follow safe food handling practices;
d) What are the microbiological qualities of some of the popular small-scale vended foods?
   Hypothesis: small-scale vended foods do not have high microbial loads that render them unsafe for human consumption.
e) What are the major components of pillars of a safety management system for small-scale vended foods?

1.6 Flowchart of Research Activities

Figure 1.2 presents the flowchart of research activities/process on the pillars of a safety management system for small-scale vended foods. The study was carried out in Sibasa and Thohoyandou areas of Thulamela Municipality.

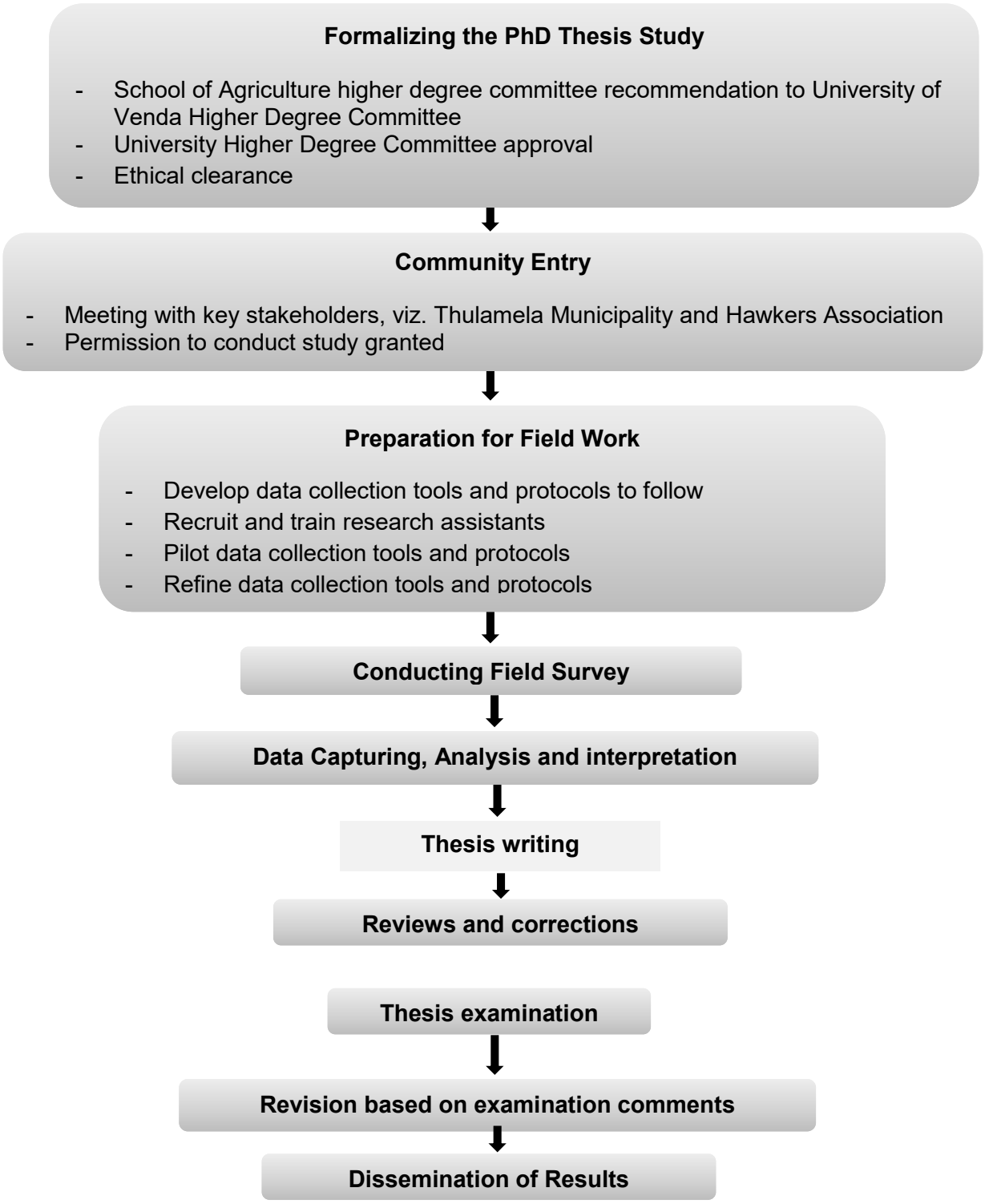

Figure 1.2: A step-by-step flowchart of research activities on to the pillars of a safety management system for small-scale vended foods in Thulamela Municipality, South Africa

1.7 Operational Definitions of Key Terms and Concepts

In this section key terms and concepts used in the study are defined. *Small-scale business* means an income generation activity that requires a small amount of capital to establish.

As Aklahel *et al*. (2015) argue, usually this type of business employs a small number (fewer than 50 full-time employees) of workers or in most cases, is personally handled by the owner.
For this study s*mall-scale vended foods* are ready-to-eat cooked foods and beverages prepared and or sold by vendors and hawkers, especially in streets and other similar places for immediate consumption or consumption at a later stage with or without further processing or preparation (Makelele *et al.*, 2015).

Small-scale food vendors are defined as anybody who prepares and/or sell ready-to-eat food and drink in public places within the area of study (Thanh, 2016).

Food safety: The assurance that when food is consumed in the usual manner does not cause harm to human health and wellbeing (FAO, 2013).

Safety policy: The overall intentions and direction of an organization with regards to safety as formally expressed by top management (FAO. 2011).

Food handler: A person who works with packaged and unpackaged food, food equipment or utensils or food contact surfaces for a food service establishment (Freeman *et al*., 2014).

Personal hygiene: The act of preserving or maintaining the body and clothing to preserve overall health and well-being through cleanliness (Freeman *et al*., 2014).

Food hygiene refers to action taken to make sure that food is handled, stored, prepared and served under hygienic conditions to prevent contamination of food by microorganisms (Ababio & Lovatt, 2015).

Environmental hygiene encompasses the measures undertaken to keep the human environment safe and healthy to live in including waste disposal, clean water supplies, food safety controls and

good housing (Musoke *et al*., 2016).

*Microorganisms a*re microscopic living entities found everywhere. Their size, shape and form determine whether they are bacteria, yeasts, mould, viruses or protozoa (Al Mamun *et al*., 2013). In general terms, those with a greater impact on food safety are bacteria and mould.

Hazard Analysis and Critical Control Point (HACCP) constitute a systematic way of analysing potential hazards in food operation, identifying the points in the operation when the hazards may occur, which are also called critical control points (CCPs) (Pal *et al*., 2016)

A Safety management system refers to a set of coordinated activities to direct and control an organization to continually improve the effectiveness and efficiency of its performance (Stolzer *et al*., 2018).

1.8 Conceptual Framework of the Study

The integrated set of key themes underpinning this thesis is presented in Figure 1.3. They include how human factors such as age, gender, education, knowledge and attitude on food safety and food handling behaviour relate with the quality and safety of food for human consumption is indicated. Similarly, assuring the safety of food requires food governance, in particular coordinated actions across policy, regulations, surveillance and control measures to reduce the risk of foodborne illness. Thus, the dynamic interaction among the various themes of the study is also illustrated.

1.9 Organization of the Thesis

The thesis is packaged following a paper format. Each chapter (except Chapters 1 and 2) begins with an abstract followed by an introduction, research methodology, results, discussion, conclusion and references. Chapter 1 is devoted to the background of the study. Soon after the background is the description of the study area. Also included in the chapter are the statement of the research problem, research objectives, research questions and hypotheses.

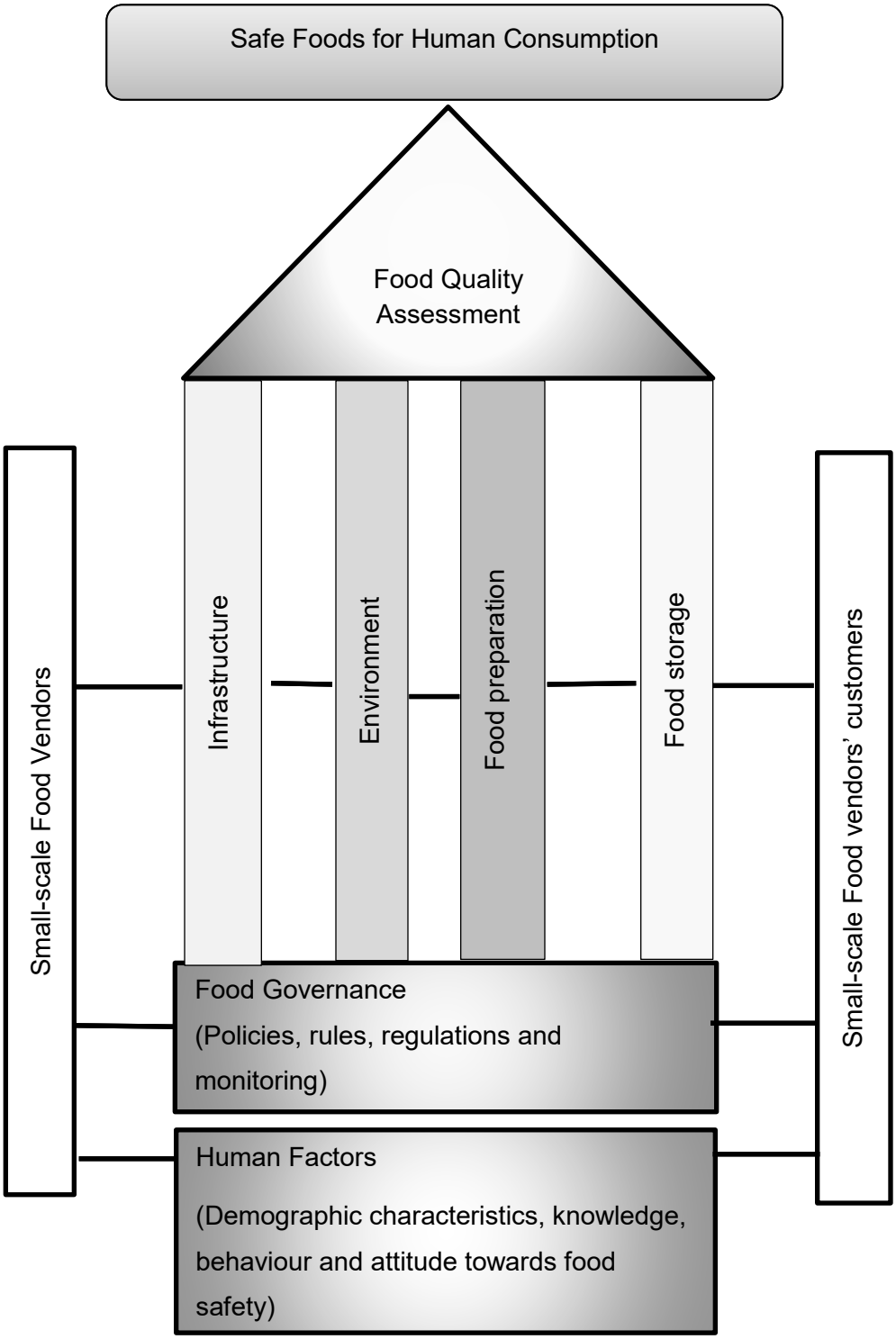

Figure 1.3: **Flow diagram of conceptual framework of the study**

Immediately after the hypothesis is a flowchart of research activities and definitions of key terms and concepts. A flow diagram of thematic areas of study occupies the last section of chapter 1 as presented in Figure 1.4 below. In Chapter 2, an overview of small-scale food vending is presented. This includes a review of literature on the definition, national and international perspectives, food safety knowledge, attitudes and handling practices. A section that explains the microbiological aspects of small-scale vended foods is included. The theoretical framework underpinning the study is discussed before the conceptual framework adopted for this study is presented. A summary of the major issues distilled from the literature review is presented at the end of the chapter. Immediately following the review of literature is Chapter 3. In this chapter, the results of the study on the knowledge and attitudes of vendors towards food safety are presented and discussed. Socio-demographic characteristics and food vending dynamics of vendors are articulated. Similarly, chapter 4 is devoted to the results and discussion of the study on the knowledge and attitudes of customers towards food safety. Socio-demographic characteristics and food vending dynamics of vendors are articulated. In Chapters 5 the results and discussion of the state of food handling practices. Chapter 6 covers the results of microbiological quality of some commonly consumed small-scale vended foods. The proposed interventions on food safety are presented and discussed in chapter 7. Lastly, in Chapter 8 a synthesis of the proposed pillars of a safety management system for small-scale vended foods is outlined.

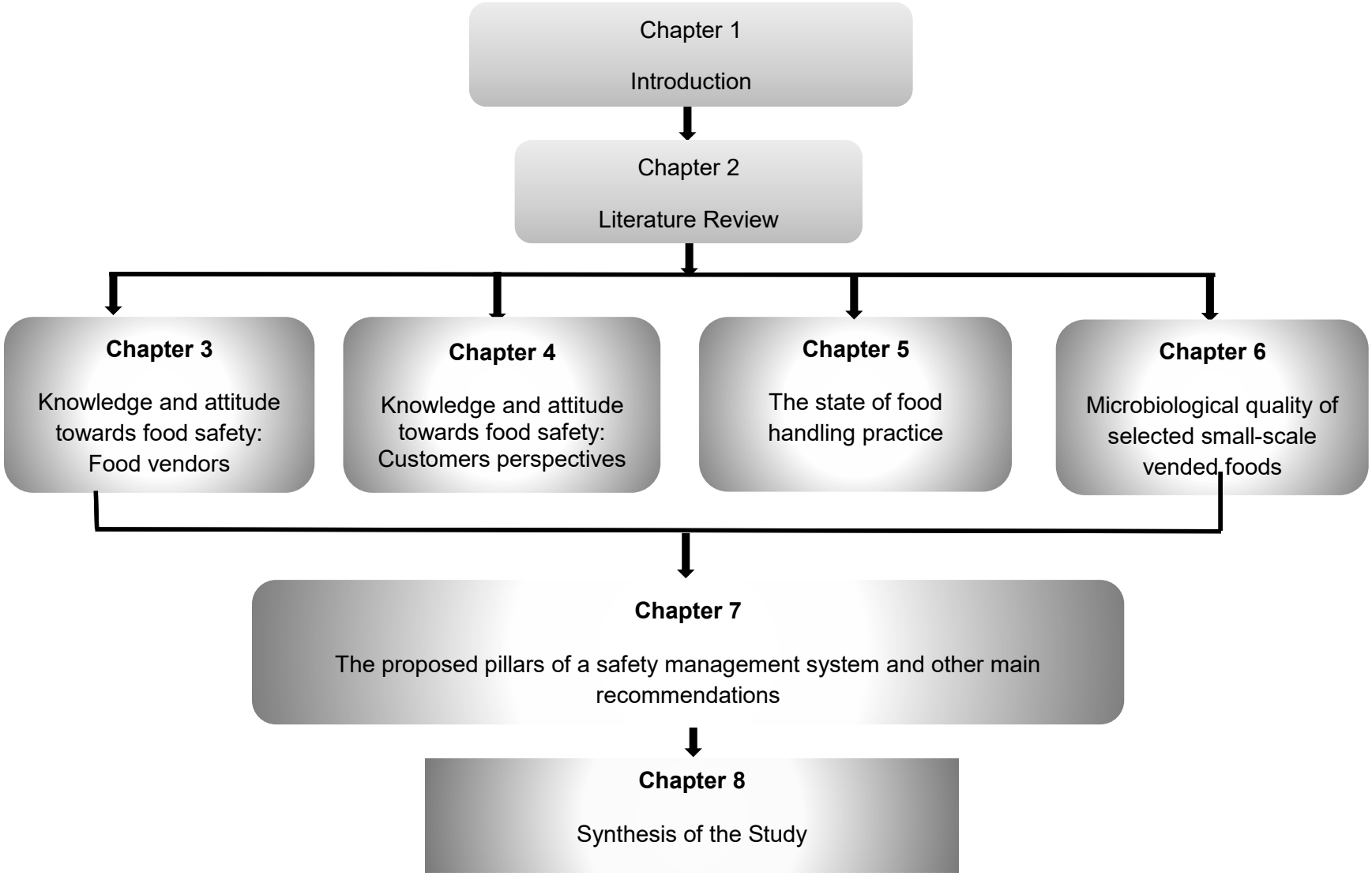

Figure 1.4: Outline of the thesis on the pillars of a safety management system for small-scale vended foods

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CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The theoretical framework for this study is anchored on the assessment of knowledge, attitudes and handling practices of small-scale food vendors. In this chapter, available literature on this subject is reviewed, highlighting critical issues and gaps. The understanding gained from the literature review serves as the starting point in distilling and proposing the pillars of a safety management system for small-scale vended foods that the current study in Thulamela Municipality focused on. Ten parts make up this chapter. The first part is devoted to an overview of small-scale food vending. This is included on the premise that it would help to understand the nature of the business. From sections two to four, the international, national and local perspectives of small-scale food vending are discussed. The literature on knowledge, attitudes and handling practices of small-scale food vendors is covered in section five. The sixth section addresses the microbial quality of small-scale vended foods, while the seventh and eighth sections focus on the regulatory framework for small-scale vended foods. In section nine, the theoretical framework of the study is articulated. The last section is the overall conclusion and summary of the chapter.

2.2 Overview of Small-scale Food Vending

As already alluded to in chapter 1, small-scale vended foods are the ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers especially in streets and other public places (FAO, 1989). The distinguishing characteristics of small-scale vended foods are that they are sold on the street; and prepared in small quantities and brought to the street food stall for sale or that they are prepared at the home of the vendor (Njaya, 2014). Throughout the world, street vending is a common activity whereby people earn a living by selling various goods and services on the street (Lalthapersad-Pillay, 2004). Street food vendors who prepare and/or sell street foods are regarded as small-scale operators or micro-entrepreneurs who form part of the so-called informal sector (Martins, 2006). This is different from the formal sector food industry in many ways as Blaauw (2005) claims. The author claims that the informal sector is unorganized, unregulated and mostly legal but unregistered economic activities that are individually or family owned and uses simple labor-intensive technology.

Many people in the developing countries who have taken up a range of self-employed, small-scale, income-generating activities, both legitimate and illegitimate, which form the informal sector. Bhowmik (2005), categorizes them into three main categories namely, 'mobile'; 'semi-mobile': vendors who may be stationary or move from one site to another and 'stationary' vendors who sell their food at the same site every day. The diversity of street foods is extensive because they vary widely from country to country and also from vendor to vendor. Street food ingredients are country-specific and mostly undocumented. According to Lalthapersad-Pillay (2004), street foods can be grouped by (a) meal (meals, constituents of meals, snacks and drinks); (b) number and type of ingredients (simple and complex foods that contain more than one main ingredients and (c) the level type of processing (minimally processed foods such as peeled or sliced, traditionally processed food made by the vendor or another informal sector operative and centrally processed commercial foods.

Foods sold in the streets may add variety in the diet and enable the customers to meet their recommended daily allowances (RDA). Examples of some of the foods sold in street include noodles or rice-based meals, fried snacks, cakes and pastries, soups, maize-meal porridge, drinks, fruits, vegetables, poultry, beef, sea foods, eggs, cereals (Manko, 2018). Like in other countries, small-scale food vendors in South Africa sell fresh produce, foods such as porridge, meat (beef, chicken) salads, cooked vegetables and fruits (Kok & Balkaran, 2014). Various methods of preparation are used to cater for personal preferences such as frying, roasting, baking, boiling and steaming as well as serving raw products.

Kok & Balkaran (2014) are of the view that at least 80 % of vendors sell goods they do not produce. Also, Lalthapersad-Pillay (2004) in a study carried out in the Durban Metropolitan area, South Africa report that approximately 97 % of women sell goods bought elsewhere. In South Africa, a limited range of goods, particularly fruits and vegetables or ready-to-eat cooked meals are sold by small-scale food vendors usually on the roadside. Similarly, in Jigjiga city Eastern Ethiopia (Bereda *et al*., 2016) reveal that the most common goods sold by street food vendors are food, fruits and vegetables. The same type of food is also sold in Thohoyandou town (Mafunzwaini, 2013). Thus, small-scale food vending seems to strengthen the economy by stimulating small and micro-production as well as the development of the entrepreneur spirit.

The small-scale vending business is sometimes the only occupational option for many poor people especially women (Marginean, 2014). The scholar further alludes that the overall participation of women in small-scale vending (street trade) is high, but the degree and type of involvement varies according to country context. The EPOC studies found that 53 % of street food vendors in Senegal were women (EPOC, 1985). Also, the findings of the study on "Evaluation of street food vending in Azamiz city, Philippines" report the predominance (63 %) of women in street food vending (Canin *et al,*. 2017). Other studies conducted in Africa (Nigeria, Tanzania, Ethiopia and South Africa) also report a predominance of women (Aluko, 2014; Mramba, 2015; Eliku, 2016; Murwira *et al*., 2017). Eliku (2016) further posits that women were involved in this business because they use it to supplement family income in order to cope with harsh economic conditions. Apparently, the highly flexible nature of small-scale food vending offers women the opportunity to balance work and domestic responsibilities. As already alluded to earlier, a large number of people involved in small-scale business is indicative of the importance of this activity in the local, national as well as international economy.

2.3 An International Perspective of Small-Scale Food Vending

Samapundo *et al*. (2015) anticipates that consultations on the vending of street food will recommend the formulation and implementation of regulations to improve the safety aspects of the sector. The same authors note an interest in the promotion of street food in many countries. Their opinion is that over-regulation of the sector is counterproductive and should be discouraged as it could lead to a reduction in the number of street vendors who provide nutritious and tasty food at affordable prices for people in both urban and peri-urban/rural areas (Haleegoah *et al*., 2015). The FAO (2014) is of the view that it is important to implement a code of hygiene for street vendors. In an enhancement of the formal requirement of a hygiene policy, some Latin American and Caribbean countries have already adopted codes that regulate the preparation and sale of street-vended food.

Street-food vending is increasing due to global socio-economic changes, brought about by unemployment. This unemployment encourages street vendors to provide the service of street food (Okojie & Isa, 2014; Rahman *et al*., 2014). This increase has been noticed for several decades and is believed to be a result of urbanization and population growth (Rahman *et al*., 2014). Tavonga (2014) note that street food provides a source of inexpensive, convenient,

nutritious food for both urban and rural poor. Also, food is an attraction that provides a food option for the tourist (Akusu *et al*., 2016). It also offers a source of income for the informal sector, particularly women, and provides an opportunity for self-employment (Oyenebo & Hedberg, 2013; Tavonga, 2014) and the development of sustainable business skills with low capital investment.

Although street foods offer a potential benefit, the fact that vendors are largely poor and uneducated cannot be ignored (Dwumfour & Agyapong, 2014). Lack of skills, coupled with their ignorance compromises the safety of small-scale vended food. Lack of knowledge concerning the safe preparation of street food potentially cause major public health risks. Thanh (2015) recommends that the government intervenes to minimize the risk of food-borne diseases such as listeriosis and botulism. Sources of potential problems listed by the FAO/WHO include lack of infrastructure and services such as portable water supply, large numbers of vendors that hamper effective control, diversity, mobility and temporary nature of the industry (Samapundo *et al*., 2015). Inadequate public awareness of the hazards because of lack of consumer education, compounds the problem of the ignorance of the vendor about the safety aspects of food handling and microbiological status. Furthermore, there are insufficient resources for inspection and laboratory analysis.

Food hygiene is not simply a problem in developing countries. Even in well-developed countries such as Britain, some people who prepare food practice unhygienic handling which may lead to death from food poisoning (Okojie & Isa, 2014). The latter authors further report that between 5 to 6 million people in the United Kingdom suffered food poisoning believed to have been caused by street-vended foods. Liu *et al*. (2014) agree, explaining that even in developed countries customers suffer from food-borne diseases, with up to twenty people per million perishing from such illnesses each year. This is supported by the fact that even in a highly-developed country like the United States of America, some seventy-six million cases of food poisoning are reported every year. These result in 325 000 hospitalizations and an estimated 5000 deaths (WHO, 2015). The incidence of food-borne diseases in developing countries is believed to be slightly higher than in the first world. However, this is difficult to estimate because of the faulty reporting mechanisms. Poor hygiene practices is also common among street vendors in South Africa, Thulamela Municipality included (Murwira *et al*., 2017; Hill *et al*., 2019)

2.4 South African Perspectives of Small-scale Food Vending

Before 1994, the apartheid government did not allow people to live and work in urban areas unless they were working in the white-owned factories, mines, offices and homes (ILO, 2013). The then government passed by-laws which made it difficult for small-scale vendors to operate. For example, the “Move On” law required vendors to move their position every 30 minutes. In the 1980s more Africans migrated to urban areas and the government could no longer control this movement like it used to do (Mukhola, 2014). The government began to relax the laws on small-scale vending. In 1991, the South African national government passed the Business Act of 1991 which recognized small-scale vendors as business people (ILO, 2004). A license was no longer a prerequisite for one to enter into small-scale vending business. However, in 1993 the government amended the Business Act of 1991. The local governments or Municipalities were given more power to limit street trading.

The local Municipalities made the bylaws and regulations about where and how the small-scale vending business must happen. In 1995, the national government published a White Paper on small, medium and micro-enterprises (SMMEs) (ILO, 2004). The White Paper made a provision for the “survivalist” business people but could not suggest strategies in which the government could assist the survivalists. The constitution of the Republic of South Africa Act 108 of 1996 states that the local government is responsible for local economic development. Therefore, most municipalities have paid more attention to small-scale vending businesses than to other segments of the informal economy, street food vending included.

The South African food industry is composed of both formal businesses and small and medium-sized enterprises (SMMEs), which are only regarded as dwarfs because they are still up and coming in the business world. Through this sector the lowest income and the unemployed groups in society gain access to economic opportunities. The fact that income and wealth distribution are disproportionate in South Africa compared with other countries in the world, makes the South African government’s action towards improving the disadvantaged society particularly important.

Mukhola (2014) explains that there is a low survival rate among SMMEs start-ups in South Africa, largely due to insufficient availability of capital. This trend is partly because most South African adults have below average skills in starting a new business compared with international

tendencies (Kok & Balkaran 2014). In the same reference, it is stated that men are much more likely to be engaged in entrepreneurial ventures in South African metropolitan areas than in rural areas and that this may be due to cultural differences (Mukhola, 2014). The author further reveals that the ratio of men to women in urban areas is 1:10 while in rural areas it is 1:56. In contrast, in countries like Indonesia, Bogor, the ratio of men to women is 15:4 due to cultural traditions that forbid women to sit on the streets and sell food (Mukhola, 2006).

Jiméne *et al*. (2015), postulate that education influences entrepreneurship. The same scholars further claim that the level of education, cultural and social norms, financial support and government policy may hinder the efforts of up-and-coming entrepreneurs. Education impacts entrepreneurship negatively in South Africa. This is largely because of a substantial proportion of the population that impacts negatively on the quality of education. To an extent this is the legacy of the apartheid policy of the previous government and has resulted in a general lack of basic skills and, in particular, high level technical skills (Tailor *et al*., 2019)

Black South Africans, in the opinion of Mukhola (2006), tend not to be self-motivated, to lack self-esteem and have very little creativity. Statistics show that a new entrepreneur with only a senior certificate is unlikely to make a success of a new business. There is a new trend, however, towards entrepreneurship among people who have a tertiary education because most of them cannot find employment but have to be trained to create jobs for themselves.

2.5 A Small-scale food vending in Thulamela Local Municipality

Thulamela Municipality is one of the four local municipalities comprising the Vhembe District Municipality. Currently, there are 40 wards in the Municipality. The Municipality is comprised of two local rural towns; these are Thohoyandou and Sibasa. Most households are living in poverty, because of high (21 %) unemployment rate (Vhembe District Municipality, 2010). As a result, large numbers of people are involved in the informal sector, especially street trading to reduce unemployment vulnerability. Some resorted to the sector because of a lack of qualifications that would enable them to work in the formal sector while others wanted to increase the income of their households.

Due to the growing number of people venturing into informal street marketing, Thulamela Municipality like other cities and towns in South Africa has expressed concerns and takes action towards dealing with informal business enterprises within its towns by introducing trading and non-trading zones. Marketing areas were constructed and stalls were provided along pavements where traders can operate, mostly situated near taxi ranks or pedestrian zones. At present, it is estimated that there are more than 1 390 informal street traders who have registered their business enterprises in the Thulamela database (Thulamela, 2015). A study conducted in Thulamela Municipality on the contribution of informal markets to poverty reduction and household food security revealed that about 69 % of street traders sold fruits and vegetables (Mafunzwaini, 2013). This is not surprising considering because Limpopo Province where Thulamela is regarded as the "Eden" of South Africa" because of rich production of fruits and vegetables (Ono *et al*., 2012). Apart from horticultural products, Mafunzwaini (2013) also report that 20 % of small-scale traders are into ready-to-eat cooked food business (pap and meat) although the studies conducted by Mathye & Maliwichi (2015) and Mathaulula *et al*. (2015) reveal that street food vendors illegally occupied the vending sites.

Even though informal street trading has been reported to play a pivotal role in many families, the sector faces challenges that are restricting the growth, profitability and sustainability of the sector and further preventing people to rise above poverty. Street traders in the study area also experience similar challenges to those identified by several scholars in other areas of South Africa (Woodward *et al*., 2011; Mafunzwaini, 2013; Willemse, 2013). The major challenge was that the traders do not have access to financial institutions for financial support. This is becoming a challenge because they cannot be able to buy products in bulk at a relatively lower price. Various scholars noted a lack of access to finance or loans as a major challenge that needed to be addressed ahead of other challenges for the growth of this sector. Apart from difficulties in securing credit and proper trading space, a study conducted by Mathaulula *et al.* (2015) revealed that street food vendors operating in Thulamela Municipality are illegally operating without possessing trading licenses. Very little has been done to improve the condition where street traders operate.

Bansah (2018) claims that the condition under which street-vended food is prepared is unclean, not well lit and close to sources of contamination. This raises concern regarding the safety of foods because of dust and flies which may spread microorganisms (Alimi, 2016). These situations

paint a picture of poor monitoring of the trading site by government officials (Mafunzwaini, 2013).The other significant challenge is the limited knowledge and attitudes of small-scale food vendors (Ghatak & Chatterjee, 2018; Madaki & Bavorova, 2019). In most cases food vendors tend to use unsafe and unhygienic produce or ingredients due to either high profit or limited knowledge. Thus, the challenges raised above necessitated the conduct of this study so to establish the knowledge, attitude and handling practices of food vendors. It is hoped that the findings obtained therefrom would be crucial in the development of pillars of a safety management system for small-scale vended foods.

2.6 Knowledge and Attitudes of Small-scale Food Vendors Towards Food Safety

The Food and Agriculture Organisation (FAO (2005) defines food safety as any food item devoid of any biological, chemical or physical hazards capable of causing harm to the consumer. The presence of the harmful contaminants not originally present in the food is believed to be introduced by humans although some do occur naturally (Bereda *et al*., 2016; Kotwal *et al*., 2019). This makes food safety a crucial issue because customers have no control over the consequences once contaminated food is ingested. Food safety is an increasing important public health issue to prevent or control foodborne illnesses (Flynn *et al*., 2019. Foodborne disease is a common public health problem worldwide. Globally, it has been reported that 2.1 million people died each year from diarrheal disease of which a large proportion of these is attributed to contamination of food and drinks (Wu *et al*., 2018; Okumus *et al*., 2019). Although information relating to foodborne diseases remains scarce due to underreporting, in most developing countries South Africa included, approximately 2.2 million people die from foodborne illnesses (WHO, 2015). However, according to the World Health Organisation, diarrhoeal diseases were the third leading cause of death in low income countries.

Food contaminants are introduced into food supply at numerous points along the way from farm to the table. Food animals and their manures can carry human pathogens without any clinical manifestations. Likewise, fresh vegetables and grains can harbour pathogens or mycotoxins without any discernible loss of quality (FAO, 2005). This seems to suggest that by the time any raw food item gets to a catering establishment, it might be carrying its own load of contaminants. It is therefore incumbent on the workers of food service establishments to either control the load of contaminants that already exist, or prevent any further contamination. This becomes even more

important since the catering industry is believed to be the primary source of foodborne outbreaks. However, Ayaz *et al.* (2019) maintain that food handlers at each point of the food chain lack the knowledge of risks involved and the related safe food handling practices. The latter authors also note that food preparers must be aware of how they can prevent cross contamination by properly cooking foods. If people are not aware of the origin and severity of foodborne diseases, they will likely be less motivated to change. Thus, it is significant to believe that people can get sick due to a lack of knowledge and bad attitude towards food handling.

Akusu *et al.* (2016) define knowledge as a complex process of remembering, relating or judging an idea or abstract phenomenon (cognitive abilities). Also, Abualoush *et al*. (2018) state that knowledge can be accumulated through learning processes and these may be formal or informal instruction, personal experience and experimental learning. On the other hand, Luan *et al.* (2019) indicate that attitude is by knowledge, which itself is a product of exposure to sources of information and personal willingness to obtaining information. Knowledge, attitude and practice can also be shaped by habits and other perceptions that result from social, cultural and economic influences.

Several studies conducted on food safety knowledge and attitude of street food vendors in Ethiopia (Bereda *et al*., 2016), Nigeria (Madaki & Bavorova, 2019) and in South Africa (Hill *et al*., 2019) reveal that vendors have poor food safety knowledge. In a study conducted in rural areas of Limpopo Province, South Africa, Mukhola (1998) reports that food vendors and their customers have little information regarding the proper preparation and storage of food as well as environmental conditions that may be detrimental to health. Bormann *et al. (*2016) and Auad *et al*. (2019) argue that demographic characteristics such as age and gender do not seem to play a role in food safety knowledge of vendors. However, Webb & Moracie (2015) and Odeyemi *et al*. (2019) reveal that there is a link between the level of education and vendors' food safety knowledge while Abdullahi (2016) does not find any significant difference. In a study conducted in Johannesburg, South Africa, Campbell (2011) reveals that there is a significant relation between knowledge and attitude while Samapundo *et al*. (2016) find no difference. Thus, knowledge of food safety is necessary because it would help design strategies for preventing foodborne illnesses.

Based on the arguments made above, education of food handlers and customers could play a

pivotal role in reducing foodborne illness and economic losses associated with foodborne diseases (Muhammad *et al*., 2016). In particular, the education programmes should focus on microbiological, chemical and physical food risks so that customers and vendors will change their behaviour associated with poor food hygiene practice. For examples, generic educational materials on safe food handling and foodborne diseases, a five keys manual entitled 'Bringing Food Safety Home' and Essentials of Serving Safe Foods could be considered as an effective guidance for food safety training. Moreover, consumer education should focus on the safe practices in good food hygiene, common causes as well as related factors to foodborne illness, basic safety of food-handling principles such as cross-contamination, and the principles of the Hazard Analysis and Critical Control Points (HACCP). Thus, Thulamela Municipality should consider providing small-scale food vendors with training to enhance their knowledge of food safety.

2.7 Knowledge and attitudes of customers towards food safety

Acheapong (2016) defines knowledge as the awareness of familiarity gained by experience of a factor or situation. The author emphasize that the customers' knowledge of the consequences of unsafe food hygiene practices can improve adherence to food safety guidelines. The consumer awareness of food safety can either be high or low. Limited knowledge in food safety may account for foodborne illnesses. A study carried out in South Africa reveal that most customers who attended a training course had adequate knowledge of foodborne diseases and preventive measures (Sibanyoni *et al*., 2017). This is crucial as a study by Ismail *et al*. (2016) prove that primary elements responsible for the outbreaks of food contamination were low food safety knowledge.

Al-Kandar *et al.* (2019) assume that customers are ignorant of the fact that inadequate food safety knowledge has accounted for the food contamination in the home, believing that vendors and food establishments are responsible for the safety of food. Socket (1995) claims that people are not aware of the fundamental guidelines of good cleanliness. However, the results of a study carried out in Handan, China (Ma *et al.,* 2017) report that generally, customers were knowledgeable about food safety. This implies that the customers' knowledge regarding the review of literature is relative.

Senyolo *et al*. (2019) in a study carried out in Limpopo Province of South Africa reveal that customers had limited knowledge and attitude regarding the proper preparation, and storage of food as well as the environmental conditions that could be harmful to human health. The authors further indicate that 60 % of the customers confirm that small-scale vended foods are prepared and sold under unhygienic conditions and this needs to be improved. Based on the above evidence, it is apparent that customers of the small-scale vended foods have limited knowledge of its safety and thus, an attempt to explore this phenomenon in the current study is crucial. The effort will assist in gaining the level of customers' awareness which will facilitate the policy modification and also prompt food vendors to take their businesses seriously.

In general, consumer attitudes towards food safety differs based on socio-demographic factors such as age, gender, educational level and economic status (Manko, 2018). This implies that behaviour of the customers towards food safety is dependent on the demographic dimensions. For instance, Abhinand (2019) claims that men are more likely to exhibit food safety knowledge than women counterparts. The author further reveal that the prevalence of risky behaviours also increases with socio-economic status. Elsewhere in Zimbabwe Zvenyika (2017) contends that male customers are knowledgeable than women regarding cross contamination and the five keys to safer food. On the contrary, Murry *et al*. (2017) reveal that men are less likely to follow cooking instructions on packaging and also took few steps to prevent cross-contamination than women. Similarly, Cheng *et al*., (2016) report that female and senior customers are concerned about vegetable safety in their study carried out in Beijing, India.

The age of the consumer plays a significant role in their of choice of food. A study conducted in Handan, China reveals that food safety attitude of the younger customers (26-35 years) was significantly better ($\bar{x} = 68 \pm 15$) than those of old age group (Ma *et al*., 2017). The authors further report that younger customers had better levels of food safety knowledge than the older group. On the contrary, in a study carried out in Canada, Murry *et al*., (2017) find that younger customers (18-29) age group were less likely to take steps to avoid cross contamination and were less aware of the risks associated with eating an undercooked hamburger. On the other hand, the oldest (60 and above) years were less likely to be aware of the risks associated with raw eggs, alfalfa sprouts and unpasteurized juice than middle (30-59) years age group. Similarly, in a study carried out in Zimbabwe (Zvenyika, 2017), respondents (customers) between the age of 18-27 years were more knowledgeable about cross contamination while those in 38-47 years age group gad limited

knowledge on five keys to safer food. This buttresses the notion that food safety behaviour of the customers is demographically determined. The impression created that food safety is gender specific needs to be explored further to confirm or reject that assumption.

2.7 Food Handling Practices and Consumer Safety

The growth of street food vending in South Africa and other parts of the world has been recognized as one of the forces that can boosted regional economy development. Westernisation, urbanisation and the need to struggle for daily survival have made many South Africans to shun away from the culture of cooking at home. Street-vended foods are accessible and sometimes affordable (Thatchinamoorthy & Meenambigai, 2018). As already alluded to in the previous sections, street food vendors employ other people who assist in handling food items from the stage of processing to marketing.

Food vendors and handlers are expected to ensure food safety throughout the food production chain (Adebukola *et al*., 2015; Andy *et al*., 2015; Thanh, 2015). In particular, food vendors who have poor handling practices or disregard hygienic practices may increase the risk of pathogens coming into contact with foods. These pathogens in some cases can survive and multiply to numbers sufficient to cause illness in customers. Several studies conducted to assess the quality of street foods in several countries have indicated that street foods are positive vectors of food-borne illnesses (Rane, 2011; Odu, 2013; Samapundo *et al*., 2015; Thanh, 2015). This is mainly explained by the poor practices on hygienic measures associated with the production and vending of street foods. For example, most of the vendors arrange both raw and cooked food items together, a consequence of which is an increased risk of cross contamination. Also, the hands are the most important vector for the transfer of organisms from feaces, nose, skin or other parts of body to food.

Microorganisms such as *Salmonella typhi*, *non-typhi Salmonella,* Campylobacteria species and *Escherichia c*oli can survive on finger tips and other surfaces for varying periods and in some cases even after hand washing (Tafesse *et al*., 2014; Adebukola *et al*., 2016. Moreover, food handlers can contaminate food either passively or actively. Based on the above statement, biological hazards may be introduced from a sick handler, from organisms on the food handlers' skin or faces, from their respiratory tract or by cross contamination after handling raw materials.

Physical hazards may be introduced by food handlers wearing jewelry, bandages or by careless food handling practices (Thanh, 2015). Thus, food vendors must refrain from their day to day operations when they are sick to curb the spread of microorganisms.

Many factors ranging from ignorance, lack of care, basic hygiene infrastructure, food storage, and preservation facilities contribute to poor attitude towards food hygiene practices among food handlers. Also, street food vendors have frequently been considered to use improper food preparation and selling practices (Nurudeen *et al*., 2014). In most cases, clean water is unavailable at vending sites resulting in hand washing often being done in buckets of water sometimes without soap (Aluko *et al*., 2014; Thanh, 2015; Marobe & Sabai, 2016). Waste water and garbage are discarded in the street which provides food for insects and rodents. Moreover, food material is usually not effectively protected from dust and flies which may harbour harmful pathogens. Thus, the government and other stakeholders working closely with food vendors should make them aware of the measures that need to be taken care of during the preparation and processing of street-vended foods.

Thanh (2015) argues that although training of vendors in food hygiene and handling practices by local authorities is widespread, most vendors do not apply what they learn or acquire in the work. This is because general, street vendors have low educational levels as well as poor knowledge of good practices in food hygiene (Dwumfour & Agyapong, 2014; Hilario, 2015). This lack of translation of acquired knowledge has explained the fact that there are usually large numbers of small street food units that need to be attended to by the local authorities. Also, one of the major factors contributing to unhygienic practices among street food vendors is the absence of sanitary amenities at vending sites. Therefore, it is urgently required to redesign and organize street food stalls following sanitary guidelines combined with vendor training and consumer sensitisation programmes so that sufficient provision of food safety and nutritional quality of street foods can be ensured.

Considering the preceding arguments, the street food sector deserves official attention from local authorities in especially developing countries regarding planning, investments, regulations and education. Furthermore, local governments need to provide support for street vendors with regards to adequate infrastructure in terms of well-designed vending structures, water supply, toilet facilities and waste disposal facilities. It is emphasized that the availability of safe and clean

water is crucial and vital to reduce food-borne diseases associated with consumption of street-vended foods whilst education can be a potential strategy to improve the safety of street-vended foods. In conclusion, local governments in collaboration with the academia should provide training on food safety to street vendors and their customers to minimise the problems associated with street vended food contaminations.

2.8 Microbial Quality of Small-scale Vended Foods

The contribution of the small-scale food sector to socio-economic growth is considerable. Therefore, the requirement of safety in this sector must be emphasized especially in developing countries (Metiboba & Kakwagh, 2014). Otherwise, small-scale vended food consumption by a large population may increase the burden for public health. Many studies on the microbiological quality of small-scale foods in Brazil (Da Silver *et al*., 2014); Vietnam (Thanh, 2015); Nigeria (Akusu *et al*., 2016) identify high levels of Coliforms and the presence of various pathogens such as *Escherichia coli, Salmonella* spp., *Staphylococcus aureus, Bacillus cereus, Clostridium perfringens* and *Vibrio cholerae*. Moreover, small-scale vended foods have been reported to be an appropriate medium for the transmission of antimicrobial-resistant pathogenic bacteria including *Salmonella* spp*, E. coli*, and *S. aureus* to people.

The results of a study conducted in the Eastern Cape Province of South Africa focusing on "assessment of aerobic plate counts, *S. aureus, E. coli* and S*almonella* spp in meat sold by street vendors" (Mazizi *et al*., 2017) reveal the presence of *S. aureus* and *E. coli* on beef, mutton and pork sold by street vendors in Alice and Kind Williams town. In a separate study carried out in Bloemfontein, South Africa, Lues *et al*. (2006) report the presence of *E. coli, S. aureus, Salmonella spp* and yeast in beef, chicken, gravy food samples sold by street food vendors. On the contrary, *Salmonella* tested negatively in all the food samples tested in Eastern Cape (Mazizi *et al.*, 2017). This is similar to what Mosupye & von Holly (1999) find in their studies carried out in Johannesburg, South Africa where they discovered that there were no species of *Salmonella* on meat sold by street food vendors. Overall, poor hygiene of street food vendors, sanitation and storage facilities were regarded as major sources of contamination.

Pathogenic bacteria pose a great challenge in small-scale vended foods where they can grow rapidly from very low numbers in food. It is evident that there are many potential health risks

associated with the initial contamination of raw foods with pathogenic bacteria as well as subsequent cross-contamination by vendors during preparation, improper handling and storage before vending. Hazard analysis and critical point studies on small-scale vended foods in many developing countries indicate that there is a high correlation between long holding times at ambient temperatures and high bacterial counts even when the food had been cooked at temperatures high enough to kill harmful vegetative forms of most bacteria (Nyenje *et al*., 2013; Moro *et al*., 2014).

In Latin America, the frequency of faecal contamination in small-scale vended foods ranges from 9.4 % to as high as 57 % above the acceptable standard (Climat, 2013). In a study carried out on street foods in Nigeria, 26.3 % and 15 % of the samples were contaminated with *B. cereus* and *S. aureus*, respectively (Madueke *et al*., 2014). In Johannesburg, South Africa, *B. cereus* and *S. aureus* were detected in 17 % and 3 % of the small-scale food samples, respectively (Mosupye & von Holy, 2000). This raises a concern especially in developing countries since small-scale vended foods are consumed by school-going children. At their tender age children may be exposed to situation where they might suffer a risk of being infected by foodborne diseases.

For many years, vendors normally sell local small-scale vended foods including light snacks and drinks with attractive and colourful food items near school-based locations under poor hygienic conditions. Bacterial contamination of the local food and beverages sold by small-scale food vendors surrounding the school areas has been a common occurrence in developing countries. Thus, the level of the contamination should be paid more attention by food safety authorities (WHO, 2015). A study carried out in Dhaka, Bangladesh to assess the microbiological quality of the food items sold by the school-based small-scale food vendors concluded that nearly half (44.5 %) of the tested foods samples were unsatisfactory and one third were unsuitable for consumption (Husain *et al*., 2015). In particular, the food samples were analysed for coliform counts and followed the coliform criteria for infants and children foods as recommended by the International Commission on the microbiological specification for Foods (ICMSF). Other studies have reported high levels of coliforms in street foods (Rane, 2011; Madueke *et al*., 2014; Chauhan *et al*., 2015). In a separate study conducted in Bloemfontein, South Africa, Lues *et al*. (2006) reveal that 74 % of beef, 72 % of chicken and 73 % of the gravy samples were contaminated with coliforms. This is similar to what Ekanem found in a study conducted in Nigeria (Ekanem, 1998). Elevated counts

of coliforms in ready-to-eat foods indicated inadequate processing or cooking and/or post-processing contamination as a result of unhygienic practices and surroundings.

Other factors that are of concern in terms of small-scale vended food contamination are factors such as contaminated water, unclean towels, dirty water for washing utensils, and cross contamination between raw and processed foods during transportation and storage. Consequently, the unsatisfactory microbiological quality of a considerable number of the small-scale vended foods has indicated public health threat to the customers of such foods. It is therefore imperative to formulate specific laws, legislations, and guidelines for operating and handling small-scale food vending in developing countries, which should be controlled by relevant national and international authorities.

2.9 The Regulatory Framework for Small-scale Vended Foods in South Africa

In South Africa, the provision of safe food to customers is the responsibility of the service provider (Murwira, 2017). However, there is an added obligation on authorities to ensure that food service establishments serving food to the general public should comply with the regulations. Also, the authorities are expected to monitor compliance. These regulations are detailed in the Health Act, No. 63 of 1977 and the Foodstuffs, Cosmetics and Disinfectants Act of 1972. Furthermore, the Codex Code of Ethics for International Trade in Food which indicates that all customers are entitled to safe, sound and wholesome food and to be protected from unfair trade practices. Thus, South Africa serves as a model for most of the countries in Africa where the implementation of hygienic practices is a priority for the authorities (Mukhola, 2006).

In South Africa, food sale is controlled by legislation whereby specialized people are trained to monitor and control hygiene. For example, Environmental Health Practitioners (EHPs) are appointed under section 10(1) of the Act, and are responsible for the control of food in all food premises. In terms of the Act, EHPs are empowered to inspect or search premises; demand information regarding any foodstuffs; and weigh, count, measure, mark or seize any such foodstuffs. Also, they are authorized to examine any book; demand from owners of food premises statements or other documents; or inspect any operation or processes carried out on such premises. Lastly, they may demand any information regarding any operation or process and seize

any foodstuffs, cosmetic or disinfectant found to be unsuitable as stipulated in Foodstuffs, Cosmetics and Disinfectants Act of 1972.

The situation presented above differ from the status quo in small-scale food sector. This is because small-scale food businesses are considered informal and as such, they are not regulated by those concerns. Moreover, there is no food safety management system in place that safeguards the safety of small-scale vended foods particularly in the proposed area of study (Boatemaa *et al*., 2019; Hill *et al.,* 2019;). It is against this background that the current study sought to establish knowledge, attitude and handling practices of small-scale food vendors in Thulamela Municipality to develop pillars of a safety management system for small-scale vended foods. Food Safety Management System is defined as a group of programmes, procedures and measures for preventing foodborne illness by actively controlling risks and hazards throughout the flow of food (National Restaurant Association Education Foundation, 2006). Mitchell *et al.* (2007) and Ma *et al*. (2019) expound that food safety systems addresses issues related to basic sanitation and operation conditions, which include personal hygiene programme, supplier selection and food specification programme. This is about the Codex Alimentarius Commission (CAC), an international body that was set by World Health Organization to ensure the safety of the consumer and fair practices in the food trade.

Food safety management systems also entail active managerial control which manages food safety risk and focuses on the five most common risk factors responsible for foodborne illnesses as identified by the Centre for Disease Control and Prevention (CDCP). The points include purchasing food from unsafe sources, failing to cook food adequately, holding food at improper temperatures, using contaminated equipment and generally practising poor personal hygiene (Mitchell, 2007).

South Africa cannot escape global and local environmental health issues, and the significant health problems associated with these. Mukhola (2014) and O´Neill *et al.* (2019) postulate that the environmental problems arise from changes in human practice, such as the increase in street vending of food, rather than from recent discovery of these concerns. Githaiga (2013) posits that in order to interpret and understand food handling practices, including the food chain from harvesting, cleaning, processing, preservation, packaging, storage, transportation to marketing, preparation and presentation for consumption, the health education perspective is indispensable.

This would empower the vendors of street food with knowledge and skills that will enable them to handle street food for the benefit of the South African society, as well as to improve their socio-economic conditions.

2.10 Theoretical Framework of the Study

In this study, Henson & Heasman (1998) compliance process model was adopted. The model describes the decision-making process carried out within a business when faced with a legislative requirement. Henson & Heasman (1998) adopted the compliance process model to specifically relate it to small businesses. The compliance process model consists of five stages namely, identification and interpretation of the legislative requirements; specific method of compliance; making a decision to comply; implementing this method and monitoring and evaluating the changes (Figure 2.1).

The compliance process model (Henson & Heasman, 1998) was considered for this study because apart from food handlers/vendors being responsible for the safety of the food they produce, it ropes in enforcement agencies. The model is based on the premise that small businesses have little capacity to carry out the compliance process themselves. Rather there is a complete reliance on others for information about regulations and their effect. The strength of this model therefore lies in the fact that much as food safety practices of food handlers would be looked at, it would also give room for the evaluation of enforcement approaches used by the regulatory agencies as they collectively impact on food safety. Also, the definition of SMMEs snugly fits small-scale food vending.

Small-scale food vending operations are poorly regulated in Thohoyandou town. This raises food safety issues and puts into question hygiene standards which should be monitored and action taken by relevant stakeholders. Thus, the adoption of a framework would be useful in ensuring effective and sustainable practices of food vending regulations. Also roping in of the relevant stakeholders would assist in raising awareness through training, monitoring and evaluation of food vending activities. The inclusion of Health officers as suggested in the framework would help to penalize food vendors who do not adhere to food vending regulations.

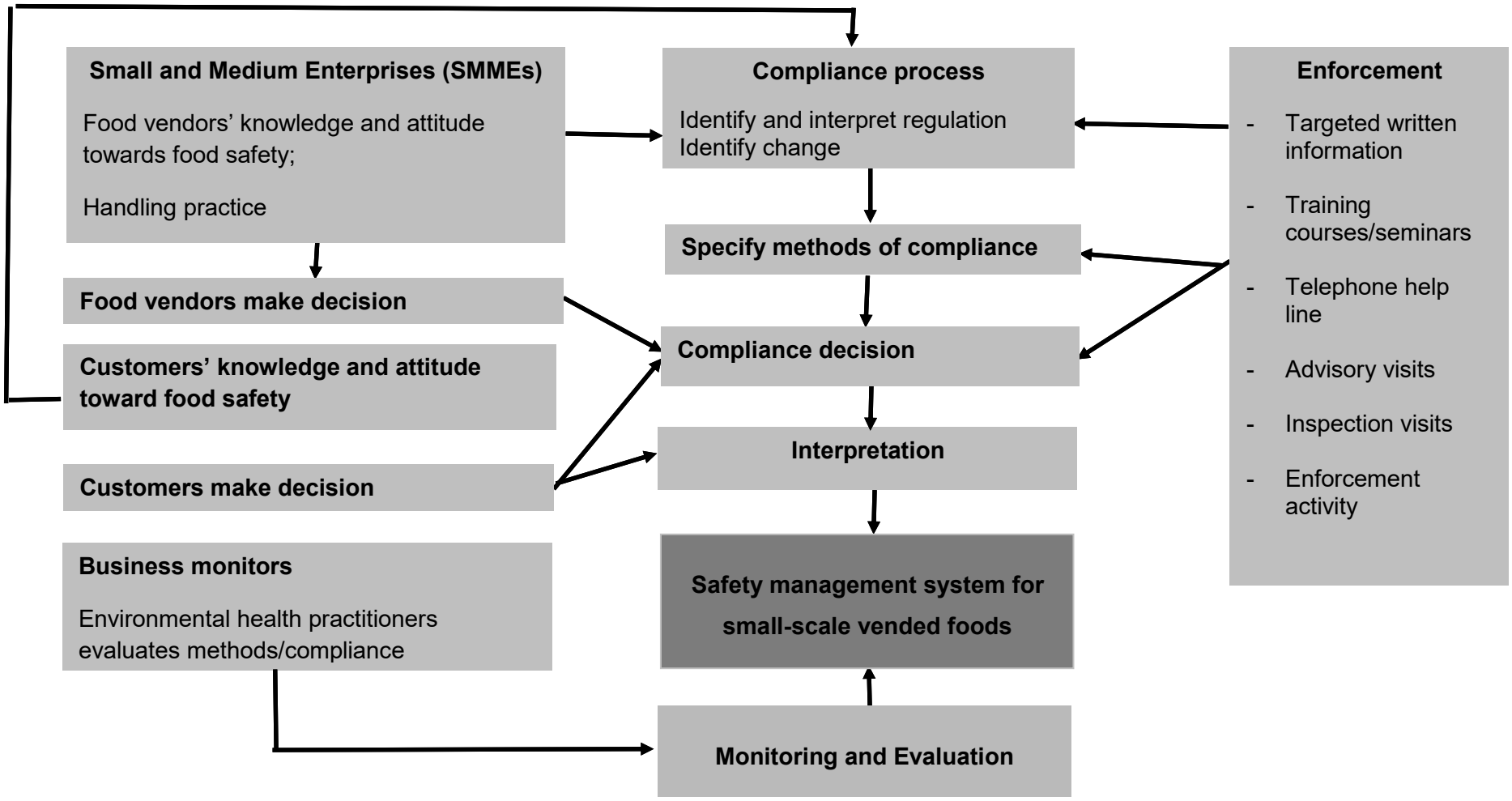

Figure 2.1: Modified theoretical framework for the compliance process model of food safety regulation (after Henson & Heasman (1998))

2.11 Summary of Literature Review

In this chapter, small-scale food vending was seen as a significant vehicle that offers employment, enriching food supply to communities and government workers while contributing to the economy of the country. Information gathered from literature and researches indicate that food safety has become one of the issues of public concern since it has a relationship with the health of the populace. However, from the literature it was evident that vendors lack knowledge and attitude towards food safety (Nguyeni *et al*., 2018; Odeyemi *et al*., 2019). It is also worth noting that small-scale food vendors have limited information regarding proper food preparation and storage of food and environmental conditions that may be detrimental to human health. Literature further revealed that most vendors do not translate the acquired basic hygiene knowledge into safe food practices. This is because generally, they have low educational levels as well as poor knowledge of good practices in food hygiene. This lack of translation of acquired knowledge has explained the fact that there are usually large numbers of small-street food units that need to be attended to by the local authorities.

The absence of sanitary amenities at vending sites is one of the major factors contributing to unhygienic practices among street food vendors. It is crucial to redesign and organize street food stalls following sanitary guidelines combined with vendor training and consumer sensitisation programmes so that sufficient provision of food safety and nutritional quality of street foods can be ensured. Other factors of concern noted from the literature were the use of contaminated water, unclean towels, dirty water for washing utensils, and cross contamination between raw and processed foods during transportation and storage. Consequently, the unsatisfactory microbiological quality of a considerable number of the small-scale vended foods discussed above is an indication of public health threat to the customers of such foods.

It was evident from the literature that most studies were carried out to assess the knowledge, attitude and handling practices of food vendors but there is still dearth of information regarding the pillars of a safety management system for small-scale vended foods. Also noted was that the perceptions of key stakeholders working closely with small-scale food vendors were not considered as crucial in defining the safety of and quality of food. Based on these, it was therefore, pertinent to explore the knowledge, attitude and food handling practices of small-scale food vendors to propose the key pillars of a safety management system for small-scale vended foods.

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CHAPTER 3: ROADSIDE VENDORS' KNOWLEDGE AND ATTITUDE TOWARDS FOOD SAFETY

3.1 Abstract

The current study was carried out to assess the knowledge and attitude of small-scale vendors of food towards its safety. The study was conducted in Sibasa and Thohoyandou towns both located in Thulamela Municipality in South Africa. A survey-underpinned exploratory sequential integrated mixed methods research design was adopted. Fifty-four respondents were purposefully selected to participate in a qualitative data collection through administering a semi-structured interview guide to focus groups and key informant interviewees. Complementary quantitative data were collected using a questionnaire administered to 136 small-scale food vendors. Qualitative data were analysed using Atlas.ti version 8.0. Mean for scores and Spearman's rank correlation coefficient were computed using Statistical Package for Social Sciences version 25.0 for analysis. The Principal component analysis was then conducted to isolate and deepen the understanding of the main factors determining the knowledge and attitude towards food safety. The analysis was pegged at 95 % level of significance. The scree plot and loading factors were followed to isolate the components. It was found that the respondents were aged between 41-60 years and almost half of them (46 %) had attained primary schooling. Although 94 % of the food vendors had not received formal training on food safety generally, they were knowledgeable about personal ($\bar{x}$ = 1.77) and food ($\bar{x}$ = 1.75) hygiene. However, the respondents rarely considered knowledge of foodborne diseases ($\bar{x}$ = 1.41) and rules and regulation ($\bar{x}$ = 1.29) as crucial in defining the quality and safety of small-scale vended foods. Yet, there was an observed highest correlation relation between variables of roadside vendors' knowledge of food safety to be between "*Staphylococcus* as a germ that causes food-borne diseases" and "Hepatitis A virus that could cause food-borne disease" ($P < 0.01$). "customers had adequate knowledge on food safety policy" and similar observations were reported with the food vendors ($P < 0.01$) respectively. Respondents reflected positive attitude towards personal hygiene ($\bar{x}$ = 3.21), food hygiene ($\bar{x}$ = 3.55) and utensils management ($\bar{x}$ = 3.43). From thirty-six factors that determine the knowledge and attitude towards food safety, the Principal Component Analysis isolated eight components that accounted for 50.47 % of the variability; with component one accounted for 11.87 % of the total variation while component two accounted for 8.15 %. Based on the results of this study, it was clear that small-scale food vendors had considerable knowledge and positive attitudes towards food safety. However, these were not adequately translated into practice. Such behaviour may endanger the health of customers and ultimately have

expensive repercussions on a country. Thus, this matter requires urgent attention of health practitioners and food specialists. Thus, it is recommended that small-scale food vendors must receive training on foodborne diseases and their transmission. It is hoped that such training might help to change food vendors' mindset and therefore, improving their food handling practices Lastly, it is imperative to carry in-depth evaluations of roadside vending enterprises and craft suitable regulations that can be used to ensure that safe and secure foods are sold on the roadsides.

Key words: Food handler, food safety; food supply chain; street vended food

3.2 Introduction

Small-scale food vending unravels major social and economic challenges especially in developing countries, South Africa included through the provision of ready-to-eat foods at relatively lower costs. It is also known for its ability to create employment (though on a temporary bases) for teeming rural and urban populace along its value chain (Minh, 2016; Alimi, 2016). In most developing countries small-scale food vending activities take place informally outside the regulation and the protection of the governments.

The economic importance highlighted above does not receive much appreciation due to the informal nature of the street food business. This is so particularly considering that 33 million people die every year after consuming contaminated foods (Li *et al*; 2018). Several authors reveal that small-scale vended foods spread foodborne illnesses mainly due to limited knowledge that food handlers have (Lubos, 2014; Pokhrel & Sharma, 2016; Akabanda, 2017). This resonates well with Noor (2016) who reveals that millions of people were estimated to become ill each year and thousands of them die after consuming contaminated foods due to poor food handling and safety methods of food handlers. Pokherel & Sharma (2016) claim that 77 % of these was associated with catering outlets. Thus, food handlers should play a vital role in ensuring food safety throughout the value chain of food preparation.

Several studies have been conducted to assess the knowledge of street food vendors about food safety. For example, studies conducted in the Philippines (Lubos, 2014) and Vietnam (Minh, 2017) on food safety knowledge of street vendors reveal that more than half of the food vendors interviewed had basic knowledge of food safety. However, such knowledge was not put into practice during food handling and preparation. Various studies have also found discrepancy in the knowledge and handling practices of the food vendors pertaining food

safety (Zanin *et al*., 2017; Ruby *et al*., 2019; Odeyemi *et al*., 2019). Thus, assessment of knowledge alone without looking into attitude and practices is a futile exercise. It was for this reason that the current study looked at both the knowledge and attitude of food vendors towards food safety. A chapter will be devoted to assessing the state of handling practices in the study area.

Available literature reveals that street food vendors acquired the knowledge through informal education either by observing others in a similar business or taught by family members (Madaki *et al*., 2019). The results of a study conducted in Guwahati, Assam in India on "assessment of food safety knowledge and practices among the street food vendors of urban and semi urban" reveal that none of the respondents had undergone any formal training on food preparation (Pokherel & Sharma, 2016). In separate studies conducted in Vietnam (Samapundo *et al*., 2016) and Nigeria (Umar *et al*., 2018), 95 % and 100 % of food vendors had not received training in food safety, respectively. This could be the reason why food vendors failed to put into practice the limited knowledge that they possess. Besides, food handlers must have the necessary knowledge and skills to enable them to handle food hygienically and thus to minimize foodborne illnesses.

The information revealed above necessitated that the current study should be conducted. Little remains known about the knowledge and attitude of people involved in small-scale food vending in Thohoyandou town, yet the business contributes to the economies of the area. It was therefore, pertinent to conduct a study focused on assessing the knowledge and attitude of small-scale food vendors in Thulamela Municipality.

3.3 Research Methodology

3.3.1 Description of study area

The survey on knowledge and attitude towards food safety was carried out in Sibasa and Thohoyandou both located in Thulamela Local Municipality. Specific information about the location is presented in Chapter 1 section 1.2.

3.3.2 Research design

Figure 3.1 is a schematic diagram of an exploratory sequential mixed methods research design.

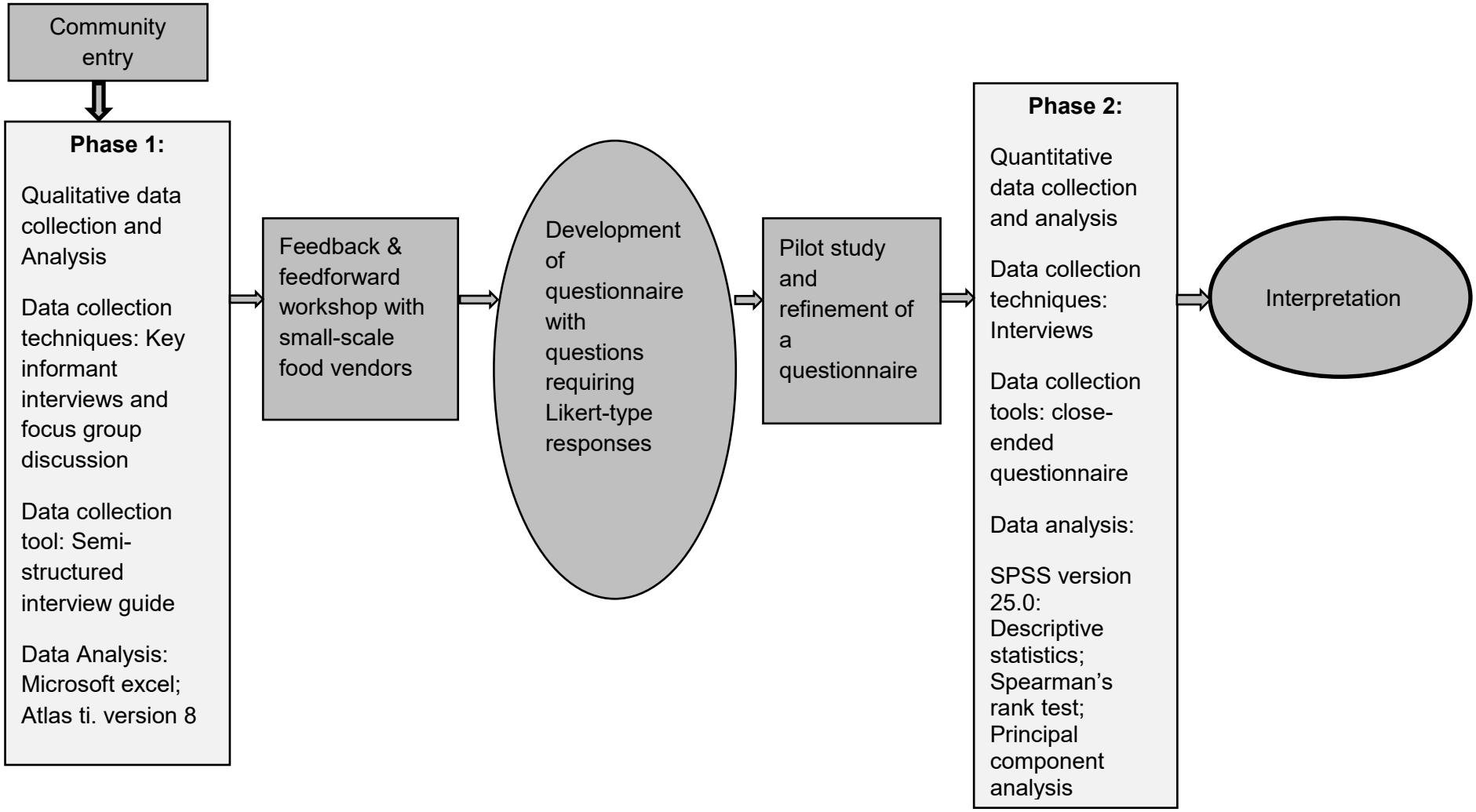

Figure 3.1 Schematic presentation of exploratory sequential mixed methods research design

An exploratory sequential mixed methods research design was deemed appropriate to explore the current phenomenon in question because it allows the collection and analysis of qualitative data first in the course of exploring the phenomenon (Cress & Clark, 2011). Thereafter, the established themes were used to drive the development of a quantitative instrument to further explore the research problem (Creswell & Clark, 2011). As a result of this design, three stages of analyses were followed viz: primary qualitative, secondary quantitative and integration. This connects the strands of qualitative and quantitative data and extends the initial qualitative exploratory phase of the findings (Creswell & Clark, 2011). Further, the qualitative approach was considered because it helped to have an in-depth understanding of such human behaviour and the reasons that control it as noted by Flick (2009). It is also worth noting that the study was exploratory because this was the first time the research of this nature was carried out in Thulamela Municipality. Also, quantitative research was carried out using closed-ended questions in order to explain the relationship found in qualitative data.

3.3.3 Training in data collection tools

Data collection tools were developed to obtain data that met the objective and its associated questions. Semi-structured interview guide and close-ended questionnaire were designed. Two university undergraduate students served as research assistants. They were chosen based on their experience in research processes and to administer data collection tools using local spoken language. They were trained to administer the data collection tools. Also, the research assistants were orientated on the objectives of the study and their specific roles. Each question in the data collection tool was explained, including the rationale for its inclusion.

3.3.4 Community entry

Permission to conduct the study was secured from Thulamela Municipality. This was done by following municipal protocols for consultation with the municipal manager. A letter for permission was sent to the Municipal Manager and Compliance Unit officer under Community Service Department before the meeting. Compliance Unit officer helped organize meeting with Hawkers Association committee members. During the meeting, objectives of the study were explained and privacy during interviews was ensured. Further, participants were provided with a written information sheet in support of the verbal explanation of the study. Approval to conduct the study in Thohoyandou town was granted (Appendix B). Thereafter, the date for the meeting with representatives of small-scale food vendors was secured. Through liaison with the chairperson of the Hawkers Association committee, a meeting to introduce the study

was held with small-scale food vendors representatives. Written information on the study was provided and a meeting was successful. Lastly, the participants especially the Compliance Unit officer and the chairperson of the Hawkers Association committee were solicited with a token of appreciation for honouring the invitation.

3.3.5 Study population and sampling procedure

The population included small-scale food vendors who sell ready to eat cooked food in Thohoyandou town. Added to this were stakeholders who worked closely with small scale food vendors. Those who sell fruits and vegetables as well as pre-packaged foods were excluded. Purposive sampling technique was employed to select four locations in Thohoyandou town viz, Thulamela, Mvusuludzo, Venda Plaza and Sibasa taxi rank. Purposive sampling technique was appropriate because the researcher wanted to focus on particular characteristics of a population that are of interest, which best enabled the researcher to answer the research questions (Palys & Atchison, 2008). Given that, the study locations were purposefully selected because they constituted part of the concentration points of small-scale vended foods in Thohoyandou town. Similarly, a purposive sampling technique was adopted to select fifty food vendors who participated in phase 1 of the study. Stakeholders who work closely with vendors were recruited using snowball sampling technique borrowed from Etikan *et al*. (2015). The scholars define snowball sampling as a technique of finding research subjects through referrals. These included Local Economic Development officer, Compliance Unit officer under the Community Service Department, Environmental Health inspector and Hawkers' Association committee. Hundred and sixty-one small-scale food vendors were recruited to participate in phase 2 of the study. However, only 136 of them responded Thus, 25 food vendors excused themselves from the study and their decisions were respected. Of 136 participants, 38 were operating in Sibasa, 35 in Thulamela, 30 in Venda plaza and 33 in Mvusuludzo taxi rank.

3.3.6 Data collection methods and techniques

Qualitative and quantitative data were collected through a two phase sequential integrated study. In the following section qualitative data collection methods and techniques are presented first.

Phase 1: Qualitative data collection methods and techniques

Qualitative data were collected through key informant interviews and focus group discussions. Key informant interviews preceded focus group discussions. Fifty food vendors and four stakeholders participated in key informant interviews. The focus groups were constituted as follows: two focus groups each with ten food vendors while the third group consisted of Local Economic Development officer, Compliance Unit officer under Community Service Department, Environmental Health inspector and chairperson of Hawkers Association committee. The following uniform set of semi-structured questions was used to guide the focus group discussions and key informant interviews: (a) What evidence shows that small-scale food vendors know about food safety?.(b) What do food vendors do to show that they have a positive attitude towards food safety?

The perceptions of key informant interviewees were recorded in a note book while those who participated in focus group discussions wrote their perceptions on flipcharts whenever there was consensus on any issue they discussed. All the flip charts were labelled correctly showing each group identification details and composition. The research assistants collected the flipcharts and stored them for further processing of the qualitative data. Data were translated into English because some of the participants responded in Tshivenda. Results were further summarized, tabulated and organized into subthemes. Consolidated data were used to give feedback to the respondents. This was desirable because confirmation and priority ranking were important in building a clearer understanding of the perceptions of the food vendors.

Phase 2: Quantitative data collection methods and techniques

Quantitative data obtained through the confirmatory focus group discussions were used to construct a face-to-face close ended interview questionnaire (Appendix D). Demographic information, food safety knowledge and attitudes were explored. The knowledge question was designed to evaluate food safety knowledge on personal and food hygiene, foodborne diseases, rules and regulations. The questionnaire contained 21 questions with possible answers “no” and “yes”. The attitudes questions were organized to test the vendors’ understanding of food, personal and environmental hygiene. Fifteen closed-ended questions that required responses on a 5-point Likert-type scale of 1(strongly disagree) to 5 (strongly agree). The questionnaire was administered to 136 purposefully selected food vendors. One hundred and sixty questionnaires had been prepared and ear-marked for completion, implying

that 85 % of the sampled food vendors were interviewed. It took at most 45 minutes to administer each questionnaire to each respondent. Before its use in data collection, the questionnaire was pre-tested with 20 randomly selected food vendors operating at about 8 km out of Thohoyandou town. None of those who participated in the pre-testing were included in the final survey. The results of the pre-test were used to revise the draft questionnaire.

3.3.7 Data analysis

Thematic content analysis was used to analyse qualitative data. That is data obtained through key informant interviews and focus group discussions were cleaned, transcribed and entered into Microsoft excel. Thereafter, data were imported into ATLAS.ti version 8 software for analysis (Konopasek, 2008). ATLAS.ti is a qualitative research tool used in analyzing project interviews and questionnaire transcripts, which are called primary documents in the programme (Muhr, 1991; Smit, 2009). Data quotations were selected and assigned codes. This involved writing memos and commenting on the data. Thereafter themes, patterns and relationships were identified. The relationships between the codes were developed under the Network View Manager. The codes were imported as nodes to design a semantic network view. The nodes(codes) were linked with quotations.

Quantitative data were analysed using Statistical Package for Social Sciences (SPSS) version 25.0, 2017. Firstly, Descriptive statistics was carried out to calculating the frequencies of occurrence of responses for each of the demographic characteristics question and food vending dynamics. Means for scores for each of the knowledge and attitude study constructs were calculated. Further, Spearman's rank test (r) was used to determine the degree of correlation among variables relating to knowledge of vendors towards food safety. Thereafter, Principal Component Analysis (PCA) was used to isolate and deepen the understanding of the main factors determining the knowledge and attitude towards food safety. The PCA technique was deemed appropriate because of its ability to reduce the dimensionality of a large dataset, while preserving as much 'variability' (i.e. statistical information) as possible (Jolliffe & Cadima, 2016). The analysis was pegged at a 95 % level of significance. The scree plot and loading factors were followed to isolate the components.

3.4 Ethical Considerations

This study was carried out after getting ethical clearance from the University of Venda Ethics Committee (Project No: SARDF/16/IRD/14/2111) (Appendix A). Permission to interview food

vendors was sought from the Compliance Unit officer under the Community Service Department, Hawkers Association and Municipal Manager of Thulamela Local Municipality (Appendix B). Informed consent and the right to participate was adhered to (Appendix C). Written consent of the food vendors was sought, meaning that only those who volunteer to participate were engaged. All participants were allowed to ask questions and decided whether to participate or not.

Before using tape recorders consent of the participants was secured to ensure that participants were acquainted in advance with every aspect of the study. For this reason, the participants were assured that the information collected would be confidential and used for the sole purpose of this study. The participants were also assured that photographs taken during the interviews would be stored in a safe place. Participants were further informed about the objectives of the study and that privacy during the interview would be recognised.

3.5 Results

3.5.1 Demographic information

The majority of the respondents (90 %) were female with (39 %) in the 51-60 age group, followed by 34 % who were aged 41-50 years, and (24 %) were 61 years. Sixty-one percent of the respondents were married and 18 % never married. Fifteen percent of the respondents were widowed while an almost insignificant number (6 %) of food vendors were divorced. Close to half (46 %) of the respondents completed primary schooling and only 15 % had no formal education. Forty percent of the respondents had attained secondary school education.

3.5.2 Market for the food vendors

The majority of food vendors' customers (92 %) were passersby. Following these were taxi drivers (49 %), employees of established shops 49 % and social grant beneficiaries (49 %), school learners (23 %) and university students (13 %). Fewer percentages (7 % and 8 %) indicated that their customers were teachers and police respectively. Most of the respondents (70 %) indicated that customers need food that tastes differently from what they buy at established shops while (58 %) revealed that customers needed cheaper food than what is normally available in other outlets while 48 % revealed that customers prefer indigenous foods.

3.5.2 Acquisition of capacity in food preparation and food handling skills

Forty-six percent of the respondents had been in the vending trade for more than 6 years while slightly more than a quarter (29 %) had more than 10 years in food vending business. Sixteen percent of them were involved in vending businesses for more than 16 years. Majority of the respondents (88 %) revealed that they started vending business to support their families in meeting needs for improved livelihoods. Thirty-six percent of the respondents in the current study pointed out that they ventured into food vending business because they were unemployed for more than 6 months and decided to do something that would help raise income. The results of the exploratory study revealed that the majority of the respondents (52) interviewed had never received training on food safety. For example, a food vendor who was operating at Thulamela market revealed that:

> *I have never received any training, education or workshop on food safety related issues.*

The explanatory results confirmed this finding where almost all respondents (94 %) admitted that they did not receive any training on food safety. Food vendors from Thulamela and Venda plaza taxi ranks indicated that they did not know about food safety. For instance, one of them claimed that:

> *we do not know anything about food safety, we just sell food in order to make a living and to satisfy our customers*.

Respondents from Thulamela, Mvusuludzo, Venda plaza and Sibasa taxi ranks claimed that they had acquired some food preparation skills through informal education. They said skills were either learnt from family members and friends or gained through observing others in the same business. This was confirmed by a food vendor from Mvusuludzo taxi rank who explained that:

> *I acquired cooking skills from my mother who was a food vendor, she passed away 6 year ago*.

Similarly, another respondent from the same location claimed that:

> *I use the knowledge I leant as I was growing up. I just observed around whilst people*

were cooking and only take what I think could work in my business.

The findings of the explanatory study also revealed that 60 % of respondents disclosed that they acquired food preparation skills from family members or friends while 39 % indicated that they acquired the skill by observing others in similar business.

3.5.3 Roadside vendors' knowledge on food safety

Table 3.1 presents the results of roadside vendors' knowledge of food safety. Knowledge of food safety variables was classified into personal, food hygiene, foodborne diseases and rules and regulations.

a) Knowledge of personal hygiene

As presented in Table 3.1, majority of the respondents knew that food handlers with abrasions or cuts on their hands should not touch unwrapped foods without gloves. Further respondents were aware that washing hands before work reduces the risk of food contamination. Respondents were also knowledgeable that there are microbes on the skin, nose and mouth of even healthy food handlers. Importantly, respondents knew that using gloves while handling food reduces the risk of food contamination.

b) Knowledge of food hygiene

The data presented in Table 3.1 indicate that all the mean scores for the variables measured knowledge on food hygiene were greater than the average mean score. This is an indication that respondents knew about food hygiene. However, important variations were noted on the bases of computed mean scores. The variable that was identified and ranked number 1 was "cutlery and cutting boards should be properly sanitized to prevent cross contamination". This was followed by "swollen cans contain microorganisms that can cause food-borne disease or poisoning

c) Knowledge on foodborne diseases

The findings of this study revealed that respondents disregarded knowledge of foodborne disease as important in defining the quality of small-scale vended foods (Table 3.1). Besides, the majority of the variables had mean scores less than the average mean.

Table 3.1: Ranked means for roadside vendors' knowledge of food safety

Study variables Knowledge on food safety	Mean score	Standard deviation	Ranking
Personal Hygiene (1= No; 2= Yes)			
a) Food handlers who have abrasions or cuts on their hands should not touch unwrapped foods without gloves.	2.0	0.21	1
b) Washing hands before work reduces the risk of food contamination.	1.9	0.30	2
c) There are microbes on the skin, nose and mouth of even healthy food handlers.	1.6	0.53	3
d) Using gloves while handling food reduces the risk of food contamination.	1.6	0.49	4
Food Hygiene (1= No; 2= Yes)			
a) Cutlery and cutting boards should be properly sanitized to prevent cross contamination.	1.9	0.25	**1**
b) Swollen cans contain microorganisms that can cause food-borne disease or poisoning.	1.8	0.42	**2**
c) Reheating cooked foods can result in contamination of food.	1.5	0.50	3
Foodborne Diseases (1= No; 2= Yes)			
a) Diarrhoea or dysentery is a food-borne disease	1.8	0.40	1
b) Children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning.	1.6	0.48	3
c) Bloody diarrhea can be transmitted via food	1.6	0.49	2
d) Food-borne diseases can cause pregnant women to abort.	1.5	0.53	4
e) Listeriosis is a food-borne disease.	1.5	0.51	6
f) Cholera is a food-borne disease.	1.5	0.52	5
g) Typhoid fever can be transmitted via food.	1.3	0.46	8
h) Salmonella is a serious cause of a fatal food-borne disease.	1.3	0.45	9
i) Staphylococcus is a germ that causes food-borne diseases.	1.3	0.48	7
j) Flu is a food-borne disease	1.2	0.43	10
k) Hepatitis A virus can cause food-borne disease.	1.2	0.41	11
l) AIDS can be transmitted via food.	1.1	0.36	12
Rules and Regulation (1= No; 2= Yes)			
a) Small-scale food vendors have adequate knowledge on food safety policy.	1.3	0.45	2
b) Customers have adequate knowledge on food safety policy.	1.3	0.93	1

*Mean score values presented are based on a 2 point Likert scale where 1 = no and 2 = yes

However, there were some variables in which their means were above the average mean score. These included the knowledge of the following: diarrhoea or dysentery is a foodborne disease, children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning and bloody diarrhoea can be transmitted via food.

d) Knowledge of rules and regulations

The results presented in Table 3.1 revealed that all the mean scores of the variables measuring knowledge of rules and regulations were lower than the average mean score.

Table 3.2 presents the coefficients of correlation between the pairs of the 21 variables of roadside vendors' knowledge of food safety. The highest correlation relations were observed to be between "*Staphylococcus* is a germ that causes food-borne diseases" and "Hepatitis A virus can cause food-borne disease" ($P < 0.01$); "customers have adequate knowledge of food safety policy" and "food vendors have adequate knowledge of food safety policy" ($P < 0.01$); "Hepatitis A virus can cause food-borne disease" and "*Salmonella* is a serious cause of a fatal food-borne disease" ($P < 0.01$); "*Staphylococcus* is a germ that causes food-borne diseases" and "*Salmonella* is a serious cause of a fatal food-borne disease ($P < 0.01$); "reheating cooked foods can result in contamination of food" and "wearing gloves reduces the risk of food contamination" ($P < 0.01$).

3.5.4 Roadside vendors' attitude towards food safety

Figure 3.2 presents the results of exploratory studies on food vendors' attitude towards food safety study construct. This was measured in terms of personal and food hygiene and utensils management subthemes. The first part of each section covers the exploratory results followed by presentation of descriptive results.

a) Attitude towards personal hygiene and practices

Respondents in the current study indicated that they wear protective clothing when handling food. For instance, a respondent at Venda plaza taxi rank indicated that:

> *I wear an apron when I cook and wear another one when I serve customers because the one I use for cooking is usually dirty.*

Table 3.2: Correlations between variables of roadside vendors' knowledge of food safety

	P1	P2	P3	P4	F1	F2	F3	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	R1	R2
P1	1.00																				
P2	.27**	1.00																			
P3	-.07	.19*	1.00																		
P4	.17*	.27**	-.03	1.00																	
F1	.11	.55**	.08	.37**	1.00																
F2	.20*	-.04	-.06	.09	.10	1.00															
F3	12	.21*	.07	.32**	.23**	.01	1.00														
D1	-.04	.01	-.01	.03	.14	-.01	.19*	1.00													
D2	.01	.06	.1.4	.19*	.17	.04	.20*	.16	1.00												
D3	.01	.22**	.09	.17*	.25**	.03	.16	.05	.08	1.00											
D4	.22	-.04	.05	.10	-.09	.15	.07	.42	.06	-.03	1.00										
D5	.10	.12	.00	.14	.07	.15	.17*	.11	.10	.10	.36**	1.00									
D6	.10	.23**	.13	.12	.19*	.10	.22**	.03	.04	.06	.19*	.31**	1.00								
D7	.17	.38*	.11	.29**	.31**	.06	.21*	-.09	-.00	.29**	.23**	.36**	.59**	1.00							
D8	.53	.26**	.13	.18*	.19*	.10	.22**	-.01	.11	.20**	.09	.28**	.59**	.67**	1.00						
D9	.03	.30**	.13	.21*	.21*	.08	.16	.77	-.00	-.08	.09	.25**	.37**	.24**	.34**	1.00					
D10	.74	.07	.35	.20*	.25**	.01	.27**	.08	.06	.19*	.02	.03	.25**	.40**	.32**	-.08	1.00				
D11	.33	.03	-.01	-.10	.00	.02	.05	.05	.16	.20*	.08	.04	.18*	.13	.31**	.12	.09	1.00			
D12	.01	.01	-.02	-.16	-.07	-.06	.02	.10	.04	-.09	.35**	-.09	.01	-.02	.09	-.04	.02	.40**	1.00		
R1	.05	.05	.06	.14	.18*	-.10	.00	-.02	-.02	.18*	-.02	.28**	.27**	.04**	.31**	.31**	.22**	-.02	-.13	1.00	
R2	.12	.12	.02	.28**	.30**	.00	.10	-.02	-.03	.21*	.06	.31**	.43**	.51**	31**	.34**	.24**	-.01	-.13	.67**	1.00

Key*: = correlation is significant if P < 0.05, **= correlation is significant if P < 0.01

Key: P1= Cholera is a food-borne disease; P2= Wearing gloves reduces the risk of food contamination, P3= Vendors touch food with cuts on the hands, P4= There are microbes on the skin of healthy people, F1= Reheating cooked foods can results in contamination of food, F2= Cutlery/cutting boards should be sanitized to prevent cross contamination, F3= Swollen cans contain microorganisms that can cause foodborne diseases, D1= Children, healthy adults, pregnant women are risk food poisoning, D2= Typhoid fever can be transmitted via food, D3= AIDS can be transmitted via food, D5= Bloody diarrhoea can be transmitted via food, D6= *Salmonella* is a serious cause of a fatal food-borne disease, D7=Hepatitis A virus can cause food-borne disease, D8= *Staphylococcus* is a germ that causes food-borne diseases, D9= Listeriosis is a food-borne disease, D10= Flu is a food-borne disease, D11= Cholera is a food-borne disease, D12= Diarrhoea or dysentery is a food-borne disease, R1= Food vendors have adequate knowledge on food safety policy, R2= customers have adequate knowledge on food safety policy

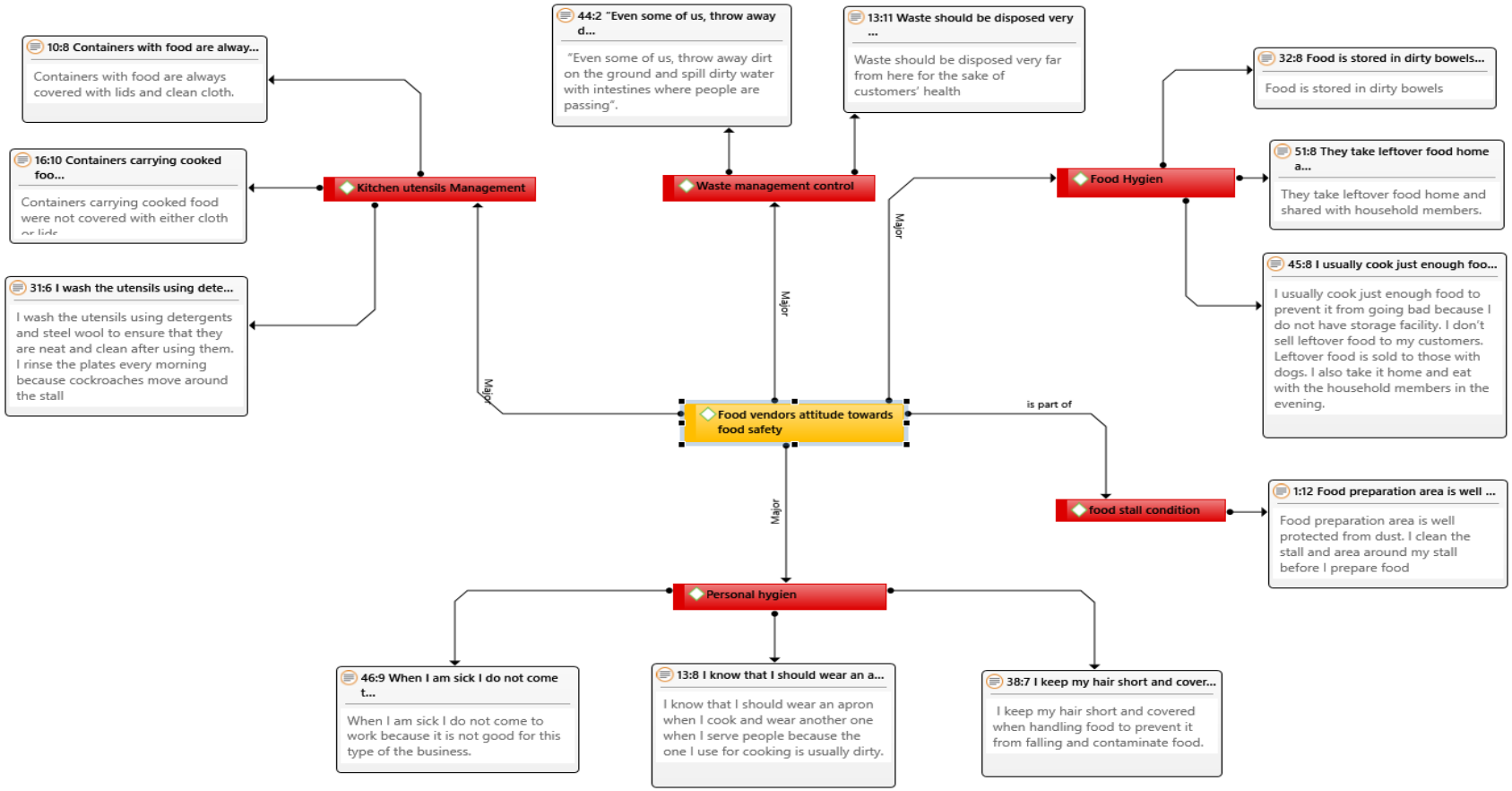

Figure 3.2: Roadside vendors' attitude towards food safety

*Key: Yellow = Main theme; Red = major components measuring attitude towards food safety

Another food vendor at Sibasa taxi rank claimed that:

I keep my hair short and covered when handling food to prevent it from falling and contaminate food. Respondents also showed positive attitude towards hand hygiene. This was revealed by food vendors at Venda plaza, Mvusuludzo and Sibasa locations. They claimed that they wash hands and those of customers before and after handling food.

For example, a respondent operating at Venda plaza mentioned that:

> *I provide my customers with water to wash their hands before and after eating.*

while the one operating at Mvusuludzo location also revealed that:

> *I wash my hands before preparing food*.
>
> *I keep my fingernails short because I am aware that they may accumulate bacteria which may contaminate the food.*

Food vendors also claimed that they keep themselves clean when handling food. For example, one of the respondents from Thulamela location affirmed that:

> *I bath my body every day and put on the clean clothes.*

This was confirmed by the Local Economic Development officer who reiterated that:

> *Some food vendors are clean such that one can be attracted to purchase the food that they sell*.

Respondents in the current study further argued that they do not handle food when they are sick. This was revealed by food vendors at Mvusuludzo and Sibasa locations. For example, one of the respondents at Sibasa claimed that:

> *when I am sick, I do not come to work because it is not good for this type of a business.*

Environmental Health inspector further added that:

> *Food vendors suffering from flu or any communicable diseases they refrain from work and ask relatives to stand in for them.*

Table 3.3 presents the ranked means for vendors' attitude towards food safety. The top ranked attitude was: "*some vendors use soiled towels to dry their hands; "most food vendors pour waste water on the road because there is no adequate waste disposal facility in the vending area"; "food vendors scratch, touch their noses and serve customers without washing their hands; "only a few vendors wear aprons when handling food";* although taking a leave from food-based work when sick was defined as an important variable, its mean score was slightly less than average making it the least important variable when compared to the rest.

b) Attitude and practices towards food hygiene

Small-scale food vendors viewed hygiene as crucial in defining safety of roadside foods in the current study. Most vendors at Sibasa and Venda plaza taxi ranks revealed that after cooking, they keep food in containers with lids to keep it warm and preventing it from dust. A good example was a food vendor at Sibasa who noted that:

> *I use clean transparent plastics to cover my food inside the buckets to keep it warm and protected from the dust.*

Another vendor operating at Venda plaza location added that:

> *I cover my food with clean cloths and tight fitting lids.*

A key informant from the Environmental Health Inspectorate attested that:

> *Vendors cook food towards lunch time to avoid spoilage. Time between food preparation and consumption should at least be 2 hours.*

Respondents claimed that they did not sell leftover food to customers. Vendors operating at Mvusuludzo, Sibasa and Venda plaza taxi rank revealed this. For example, one of them at Mvusuludzo indicated that:

> *I cook just enough food to avoid leftovers because I do not want to serve leftovers to customers, it's not healthy*.

Table 3.3: Ranked means for roadside vendors' attitude towards food safety

Study variables	Mean score	Standard deviation	Ranking
Personal Hygiene	**3.2**		
a) Some vendors use soiled towels to dry their hands	4.3	0.85	1
b) Most food vendors used one towel for to dry customers' hands.	3.5	1.15	3
c) Most of us pour waste water on the road because there is no adequate waste disposal facility where we operate from.	3.5	1.29	2
d) We see food vendors scratching, touching their noses and serving customers without washing hands.	2.8	1.15	4
e) Only a few vendors wear aprons when handling food	2.6	1.16	5
f) It is necessary to take leave from food-based work when sick.	2.5	1.20	6
Food Hygiene	**3.5**		
a) We do not sell leftover food, rather, we take it home and eat with family members.	4.4	0.79	1
b) It is important to maintain correct temperature at which food is stored to reduce the risk of food contamination.	3.8	0.82	2
c) Well-cooked foods are normally free of contamination	3.7	0.92	3
d) Food should be prepared two hours before lunch to minimize food spoilage.	3.5	0.99	4
e) Using water stored in soiled or unclean buckets does not necessarily result in contamination of food.	2.3	1.45	5
Utensils Management	**3.4**		
a) Limited or inadequate storage facilities make it necessary to prepare enough food that can all be sold within a short period.	4.1	1.03	1
b) We wash our utensils with detergent because it leaves them very free of any contamination.	3.7	0.89	2
c) Food vendors rarely use clean water to wash utensils, arguing that it is difficult to access potable water.	3.4	1.19	3
d) We do not find it necessary to cover utensils because there is dust everywhere and thus will always make them dirty anyway.	2.5	1.25	4

*Mean score values presented are based on a 5 point Likert scale where 1 = strongly disagree and 5 = strongly agree

Another respondent from the Sibasa taxi rank highlighted that:

> *usually cook just enough food to prevent it from going bad because I do not have storage facility. I do not sell leftover food to my customers, I sold to those with domestic dogs.*

Washing food before cooking by vendors in the current study was an indication of having positive attitude towards hygiene. For instance, one vendor based at the Venda plaza said:

> *I wash the vegetables with clean water before cooking*".

Another respondent from the same location claimed that:

> *the food I cook should be clean and safe for human consumption.*

As shown in Table 3.3, the respondents in the current study had a positive attitude towards food hygiene. Moreover, important variations were noted on the bases of computed mean scores. This included "food vendors do not sell leftover food" followed by "it is important to maintain correct temperature at which food is stored to reduce the risk of contamination"; "well-cooked foods are normally free of contamination"; "food should be prepared two hours before lunch to minimize spoilage". Variable that scored the least score was "use of water stored in soiled buckets does not necessarily result in food contamination".

c) Attitude towards utensils management

Proper utensils management system in food vending business is critical to the safety of food. In the current study, food vendors showed positive attitude towards the cleanliness of the kitchen utensils. This was revealed by food vendors from all the research sites. For instance, a food vendor operating at Mvusuludzo location claimed that:

> *I wash the utensils using detergents and steel wool to ensure that they are neat and clean after using them. I rinse the plates every morning because cockroaches move around the stall.*

On average respondents in the current study agreed that attitude towards utensils management study construct is crucial (Table 3.5). Important variations were noted on the relative importance of each specific variable defining attitude towards utensils management. A close look at the specific mean score values calculated for each variable showed that inadequate storage facilities were ranked the most important. This was followed by *"we wash our utensils with detergent because it leaves them free of contamination"; and "food vendors rarely use clean water to wash utensils, arguing that it is difficult to access potable water".* Although still important, protective covering of utensils was ranked the least relative to other variables.

3.5.5 The major determinants of food vendors' knowledge and attitude towards food safety

Principal Component Analysis (PCA) was used to isolate and deepen the understanding of the main factors determining the knowledge and attitude towards food safety. The analysis was pegged at a 95 % level of significance. From thirty-six factors, the PCA isolated eight components that accounted for 50.47 % of the variability. The scree plot and loading factors were followed to isolate the eight components as presented in Figure 3.3 and Tables 3.4 and 3.5. Component one accounted for 11.87 % of the total variation. It had the following load factors: Hepatitis A virus can cause food-borne disease, *Staphylococcus* is a germ that causes foodborne diseases, wearing gloves reduces the risk of food contamination and *Salmonella* is a serious cause of a fatal food-borne disease. This component was termed knowledge of foodborne diseases and is in line with the exploratory and descriptive statistics results presented earlier on.

The second component accounted for 8.15 % of the total variability. This component had the following loading factors: food should be prepared two hours before lunch to minimize food spoilage, well-cooked foods are normally free of contamination, we do not sell leftover food, rather, we take it home and eat and bloody diarrhoea can be transmitted via food. This component was termed knowledge of food hygiene. The third component accounted for 6.63 % of variability and the following loading factors: well-cooked foods are normally free of contamination, most of the vendors have only one towel that their customers use to dry hands, using water stored in soiled or unclean buckets does not necessarily result in contamination of food and food vendors rarely use clean water to wash utensils, arguing that it is difficult to access potable water. This component was termed attitude towards food hygiene confirming the results of exploratory and descriptive statistics presented in previous sections.

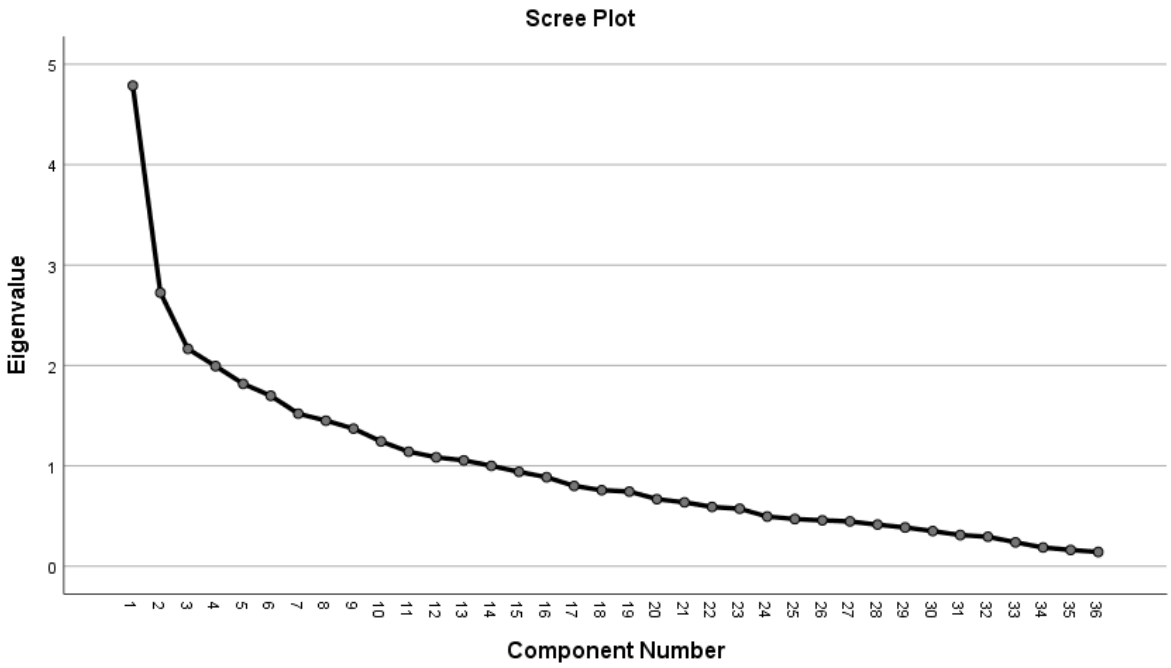

Figure 3.3: Scree plot showing the loading factors of 36 variables of roadside vendors' knowledge and attitude towards food safety

Table 3.4: **Eight principal components of roadside vendors' knowledge and attitude towards food safety**

Principal Components						
Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	4.867	11.872	11.872	4.867	11.872	11.872
2	3.343	8.153	20.025	3.343	8.153	20.025
3	2.720	6.633	26.658	2.720	6.633	26.658
4	2.313	5.641	32.299	2.313	5.641	32.299
5	2.097	5.115	37.414	2.097	5.115	37.414
6	2.023	4.934	42.348	2.023	4.934	42.348
7	1.768	4.311	46.660	1.768	4.311	46.660
8	1.565	3.816	50.476	1.565	3.816	50.476

Table 3.5: Loading factors of roadside vendors' knowledge and attitude towards food safety

Factor loading	**Component 1**	**Component 2**	**Component 3**	**Component 4**	**Component 5**	**Component 6**	**Component 7**	**Component 8**
	Knowledge of Foodborne diseases	Knowledge of food hygiene	Attitude towards food hygiene	Foodborne transmission	Knowledge of hand hygiene	Knowledge of personal hygiene	Utensils management	Environmental hygiene
Hepatitis A virus causes food-borne disease.	0.761							
Staphylococcus causes food-borne diseases.	0,675							
Hand gloves reduces the risk of food contamination	0,642							
Salmonella causes food-borne disease.	0,612							
Food should be prepared soon before serving minimize food spoilage		0,568						
Well-cooked foods are free of contamination		0,559						
We do not sell leftover food,		0.541						
Bloody diarrhoea can be transmitted via food		0.302						
Well-cooked foods are of contamination			0.507					
Vendors use one towel to dry hand			0.484					
Diarrhoea is a food-borne disease				504				
Bloody diarrhoea can be transmitted via food				391				
Typhoid fever can be transmitted via food				0.386				
Cholera is a food-borne disease				0.363				
Eigenvalues	4.867	3.343	2.720	2.313	2.097	2.023	1.768	1.565 **Total**
% of variance	11.153	8.153	6.633	5.641	5.115	4.934	4.315	5.641 **50. 47 %**
Number of items extracted	4	4	2	4	4	3	4	3

The fourth component accounted for 5.64 % of variability. It had the following as loading factors: diarrhoea or dysentery is a food-borne disease, bloody diarrhoea can be transmitted via food, Typhoid fever can be transmitted via food and Cholera is a food-borne disease. The fourth component was termed knowledge and awareness of transmission of foodborne diseases. The fifth component accounted for 5.11 % of the variability and had the following as loading factors: most of the vendors have only one towel that their customers use to wipe their hands after washing, *Staphylococcus* is a germ that causes food-borne diseases, foodborne diseases can cause pregnant women to abort and *Salmonella* is a serious cause of a fatal food-borne disease. This component was termed knowledge of hand hygiene.

The sixth component counted for 4.93 % of the variability. It had the following as the loading factors: using water stored in soiled or unclean buckets does not necessarily result in contamination of food, some vendors use soiled towels to dry their hands, most of us pour waste water on the road because there is no adequate waste disposal facility where we operate from, and we do not sell leftover food, rather, we take it home and eat. Component seven accounted for 4.31 % of the variability. It had the following as loading factors: we wash our utensils with detergent because it leaves them very free of any contamination, limited or inadequate storage facilities make it necessary to prepare enough food that can all be sold within a short period, cutlery/boards should be sanitized to prevent cross contamination and hand washing before work reduces the risk of food contamination. This component was named attitude towards utensils management. Component eight accounted for 3,82 % of the variability. It had the following as loading factors: there are microbes on the skin of healthy people, most of us pour waste-water on the road because there is no adequate waste disposal facility where we operate from, well-cooked foods are normally free of contamination and swollen cans contain microorganisms that can cause FBDs.

3.6 Discussion

In general, respondents in the current study area were predominately females. Contrasting representation of gender dominance participating in food vending has not been similar. According to the study findings of Monney *et al*. (2013), Njaya (2014), Mramba (2015) and Iwu *et al.* (2017) women were in the majority whilst studies conducted by Muinde & Kuria (2005) in Kenya; Pokhrel & Sharma (2016) in Guwahati, Assam; Cortese *et al*. (2017) in Brazil reported the male counterparts dominating the sector. It could be argued that, the geographical locations, informal economy and gender roles dynamics may possibly have some influence on gender ratio participating in food vending. In the South African context, the

domination of women populace in food vending is not surprising because, they are popularly involved in street food vending as they depend on it as a means of complementing family income in the midst of a harsh economy (Adane *et al*., 2018; Ohin *et al*., 2018). Also, in rural set up the populace is mostly women (Jaka & Shava, 2018).

Most respondents were 41-60 years old and married. This finding corroborates the results of the earlier studies in various countries which allude to massive involvement of people between the ages 41 and 60 years in the food vending business (Musa & Akabanda, 2014; Cortese *et al*., 2016; Madaki & Bavorova, 2019). This confirms that small-scale food vending is most common in younger adult population group and adults. This is the age group that is expected to be economically active, if not in the formal sector they will find ways to generate income. Studies conducted by Akabanda *et al*. (2017) and Madaki & Bavorova (2019) showed that food vendors in older age group had better hygiene practices than younger counterparts.

A large proportion of married women participated in small-scale food vending to augment the family resources. This is agrees with the findings by Muranja *et al.* (2011) in Bangkok; and Aluko *et al*. (2014) in Ile Ife, Southwest of Nigeria. However, these findings are presenting a different outlook to the results of a study carried out in Shah Alam, Selangor in Malaysia (Ismael *et al.*, 2016) and Dessie town Ethiopia (Adane *et al*, 2018) where 66 % and 64 % of the respondents were single respectively. In the current study, it was discovered that the married vendors who participated in street food vending did that to augment the family income, whilst the single women depend entirely on street food vending. In terms of the highest level of education attained by food vendors, the results indicated that primary education was the most common among food vendors in the study area. This resonates well with the findings of the Cortese *et al*. (2017) study who found a predominant proportion of food vendors with primary school education. This section fits nicely with the fact around the age groups that were participating in the street food vending sector. They lacked the necessary qualifications to be employed.

A good proportion of the respondents had been in the vending trade for more than six years. The majority of them went into small-scale food vending because they wanted to support their families in meeting needs for improved livelihoods. Unemployment is one of the developmental problems that face every developing economy in the 21st century as Akintoye (2008) points out. The scholar claims that international statistics reveal that industrial and service workers in developing regions account for about two-thirds of the unemployed. Thus, the results of this study indicate a soaring interest in the street vending business over the past decade.

Unemployment is one of South Africa's most pressing socio-economic challenges, affecting a quarter of the workforce (Alenda-Demoutiez & Mügge, 2019). Apparently, job creation in the formal sector has failed to keep pace with the participation of an expanding labour force. Based on this fact, the unemployed pursue job opportunities in the informal sector. This argument confirms the conclusion that the informal sector accounts for most of the job creation in developed and developing countries (Monney *et al*., 2013). Thus, small-scale food vending employ for both men and women who cannot secure employment elsewhere.

The vast majority of respondents (94 %) revealed that they did not receive any training on food safety. As a result, over half of the respondents claimed that they acquired food preparation skills from family members and friends or by observing others in a similar business. This is in line with the findings of the studies conducted in Vietnam (Samapundo *et al*., 2016) and Nigeria (Umar *et al.*, 2018) where 95 % and 100 % of food vendors did not receive training in food safety respectively. Even where some participants have received some form of formal training, but a significant number still relies on generation to generation skills transfer. Musa & Akande (2003) assume that vendors who did not receive any formal training may have little or no understanding of the risks of microbial or chemical contamination of food and how to circumvent them. Thus, small-scale food vendors must receive training on basic principles of food safety. Their training should include important information such as safe food handling practices, sources of contamination, personal hygiene.

All food vendors surveyed in this study did not have a certificate of acceptability. Similar trends were observed in the studies conducted in Florianopolis, Brazil (Cortese, 2016) and in Cape town, South Africa (Hill *et al.*, 2016) were the majority of food vendors engaged in the business did not have certificate of acceptability. The scholars attribute this lack in certification to the non-existence of a proper regulatory policy. Thus, the concerned authorities must speed up the necessary evaluations of the small-scale vending enterprise so to develop the suitable regulations that would bring together the needs of the vendors with relevant laws in place.

Most of the people who supported street food vendors in the current study were passersby. As mentioned earlier, it seemed that this was due to the fact that most food vendors operated near taxi or bus ranks, on pavements and along road sides frequented by people. Consequently, customers appreciated the services that food vendors provide. Almost three-quarters of the street food vendors mentioned that customers liked buying from them because their food tasted differently from what they usually buy from established shops. Similar results were obtained in a study conducted in Gauteng and Limpopo where 100 % of the customers

cited tastiness of street food as the main reason for buying it (Martins & Anelich, 2000, Mathaulula *et al*., 2015). Based on the results of this study it is clear that customers do not consider safety when buying food. Thus, it is the responsibility of food vendors to ensure that they provide safe food to their customers.

Ali & Genitha (2017) allude that food handling personnel play a significant role in ensuring food safety throughout the value food chain i.e. food production, processing, storage and preparation. Mishandling and disregard of hygiene measures on the part of the food vendors may enable pathogens to come into food and in some cases to survive and multiply in sufficient numbers to cause illness in the customers. In the current study, respondents were aware that food vendors who have abrasions or cuts on their hands should not touch unwrapped foods without gloves. This is similar to the results of studies carried out in Calabria, Italy; South Africa (Kwazulu-Natal) and Ghana (Angelillo *et al*., 2000; Akabanda *et al.,* 2017; Mjoka & Selepe, 2017). The awareness of such important hygienic practices by the majority of food vendors in the current study is very crucial. Ohiokpehai (2003) claims that food handlers may introduce biological hazards by cross-contamination if they carelessly handle food with abrasion or cuts on their hands or when they are sick. For instance, a study carried out in Colombia reveal that over 30 % of a group of food handlers examined were carriers of pathogenic microorganisms such as *Salmonella typhi, S. aureus, Salmonella enteritidis* and *Shigella* (Rane, 2011). This is because the hands of food handlers can serve as vectors in the spread of foodborne diseases due to poor personal hygiene or cross contamination.

Proper and regular hand washing is a critical part of any food safety system. Food handlers should always wash their hands after sneezing, coughing, touching mouth or nose; use bathroom; smoking; use toothpicks; handling raw foods; cleaning food preparation surfaces; handling soiled objects, garbage or money. In the current study small-scale food vendors regarded washing of hands while handling food as one of important personal hygiene practices. This is in agreement with the results of the study carried out in South Africa whereby 71 % of the vendors washed their hands under all circumstances (Murwira, 2017). This result is also similar to the findings carried out in Ghana (Akabanda *et al*, 2017). However, these results are contradictory to the findings of the study conducted in Haiti (Samapundo *et al*., 2015) and Guwahati, Assam (Pokhrel & Sharma, 2016) where washing of hands and use of gloves were devoid among food vendors observed. Disregarding hand washing by food vendors has a wide range of negative impacts. Several foodborne disease outbreaks are associated with the poor personal hygiene of food handlers. Consequently, it is advised that food vendors should avoid handling food with bare hands.

Rane (2011) is of the view that the hands of food handlers are the most important vehicle for the transfer of organisms from faces, nose, skin to the food. However, the literature reveals that proper hand washing by food vendors could significantly reduce the threat of diarrhoeal disease (Ali & Genitha, 2017). The later scholars therefore, suggest that hand washing be encouraged as it could similarly help minimize the risk of diarrhoea and other foodborne diseases in food vending businesses. Stepanović *et al*. (2005) in their study "Identification and characterization of clinical isolates of members of the *Staphylococcus sciuri* group" report that food handlers had coagulase-positive *staphylococci* isolated from their hands, and this could be a source of food contamination. Therefore, it is critical to combine proper hand washing with the wearing of gloves and other hygienic practices in order to minimize the risk of contamination during food handling.

In the present study respondents showed that they had good knowledge of food hygiene which is similar to the report of Malaysia (55 %); Sri Lanka (60 %) and Ethiopia (72 %) (Nee, & Sani, 2011; Galgamuwa *et al*., 2016; Adane *et al*., 2018). Food vendors admitted that they sanitise their cutlery and cutting boards to prevent cross contamination. Similar results have been reported in a study carried out in Trinidad (Pattron, 2006); Sri Lanka (Galgamuwa *et al*., 2016) and Nigeria (Faremi *et al*., 2018) whereby food handlers show a habit of cleaning and sanitising food preparing equipment and tools before and after use. This was way lower in the study by Tolulope *et al*. (2015) where only 16 % practices cleaning and sanitisation of cutting surfaces.

Muinde & Kuria (2005) and Havelaar *et al*. (2013) show that unclean equipment and work premises affect food handling practices. Germs like *Campylobacter* can last on kitchen surfaces for up to 1 hour and *E. coli* can last for up to 24 hours. A study conducted in Johannesburg, South Africa reveals a potential risk of preparing unsafe foods due to cross-contamination of cooked products (Mosupye & von Holy, 1999). Re-contamination of the cooked food could be as a result of using cooking utensils that are not thoroughly cleaned. Thus, proper cleaning of food preparation places and utensils is crucial if the spread of foodborne diseases is to be reduced. However, this proves to be difficult unless basic sanitation facilities such as running water and toilets are provided.

The results of the current study revealed that food vendors knew that swollen cans contain microorganisms that may cause foodborne disease or poisoning. Al-Mamun *et al.*(2018) claim that canned foods especially home-made canned foods such as fruits, vegetables,

condiments, fish and poultry are often associated with botulinum if not properly handled. The former author posits that home canning or bottling provide ideal conditions for the organisms to multiply and produce toxin botulism. This could also occur in commercial canned foods. Thus, Attrey (2017) recommends that all swollen cans with bulging lids must be discarded because their consumption could cause serious foodborne illness.

Foodborne illnesses are major public health concern and cause of morbidity and mortality globally (Shonhiwa *et al*., 2017). Each year, foodborne illnesses affect up to one-third of the population of developed countries (Draeger *et al.*, 2019). It is estimated that 600 million, which is almost 1 in 10 people in the world fall ill after eating contaminated food, leading to 420 000 dying every year. Almost 33 million healthy life are lost every year (Bako, 2018). In Europe, approximately 5 196 foodborne outbreaks (including water-borne outbreaks) occurred in 2013 (Thanh, 2015). In South Africa, 327 foodborne outbreaks were reported between 2013 and 2017. These caused illnesses in 11155 individuals, with 78 % hospital visits, 4 % hospital admissions and 0.41 % deaths (Shonhiwa *et al*., 2017). The authors reveal that majority of the outbreaks (43 %) were reported in Kwazulu-Natal. In most cases, food vendors are blamed for foodborne outbreaks because of improper food preparation and mishandling. This could be because food vendors have limited understanding of their roles in ensuring proper personal and environmental hygiene coupled with the basic food hygienic practices when buying, prepare and sell food (WHO, 2015).

From the information presented above, it is not surprising that respondents in the current study disregarded knowledge of foodborne disease as crucial in defining the safety of small-scale vended foods. However, this finding is at variance with the findings of a study conducted in Kumasi, Ghana where respondents had knowledge on foodborne diseases and their ways of transmission (Rheinlander *et al*., 2015). In a separate study conducted in Ghana, Elvis and colleagues reveal that majority of the vendors (87 %) had knowledge of foodborne diseases and another 94 % were knowledgeable about contamination route (Elvis & Addo, 2016). On the other hand, some respondents in Thohoyandou town were aware that diarrhoea or dysentery is a foodborne disease. They further admitted that children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning. Food vendors in the current study further agreed that bloody diarrhoea can be transmitted via food. It is also worth noting that respondents knew that listeriosis and cholera are foodborne diseases. This is inconsistent with the submissions of the studies conducted in Sri Lanka and Nigeria (Galgamuwa *et al*., 2016; Faremi *et al*., 2018).

Although respondents ($\bar{x}$ = 1.4) in the current study showed knowledge of foodborne diseases, they were not aware that typhoid can be transmitted via food; *Salmonella* and *S. aureus* can cause foodborne illnesses and Hepatitis A is a foodborne disease. Similarly, Kubde *et al*. (2016) report that out of 86 food vendors interviewed, only 28 % knew foodborne diseases. Also, Angelillo *et al*. (2000) reveal that most of the food vendors surveyed in Italy did not know most of the foodborne pathogens. It is shocking to note that respondents in study area believed that AIDS can be transmitted via food despite the many campaigns on HIV/AIDS and how it can be transmitted. This confirms the findings presented above that food vendors in the current study had not received training on food safety. Thus, small-scale food vendors operating in Thohoyandou town must receive formal training on food safety and hygiene. Such training is crucial and should be done on regularly to ensure that small-scale food vendors provide food which meets the required safety standards. Also, it is advisable that vendors in the current study should play their role in reducing the risk of foodborne diseases because they are in direct interaction with the customers of small-scale vended food.

Ensuring food safety requires appropriate legislation and adequately resourced institutions to enforce these legislations. Against this background, South Africa has over the years developed a quite number of legislations and allocated various institutions to ensure the hygiene and safety of food from farm to fork. However, it appears from the results of this study that food vendors seemed not to be aware of the rules and regulation that guide the safety of food particularly small-scale vended foods. Lack of knowledge on rules and regulations exhibited by the food vendors was not surprising because literature reveals that in majority of developing countries, street food safety policies do not either exist or are poorly enforced (Liu *et al*., 2014; Alano-Tolelada *et al*, 2018). Small-scale food businesses are considered informal and as such they less regulation by those concerns. Bhowmik (2005) propose that to assist with the management of street foods vending, municipalities should join forces with the police, the municipalities as the regulation formulators, and the police as the enforcers. Also, Modarressi & Thong (2010) and Imathiu (2017) recommend the engagement of experts in food and health related disciplines to draw up guidelines for the management of street food practices. Thus, it is vital to officially recognize street foods and street food vending. This would help in eradicating the tendencies of operating this highly risky food business in hiding and thus ensuring a significant reduction in the hazards of street food consumption. This calls for the development of well-structured guidelines and/or regulations specifically for this food service sector.

Majority of disease outbreaks related to street foods are linked to negligence of food handlers (Alim, 2016). For example, Lui *et al*. (2015) report that about 15 cases of foodborne disease outbreaks monitored in Zhapo, China from 2008-2011 were traced to the negligence of food vendors. In the current study most food vendors agreed that they used soiled towels to dry their hands. This is in agreement with the results of the study done in Cagayan de Oro city, Philippines which reveals that only 2 % of the food vendors agreed that clean towel or disinfecting solution is needed in hand washing (Lubos, 2015). The use of soiled towels may lead to cross contamination and transmission of infectious diseases among food vendors and customers of street-vended foods. Vendors further agreed to the fact that they do not wash their hands after scratching, picking their noses and serving customers. Similarly, Lubos (2014) report that majority of respondents (70 %) agreed that they did not see the need of washing hands after scratching or after continuous handling of food.

Respondents agreed that it is necessary to take leave from food-based work when one's skin is infected by a disease. This finding corroborates with the findings of the study by Abdalla *et al*. (2009), whereby 94 % of vendors agreed that food handlers should be prevented from cooking and vending if they are sick. This is similar to what Lubos (2014) found in a study carried out in the Philippines where food vendors agreed that sore eyes and stomach cramps are enough reasons to stop vending and cooking temporarily. However, these results are in sharp contrast with the results of the study carried out in Bloemfontein, South Africa where all food vendors interviewed confessed that they had prepared food at some point while sick (Lues *et al.*, 2006). Probably this was because their sustenance depended on daily returns from the business. This attitude greatly exposes street food customers to foodborne illnesses which could lead to an epidemic if not promptly controlled. Thus, education and training of food vendors on personal and food hygiene with constant monitoring by the relevant authorities is therefore needed to ensure that food vendors do not sell food to the public while experiencing illnesses.

Food hygiene is the conditions and measures necessary to ensure the safety of food from production to consumption. Food can become contaminated at any point during slaughtering or harvesting, processing, storage, distribution, transportation and preparation. Lack of adequate food hygiene can lead to foodborne diseases and death of customers. The results of the current study reveal that food vendors have a positive attitude towards food hygiene. They claimed that they do not sell leftover food, rather, they take it home and eat with household members. This is similar to the results of the study carried out in Guwahati, Assam in India where majority (97 %) of vendors reveal that consumption of leftover foods was a

common practice among them (Pokhrel & Sharma, 2016).

The above findings are at variance with the results of an earlier studies done in Nairobi, Kenya (Muinde & Kuria, 2005) and Owerri, Nigeria (Chukuezi, 2010). The former scholars report those food vendors in their studies stored food for the following day's sale. The leftover foods were stored in ambient temperature which may promote the sale of stale food. This is risky because safety from contamination by pathogenic microorganisms was not assured. Also, the maintenance of optimal qualities of colour, texture and nutritive value were not put into consideration. This behaviour exhibits negative attitude towards food safety as alluded to earlier on. Thus education and training of food vendors on food hygiene are crucial.

Contrary to the above, food vendors in the present study agreed that it is important to maintain correct temperature at which food is stored to reduce the risk of food contamination. However, this was not practised because of the nature of the business and lack of appropriate basic infrastructure. Food vendors were observed cooking and stored foods at ambient temperature for several hours before sale. A similar observation was made in the Philippines (Lubos, 2014). This practice may create favourable conditions for the growth of pathogens. In such foods, the counts of *E. coli, S. aureus, B. cereus* and *Clostridium perfringens* are reported to be high (Rane, 2011). FAO (1992) recommends that if food cannot be served immediately it should be kept hot or cooled down rapidly and reheated completely to a temperature of at least 70^0 C before eating. This is to ensure that microbes should not thrive on the food because they flourish well between 10^0 C and 60^0 C. Thus, it is advisable that vendors should prepare enough food for the day since most of them do not have good appropriate utensils and storage facilities.

On average food vendors agreed that attitude towards utensils management is another key study construct that one may consider in maintaining the quality and safety of small-scale vended foods. The use of proper utensils for cooking, storage and serving of prepared food is crucial to the safety of small-scale vended foods. Poor quality of material coupled with improper practices may lead to toxin formation, pathogen growth and recontamination. The serving stage is a critical point in the street food industry. Rane (2011) claims that serving utensils used at the vending site are often contaminated with *Micrococcus spp*. and *Staphylococcus spp*. It is assumed that such microbial contaminants originate from food vendors hands when they touched the food preparation areas, dishcloths or water during dish washing or hand washing which indicates cross contamination between dishwater, food preparation surfaces and the food itself (Mensah *et al*., 2002; Cardinale *et al*., 2005). Thus,

Food serving utensils should be maintained in a good and clean condition.

Food vendors in the present study showed a positive attitude towards utensils management. Most vendors agreed that they wash their utensils with detergent because it leaves them very free of any contamination. This is similar to the results of the study conducted in Kwa-Dlangezwa, Kwazulu-Natal, South Africa where by all food vendors interviewed agreed that it is important to use clean utensils at all times (Mjoka & Selepe, 2017). Good maintenance of cooking equipment and utensils used for food preparation and sale is crucial for food safety. Thus, decontamination with appropriate detergents and disinfecting liquids is essential in order to prevent the growth of bacteria on the surfaces of the utensils that could results in re-contamination of food.

Literature has identified the point of service as the most critical step for potential contamination of street food (Proietti *et al*., 2014; Cortese *et al*., 2016; Adane, 2018). The lack of running water or potable water storage makes food safety conditions untenable, as water is needed for washing utensils and equipment for proper food preparation procedures (Omemu & Aderoju, 2008; Proietti *et al*., 2014; Rane, 2011). Without proper washing facilities, the vendors become likely vectors of food contaminants.

Of great concern is that majority of respondents in the present study reported that they rarely used clean water to wash utensils, arguing that it is difficult to access potable water. Ghatak & Chatterjee (2018) also report similar results in a study conducted in Kolkata, India. The former scholars reveal that majority of vendors (81 %) did not have access to drinking water with only 19 % claimed to have water for washing their vessels in India. Limited water for dish washing in vending sites is a matter of serious concern. Rane (2011) argues that bacteria from dirty dish washing water and other sources adhere to the utensil surface can constitute a risk during food vending process. Results of a study on “microbiological analysis of utensils surface and knives” have shown the presence of S*almonella and Shigella* (Barro *et al.*, 2006). Mensah and colleagues also report that during the preparation of food, the raw material is cut and chopped using the same knife without in between cleaning and such knives are often invaded by flies (Mensah *et al*., 2012). This could be a consequence of the multiple functions performed by an individual vendor at each point of sale and is consistent with the findings of international literature (Chukuezi, 2010; Samapundo *et al*., 2015).

3.7 Conclusion

The majority of small-scale food vendors were predominately married women aged 41-50 years. Most of them had attained primary education and had been in the business for more than six years. The main reason for venturing into the business was to support their families in meeting needs for improved livelihoods. The majority of the people who patronized small-scale vended foods were passersby as they needed food that tasted differently from what they got from established restaurants. Food vendors were knowledgeable about personal and food hygiene. They were aware that they were not supposed to handle food with abrasions s on their hands without gloves. Also, they knew that sanitising the cooking utensils such as cutlery and cutting boards will prevent cross contamination. The awareness of such important hygienic practice was crucial otherwise food handlers would introduce biological hazards through cross-contamination. Although food vendors showed knowledge of foodborne diseases, they were not familiar with the transmission of foodborne diseases. They were not aware that typhoid can be transmitted via food. Surprisingly, food vendors in the current study believed that AIDS can be transmitted through food despite the many campaigns on HIV/AIDS. This validates the fact that majority of them had not received formal training in food safety. Attitude towards food safety was also met to some extent. The respondents attested that they used soiled towels to dry hands, disregarded washing their hands after scratching, touching their noses, did not take a leave from food-based work when they were sick. This behaviour may put the lives of customers in danger. The fact that small-scale food vendors in the study area agreed that they do not sell leftover food, stored food at correct temperatures to reduce the risk of food contamination is worth applauding. However, some respondents admitted that they rarely used clean water to wash utensils, arguing that it is difficult to access potable water. This implies that bacteria from dirty water and other sources adhered to the surface of the utensils can constitute a risk during food vending process. Thus, it is clear that Thulamela Municipality and other relevant stakeholders should explore the possible avenues for supporting small-scale food vending business. Linked to this is the provision of appropriate infrastructure which will enable the small-scale food vendors to provide food that will meet the required safety standards. Importantly, food vendors should be assisted to gain relevant knowledge and favourable attitudes towards food safety through formal and informal training. Such knowledge and attitude will enable the development of coordinated, effective, integrated and preventive strategies in line with the WHO “five keys to safer food” aiming at reducing the risk of contamination as food vendors buy, prepare and serve the customers.

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CHAPTER 4: KNOWLEDGE AND ATTITUDE TOWARDS FOOD SAFETY: CUSTOMERS' PERSPECTIVES

4.1 Abstract

The objective of the study was to assess the knowledge and attitude of small-scale vended foods customers towards their safety. Thohoyandou town in Limpopo Province of South Africa was the case study area. A survey underpinned quantitative research design approach was adopted. Two hundred and seventy-two customers were purposefully selected to participate in this study. Data were collected using a closed-ended questionnaire. All the questions relating to customers' knowledge required responses on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Mean for scores and Spearman's rank correlation coefficient was computed using Statistical Package for Social Sciences version 25.0 for analysis. Principal component analysis was then computed. It was found that 51 % of the respondents were females. Almost half of them (47 %) had attained secondary schooling. Those who had been buying small-scale vended foods for less than 5 years constituted 41 % of the total number of respondents. It was revealed that 57 % of the respondents preferred small-scale vended food because it was affordable. The majority of customers knew about food ($\bar{x}$ = 1.88) and personal ($\bar{x}$ = 1.86) hygiene. However, the respondents rarely considered knowledge of foodborne diseases ($\bar{x}$ = 1.40) and rules and regulations ($\bar{x}$ = 1.44) as crucial in defining the quality and safety of food. Rather, respondents reflected positive attitude towards personal ($\bar{x}$ = 3.66) hygiene, food ($\bar{x}$ = 3.72) hygiene and utensils management ($\bar{x}$ = 3.56). The highest correlation relations between variables of customers' knowledge of food safety were observed to be between "*Staphylococcus* is a germ that causes foodborne diseases" and "*Salmonella* is a serious cause of a fatal foodborne disease" (P< 0.0 1). From thirty-six factors that determined the knowledge and attitude towards food safety, the Principal Component Analysis isolated ten components that accounted for 60.15 % of the variability. Component one accounted for 16.03 % of the variability while component two accounted for 9.89 %. Inadequate knowledge of foodborne diseases and rules and regulations by majority of respondents in this study calls for an urgent attention of those responsible such as the environmental health practitioners and local government under Thulamela Municipality if the quality of small-scale vended food is to be improved. Also, experts in food safety issues should make efforts to educate customers on foodborne awareness and their transmission. Lastly, it significant to use various sources of information such as campaigns, workshops and fliers to increase customers awareness of food safety.

Key words: Customers, food safety behaviour, personal hygiene; utensils management.

4.2 Introduction

Rapid industrialization and changing lifestyles led to the development and demand for small-scale vended foods which are prepared for public consumption. The literature revealed that there has been a marked increase in the consumption of food away from home, street-vended foods included (Omemu & Aderoju, 2008; Samapundo *et al*., 2015). As defined in earlier chapters, street-vended foods are ready to eat foods and beverages prepared and or sold by vendors and hawkers especially on the roadside and other similar public places for immediate consumption without further processing or preparation (Rane, 2011; Khan *et al*., 2015). Street food provides a convenient diet for people in developing countries (Ma *et al*., 2019). Approximately 2.5 billion people eat street-vended foods every day, with the consumption supporting the livelihood of millions of low-income people and contributing greatly to the economy (Imathiu, 2017).

Besides the potential benefits mentioned above, prevalent consumption of small-scale vended foods raises the importance of its safety in relation to health. Street-vended foods can be affected by several factors such as the quality of the raw materials, preparation, handling and storage conditions as well as the vending locations that do not meet safety requirements (Aluko *et al*., 2014; Asiegbu *et al*., 2016). This is further exacerbated by the fact that food vendors often operate unregulated without monitoring by relevant authorities (Asiegbu *et al*., 2016; Ghatak & Chatterjee, 2018). Presumably, street-vended foods have the potential to become contaminated, exposing customers to the potential risk of food poisoning (Alimi, 2016; Ekhator *et al*., 2017; Ombeni *et al*., 2018). For example, FAO (2014) claims that up to 2 million people, most of whom were children, died of diseases caused by the consumption of contaminated of food and water. Recently in South Africa, 183 people died due to the outbreak of listeriosis (WHO, 2018).

With the increase in number of people who consume street-vended food, food safety measures must be taken by customers. This could play a significant role in the prevention of foodborne diseases as they constitute the last link “from farm to fork” food chain (Losasso *et al*., 2012; Asiegbu *et al*., 2016). Reducing the risk of food poisoning does not depend only on the maintenance of adequate food hygiene practices by small-scale food vendors, but also on the behavior of the customers when purchasing food.

Studies about the knowledge, attitude and handling practices of small-scale food vendors have been carried out in different parts of South Africa (Mosupye & von Holy, 1999; von Holly &

Makhoane, 2006; Asiegbu *et al*., 2016; Mafune, 2016; Gamieldiene, 2017). However, little remains known about the knowledge and attitude of customers of small-scale vended foods towards food safety in South Africa with particular reference to Thohoyandou town as the study area. It was therefore, pertinent to conduct a study focused on assessing the knowledge and attitude of customers in Thohoyandou town.

4.3 Research Methodology

4.3.1 Description of the study area

The survey on knowledge and attitude towards food safety was carried out in Thohoyandou town. Specific information about the location of Thohoyandou is presented in Chapter 1.

4.3.2 Research design

The study was quantitative and descriptive. Quantitative research in the sense that it sought to describe systematically and accurately the facts and characteristics of a given population or area of interest (Creswell, 2002). A descriptive research design was also employed because it sought to obtain information concerning the current status of the phenomena and to describe what exists for variables or condition in a situation.

4.3.3 Training in data collection tools

Specific details about the training of research assistants in data collection tools are presented in Chapter 3 section 3.3.3.

4.3.4 Community entry

Specific details about community entry are presented in Chapter 3 section 3.3.4.

4.3.5 Population and sampling procedure

The population included the regular customers of the small-scale food vendors who were 18 years and/or above at the time of the study. Both purposive and random sampling techniques were employed to select the respondents. To establish that the sample represented regular customers of food vendors who sell ready-to-eat small-scale vended foods, purposive

sampling technique was employed. With the help of the food vendors, two regular customers per food vendor were randomly selected and requested to voluntarily participate in the study. Upon acceptance to participate in the study, respondents were requested to sign a consent form affirming the desire to voluntarily participate in the study. The questionnaire of each respondent was coded to ensure anonymity. This exercise was repeated until 272 respondents were selected. Of 272 participants, 38 were selected at Sibasa, 35 at Thulamela, 30 at Venda plaza and 33 at Mvusuludzo taxi rank., meaning that 70 were recruited in Thulamela, 60 in Venda plaza, 66 in Mvusuludzo and 76 in Sibasa taxi rank.

4.3.6 Data collection methods and techniques

a) Research questionnaire

A face-to-face questionnaire was administered to 272 randomly selected respondents (Appendix E). Specific details about the questionnaire are presented in Chapter 3. Before its use in data collection, the questionnaire was pre-tested with 20 randomly selected regular customers of small-scale food vendors located 8 km away Thohoyandou central business. This was done to allow for better application of the instrument and to ensure validity and reliability. None of the customers who participated in the pre-testing were included in the final survey. The results of the pre-test were only used to revise the draft questionnaire.

b) Data collection methods and techniques

The same questionnaire used during roadside food vendors survey was used. Demographic information, food safety knowledge and attitudes were considered. The knowledge question was designed to evaluate food safety knowledge on personal and food hygiene, foodborne diseases, rules and regulations. This questionnaire contained 21 questions with possible answers “no” and “yes”. The attitude question was organized to test the customers’ understanding of food, personal and environmental hygiene. Fifteen closed-ended questions that required responses on a 5-point Likert-type scale of 1(strongly disagree) to 5 (strongly agree).

The questionnaire was administered to 272 purposefully selected customers of small-scale vended foods. It took at most 45 minutes to administer each questionnaire to each respondent. Before its use in data collection, the questionnaire was pre-tested with 20 randomly selected food vendors operating at about 8 km out of Thohoyandou town. None of the customers who

participated in the pre-testing was included in the final survey. The results of the pre-test were used to revise the draft questionnaire.

4.4 Data analysis

Data were analysed using Statistical Package for Social Sciences (SPSS) version 25.0, 2017. Firstly, Descriptive statistics was carried out to calculating the frequencies of occurrence of responses for each of the demographic characteristics question and food vending dynamics. Means for scores for each of the knowledge and attitude study constructs were calculated. Further, Spearman's rank correlation coefficient test (r) was computed to determine the degree of correlation among variables relating to knowledge of customers towards food safety. Thereafter, Principal Component Analysis (PCA) was used to isolate and deepen the understanding of the main factors determining the knowledge and attitude towards food safety. As noted in chapter 3 section 3.3.7, the PCA technique was deemed appropriate because of its ability to reduce the dimensionality of a large dataset, while preserving as much 'variability' (i.e. statistical information) as possible (Jolliffe & Cadima, 2016).The analysis was pegged at a 95 % level of significance. The scree plot and loading factors were followed to isolate the components.

4.5 Ethical considerations

The ethical protocols as discussed in Chapter 3 section 3.4 have been adhered to in this study. Various obligations have been taken care of during the research process. The researchers ensured that the research was conducted with honesty, objectivity and integrity (Parveen & Showkat, 2017. A permission and support was sought from the Hawkers' committee, food vendors and the participants themselves. Meaning that only those who volunteer to participate were engaged. All participants were allowed to ask questions and decided whether to participate or not. Also, participants' cultures, values, religion and economic status were respected.

4.6 Results

4.6.1 Demographic information

The majority of the respondents (51 %) were female with 53 % between the ages 20-40 years. Forty-nice percent of them were married while 35 % never married. Only nine percent of

respondents were divorced while an almost insignificant number (7 %) of the customers were widowed. Close to half (46 %) of the respondents completed secondary schooling while 38 % had attained tertiary qualification. Thirteen percent of the respondents had completed primary schooling while an almost insignificant proportion (4 %) had no formal education.

Out of 272 respondents, 59 % had been buying small-scale vended foods for more ten years More than half of the respondents (57 %) bought small-scale vended food because it was affordable while 47 % bought because vendors were friendly. These were followed by 44 % who indicated freshness of the food as the reason for buying. Other reasons for buying included “taste”, “indigenous food” “we never get sick after consuming food”, “generosity”, “buying on credit”, “nutrition” and “clean stalls”.

4.6.2 Customers’ knowledge of food safety

Table 4.1 presents results on customers’ knowledge of food safety. Knowledge on food safety variables was loosely classified into personal and food hygiene, foodborne diseases and rules and regulations subthemes. Customers were requested to indicate the extent to which they agreed with the 21 variables measuring the knowledge of food safety. Out of variables that measured knowledge of personal hygiene “food handlers with abrasions or cuts on their hands should not touch unwrapped foods without gloves” was ranked first followed by “washing hands before work reduces the risk of food contamination”. Variable that scored the least though important was that “there are microbes on the skin, nose and mouth of even healthy food handlers”.

Out of the variables that measured knowledge of food hygiene, “cutlery and cutting boards should be properly sanitized to prevent cross contamination” was ranked first. Other major variables that measured knowledge of food hygiene were “swollen cans contain microorganisms that can cause foodborne disease or poisoning”, “reheating cooked foods can result in contamination of food”. Out of the variable that measured knowledge of foodborne diseases, “diarrhoea or dysentery is a foodborne disease, was ranked first. “Bloody diarrhoea can be transmitted via food” was ranked number two. Other major variables that measured knowledge of foodborne diseases were “listeriosis is a foodborne disease”, “foodborne diseases can cause pregnant women to abort”, “children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning” and “Cholera is a foodborne disease”.

Table 4 1: Ranked means for customers' knowledge on food safety in Sibasa and Thohoyandou

Study variables	Mean score	Standard deviation	Ranking
Personal Hygiene (1=N0; 2=Yes)	**1.9**		
Food handlers who have abrasions or cuts on their hands should not touch unwrapped foods without gloves	2.0	0.17	1
Washing hands before work reduce the risk of food contamination	1.9	0.23	2
Using gloves while handling food reduces the risk of food contamination.	1.8	0.42	3
There are microbes on the skin, nose and mouth of even healthy food handlers	1.7	0.43	4
Food Hygiene (1=N0; 2=Yes)	**1.8**		
Cutlery and cutting boards should be properly sanitized to prevent cross contamination	1.9	0.21	2
Swollen cans contain microorganisms that can cause foodborne disease or poisoning	1.9	0.34	1
Reheating cooked foods can result in contamination of food	1.6	0.48	3
Foodborne Diseases (1=N0; 2=Yes)	**1.4**		
Diarrhoea or dysentery is a foodborne disease	1.8	0.37	1
Bloody diarrhoea can be transmitted via food	1.7	0.45	5
Listeriosis is a food-borne disease	1.7	0.46	4
Food-borne diseases can cause pregnant women to abort	1.7	0.47	3
Children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning	1.7	0.48	2
Cholera is a food-borne disease	1.5	0.50	7
Salmonella is a serious cause of a fatal foodborne disease.	1.5	0.52	5
Staphylococcus is a germ that causes foodborne diseases.	1.5	0.49	8
Typhoid fever can be transmitted via food	1.4	0.50	9
Hepatitis A virus can cause food-borne disease.	1.4	0.48	10
Flu is a food-borne disease	1.2	0.40	11
AIDS can be transmitted via food	1.1	0.34	12
Rules and Regulation (1=N0; 2=Yes)	**1.4**		
Small-scale food vendors have adequate knowledge of food safety policy	1.5	0.52	1
Customers have adequate knowledge of food safety policy	1.4	0.54	2

*Mean score values presented are based on a 2 point Likert scale where 1 = no and 2 = yes

The remaining variables received the least scores. Out of two variables that measured knowledge of rules and regulations, “small-scale food vendors have adequate knowledge on food safety policy” was ranked first followed by “customers have adequate knowledge on food safety policy”. However, no variations were found concerning specific knowledge attributes on rules and regulation as they all attracted fewer scores respectively as shown in Table 4.1.

Table 4.2 presents the coefficients of correlation between the pairs of the 21 variables defining the knowledge of customers of food safety. The highest correlation relations were observed to be between “*Staphylococcus* is a germ that causes foodborne diseases” and “*Salmonella* is a serious cause of a fatal food-borne disease” $P < 0.01$); customers have adequate knowledge on food safety policy” and “small-scale food vendors have adequate knowledge on food safety policy” ($P < 0.01$); “Hepatitis A virus can cause food-borne disease” and “*Salmonella* is a serious cause of a fatal food-borne disease” ($P < 0.01$); “*Staphylococcus* is a germ that causes food-borne diseases” and Hepatitis A virus can cause food-borne disease” ($P < 0.01$); “swollen cans contain microorganisms that can cause foodborne diseases” and “There are microbes on the skin of healthy people” ($P < 0.01$); “*Salmonella* is a serious cause of a fatal food-borne disease” and “Typhoid fever can be transmitted via food” ($P < 0.01$).

4.6.3 Customers’ attitude towards food safety

Mean scores for customers’ attitude towards food safety study construct are presented in Table 4.3. Attitude on food safety was measured in terms of personal, food hygiene, and utensils management subthemes. Each of these subthemes is described below:

Customers were requested to indicate the extent to which they agreed with the 15 variables measuring the attitude towards food safety. Out of the variables that measured attitude towards personal hygiene, “some vendors used soiled towels to dry their hands” was ranked number one. “Vendors pour waste water on the road because there is no adequate waste disposal facility” was ranked number two. The least ranked variable though important was “It is necessary to take leave from food-based work when one’s skin is infected by a disease. Out of the variables that measured attitude towards food hygiene, “it is important to maintain correct temperature at which food is stored to reduce the risk of food contamination” was ranked first followed by “we do not sell leftover food, rather, we take it home and eat. Variable that scored the least score was “using water stored in soiled or unclean buckets does not necessarily result in contamination of food”.

Table 4 2: Correlations between variables of customers' knowledge of food safety

	P1	P2	P3	P4	F1	F2	F3	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	R1	R2
P1	1.00																				
P2	.26**	1,00																			
P3	.15*	0,11	1.00																		
P4	.06	.16**	.00	1.00																	
F1	.13*	.28**	.15*	.20**	1.00																
F2	,02	,04	,06	,03	0,05	1.00															
F3	,01	,07	,00	.42**	.17**	.17**	1,00														
D1	-,10	,04	-,03	.21**	-,08	-,01	.12*	1,00													
D2	-,11	,06	,03	.14*	,00	-,01	.17**	.26**	1,00												
D3	-,06	,03	,07	.10	.12*	,01	0,01	,11	.17**	1,00											
D4	-,04	,11	.19**	.06	-,05	.14*	0,04	-,03	.17**	,08	1,00										
D5	,08	.17**	,02	.14*	.21**	,04	.17**	.06	,10	,09	,09	1,00									
D6	-,02	,10	,04	.17**	,10	,05	.20**	,06	.40**	.13*	.20**	.28**	1,00								
D7	-.05	.13*	-,00	.17**	.18**	-,04	.18**	.20**	.27**	.22**	,10	.32**	.60**	1,00							
D8	-,05	,08	-,01	.19*	,02	,04	.20**	.16**	.35**	.14*	.14*	.21**	.65**	.60**	1,00						
D9	,09	.17**	,08	.28**	,11	,04	.29*	,01	,09	,04	.16**	.28**	,08	,07	,11	1,00					
D10	-.13*	-,08	-,03	,06	,03	,02	,06	.15*	.28**	.29**	,07	,07	.21**	.27**	.32**	-,05	1,00				
D11	,07	,05	01	,06	-,09	.14*	.17**	,10	.38**	.21**	.27**	-,00	.30**	.20**	.36**	.19**	.31**	1,00			
D12	-,06	-,02	.10	.16**	-,05	.18**	.14*	,00	.17**	,08	.34**	.14*	.13*	.06	.15*	.26**	,08	.23**	1,00		
R1	,09	.14*	,12	.09	.38**	-,03	,03	-.14	-.26**	,02	.01	.20**	.00	,09	-,04	,11	,01	-.26**	-,01	1,00	
R2	,00	.15*	,01	,04	.33**	-,06	,05	-.16**	-.19**	,04	-,02	.27**	,01	.12*	-,02	.16**	,03	-.25**	-,12	.65**	1,00

Key: * = correlation is significant if P < 0.05, ** = correlation is significant if P < 0.01

Key: P1 = Cholera is a food-borne disease; P2 = Wearing gloves reduces the risk of food contamination, P3= Vendors touch food with cuts on the hands, P4 = There are microbes on the skin of healthy people, F1 = Reheating cooked foods can results in contamination of food, F2 = Cutlery/cutting boards should be sanitized to prevent cross contamination, F3 = Swollen cans contain microorganisms that can cause foodborne diseases, D1 = Children, healthy adults, pregnant women are risk food poisoning, D2 = Typhoid fever can be transmitted via food, D3 = AIDS can be transmitted via food, D5 = Bloody diarrhoea can be transmitted via food, D6 = Salmonella is a serious cause of a fatal food-borne disease, D7 = Hepatitis A virus can cause foodborne disease, D8 = *Staphylococcus* is a germ that causes food-borne diseases, D9 = Listeriosis is a food-borne disease, D10 = Flu is a foodborne disease, D11 = Cholera is a food-borne disease, D12 = Diarrhoea or dysentery is a food-borne disease, R1 = Food vendors have adequate knowledge on food safety policy, R2 = customers have adequate knowledge on food safety policy

Table 4 3: Ranked means of customers' attitudes towards food safety

Study variables	Mean score	Standard deviation	SE	Ranking
Personal Hygiene				
Some vendors use soiled towels to dry their hands	4.5	0.76	0.046	1
Most vendors pour waste water on the road because there is no adequate waste disposal facility where we operate from	4.1	1.08	0.065	2
Most of the vendors have only one towel that their customers use to wipe their hands after washing	3.6	1.17	0.071	3
We see food vendors scratching, picking their noses and serving customers without washing hands	3.4	1.20	0.073	4
Only a few vendors wear aprons when handling food	3.2	1.24	0.075	5
It is necessary to take leave from food-based work when one's skin is infected by a disease	3.2	1.34	0.081	6
Food Hygiene				
It is important to maintain the correct temperature at which food is stored to reduce the risk of food contamination	4.1	0.80	0.048	1
We do not sell leftover food. Rather, we take it home and eat	4.0	1.08	0.065	2
Well-cooked foods are normally free of contamination	3.9	1.01	0.061	3
Food should be prepared two hours before lunch to minimize food spoilage	3.8	0.88	0.053	4
Using water stored in soiled or unclean buckets does not necessarily result in contamination of food	2.7	1.30	0.079	5
Utensils Management				
Limited or inadequate storage facilities make it necessary to prepare enough food that can all be sold within a short period	3.9	1.02	0.062	1
We wash our utensils with detergent because it leaves them very free of any contamination	3.8	0.84	0.051	2
Food vendors rarely use clean water to wash utensils, arguing that it is difficult to access potable water	3.4	1.18	0.072	3
We do not find it necessary to cover utensils because there is dust everywhere and thus will always make them dirty anyway	3.1	1.24	0.076	4

*Mean score values presented are based on a 5 point Likert scale where 1 = strongly disagree and 5 = strongly agree

Out of the variables that measured attitude of customers towards utensils management, "limited or inadequate storage facilities make it necessary to prepare enough food that can all be sold within a short period" was ranked first. The other major variables that measured attitude towards utensils management were "we wash our utensils with detergent because it leaves them very free of any contamination, "food vendors rarely use clean water to wash utensils, arguing that it is difficult to access potable water". The least ranked variable though still important was "we do not find it necessary to cover utensils because there is dust everywhere and thus will always make them dirty anyway".

4.7 Major Determinants of knowledge and attitude towards food safety

Principal Component Analysis (PCA) was used to isolate and deepen the understanding of the main factors determining the customers' knowledge and attitude towards food safety. The analysis was pegged at a 95 % level of significance. From thirty-six factors the PCA isolated ten components that accounted for 60.15 % of the variability. The scree plot and loading factors were followed to isolate the ten components as presented in Figure 4.1 and Tables 4.4 and 4.5. Component one accounted for 16.03 % of the variability. It had the following as the loading factors: food vendors do not find it necessary to cover utensils because there is dust everywhere and thus will always make them dirty anyway, most of the vendors have only one towel that their customers use to wipe their hands after washing, we see food vendors scratching, picking their noses and serving customers without washing hands and Typhoid fever can be transmitted via food. This component was termed attitude towards personal hygiene. The second component accounted for 9.89 % of variability and had the following as its loading factors: foodborne diseases can cause pregnant women to abort, small-scale food vendors have adequate knowledge on food safety policy, reheating cooked foods can result in contamination of food and customers have adequate knowledge on food safety policy. This component was named knowledge of rules and regulations.

Component three accounted for 6.38 % of the variability. It had the following as the loading factors: bloody diarrhea can be transmitted via food, diarrhoea or dysentery is a food-borne disease, it is necessary to take leave from food-based work when one's skin is infected by a disease and food vendors do not sell leftover food, rather, take it home and eat. This component was termed knowledge and awareness of foodborne diseases and their transmission.

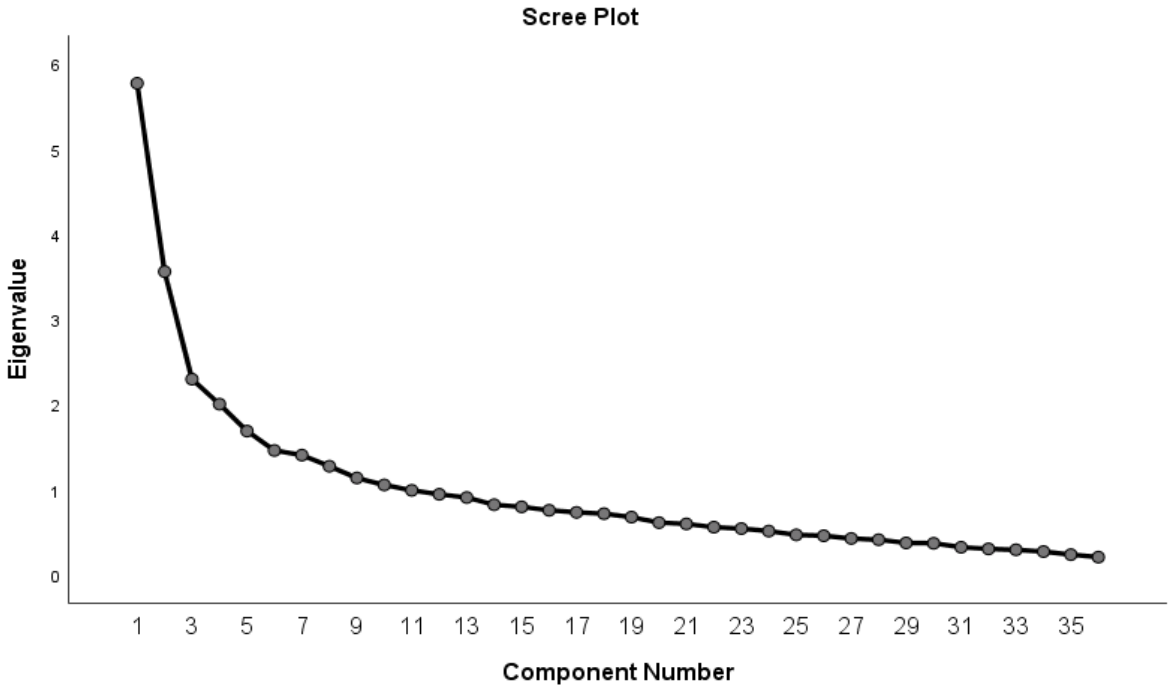

Figure 4.1: Scree plot showing the loading factors of 36 variables of knowledge and attitude towards food safety

Table 4 4: Ten principal components of knowledge and attitude towards food safety

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.770	16.027	16.027	5.770	16.027	16.027
2	3.560	9.889	25.916	3.560	9.889	25.916
3	2.298	6.383	32.299	2.298	6.383	32.299
4	2.004	5.567	37.866	2.004	5.567	37.866
5	1.689	4.691	42.557	1.689	4.691	42.557
6	1.461	4.059	46.616	1.461	4.059	46.616
7	1.405	3.903	50.519	1.405	3.903	50.519
8	1.276	3.544	54.063	1.276	3.544	54.063
9	1.137	3.158	57.221	1.137	3.158	57.221
10	1.055	2.931	60.152	1.055	2.931	60.152

Table 4 5: Loading factors vendors' knowledge and attitude towards food safety

Factor loading	Component 1	Component 2	Component 3	Component 4	Component 5
	Attitude towards personal hygiene	Knowledge of rules and regulations	Foodborne diseases awareness	Knowledge of food hygiene	Knowledge of personal hygiene
Food vendors do not cover utensils	0.687				
Vendors used one towel to dry hands	0.679				
Typhoid fever can be transmitted via food	0.646				
Food vendors scratched, picked their noses and served customers without washing hands	0.42				
Vendors use soiled towels to dry their hands	0.631				
Food-borne diseases cause pregnant women to abort		0.586			
Reheating cooked foods results in contamination of food		0.565			
Food vendors have adequate knowledge on food safety policy		0.558			
Customers have adequate knowledge on food safety policy		0.513			
Bloody diarrhoea can be transmitted via food			0.494		
Diarrhoea or dysentery is a food-borne disease			0.458		
Take a leave when sick			0.438		
Vendors do not sell leftover food			0.419		
Vendors do not sell leftover food				0.514	
Food vendors wash utensils with detergent				0.481	
Food should be prepared two hours before lunch to minimize food spoilage				0.426	
Well-cooked foods are free of contamination				0.388	
Washing hands reduces the risk of food contamination					0.486
Using gloves while handling food reduces the risk of food contamination					0.392
There are microbes on the skin, nose and mouth of even healthy food handlers					0.388
Food vendors scratched, picked their noses and served customers without washing hands					0.382
Eigenvalues	5.770	3.566	2.298	2.004	1.689
% of variance	16.027	9.889	6.383	5.567	4.961 Total = 60 %
Number of items extracted	5	4	4	4	4

The fourth component had accounted for 5.57 % of the variability. It had the following as the loading factors: food should be prepared two hours before lunch to minimize food spoilage, well-cooked foods are normally free of contamination, food vendors do not sell leftover food, rather, take it home and eat and food vendors wash utensils with detergent because it leaves them very free of any contamination. This component was termed knowledge of food hygiene The fifth component accounted for 4.69 % of the total variation and had the following loading factors: washing hands before work reduce the risk of food contamination, using gloves while handling food reduce the risk of food contamination, there are microbes on the skin, nose and mouth of even healthy food handlers and we see food vendors scratching, picking their noses and serving customers without washing hands. This component was termed knowledge of personal hygiene. Components six, seven, eight and nine accounted for 4.06 %, 3.09 %, 3.54 % and 3.14 % respectively while component ten accounted for 2.93 % (Table 4.5).

4.8 Discussion

Generally, the respondents in the current study area were predominantly young women. This shows that small-scale vended food consumption is particularly popular among young females. This might be because such foods are convenient, affordable and readily available to young people who may be traders, hawkers, casual workers, students, unemployed and or workers who are busy and do not have time to prepare meals for themselves (Khairuzzaman *et al*., 2014). This trend was similarly observed in previous studies where customers of small-scale vended foods were predominately women (Samapundo *et al*., 2016; Nguyen *et al*,. 2018). A great proportion of the respondents were between 18-45 of age and were married. This finding is at variance with the results of the earlier study in Johannesburg, South Africa which allude that slightly over half (54 %) of the customers were single (Asiegbu *et al*., 2016).

In terms of the highest level of education attained by food vendors, the results indicate that secondary education was the most common among customers in the study area. This is in consonance with the findings by Asiegbu *et al*. (2016) in South Africa, Nguyen *et al*. (2018) in Vietnam where and Ma *et al*. (2019) in China. The acquisition of secondary qualification by the customers in the study area is worth applauding because it will contribute to their knowledge of food hygiene and safety issues than those with low formal education level. However, previous studies proved this wrong by indicating that food safety issue among people with high level of education is less satisfactory (Carbas *et al*., 2013; Hassan & Dimassi, 2014; Samapundo *et al*., 2015).

The findings of the current study revealed that majority of the customers had been consuming small-scale vended foods for more than six years. Affordability, friendliness of the vendors, freshness and better taste were the most cited reasons for purchasing small-scale vended foods. This resonates well with the results of Martin (2006) in South Africa, Mensah *et al*. (2013) in Ghana and Lin (2014) in Yangon. Based on these findings it can be safely concluded that customers of the street-vended foods do not consider food safety issues when they buy. This is a matter of public concern which needs urgent attention. Thus, education of customers in the study area focusing on food safety awareness is crucial. On the other hand, these findings are at sharp contrast with the results of Nguyen *et al*. (2018) whereby customers in Hanoi, Vietnam perceived hygiene and safety of food as an important factor when purchasing street-vended foods. Also, results of a study carried out in Canada reveal that safety of meals was a predominant trait affecting the decision of dinning out by the customers (Henson *et al*., 2006). The authors further allude that the safety of the restaurants in Canada was measured in terms of cleanliness of the kitchen, utensils, dining area and restrooms. In Asia too, cleanliness of the kitchen was the most important feature signaling the safety of food (Lee *et al*., 2012).

Customers in the current study had adequate knowledge of food safety. Majority of them were aware that food handlers should wear protective clothing when handling food. This aligns with the findings of the earlier studies conducted in Vietnam and Ghana (Samapundo *et al*., 2016; Akabanda *et al*., 2017). Respondents in this study attested that they knew that washing hands before food preparation reduces the risk of contamination. This finding is in agreement with those of Samapundo *et al*. (2016) in Ho Chi Minh, Vietnam and Temitayo (2016) in Ile-Ife, Nigeria. Awareness of such essential hygienic practices by majority of respondents in this study is appreciated because proper hand washing by the food handlers and the customers has been reported to significantly decrease the threat of diarrhoeal disease (Akabanda *et al.,* 2017).

Tomaszewska *et al*. (2018) observe the discrepancies between hand washing, hygiene, knowledge and practice in a study conducted in Poland and Thailand. The scholars report that customers were less likely to wash their hands before food preparation and consumption even though hands of the food handlers and customers can serve as vectors in spreading foodborne diseases. This is evidenced by the findings of Malhotra *et al. (*2006) whereby the presence of faecal bacteria was found in the nails of over 70 % of customers in India. This was a consequence of improper hand washing. This behaviour shows that customers' attitudes toward food safety was not corresponding to the degree of knowledge demonstrated. Thus,

maintaining adequate hand washing coupled with education is crucial for the reduction of microbial infections.

Customers in this study had satisfactory knowledge of food hygiene. They were aware that cutlery and cutting boards should be properly sanitized to prevent cross-contamination. This finding is in agreement with the findings of the studies conducted in Vietnam and Bulgaria (Samapundo *et al*., 2016; Stratev *et al*., 2017) Cross-contamination occurs when disease-causing microorganisms, like bacteria and viruses are transferred from one food to another. Odeyemi *et al*. (2019) view that customers may also cross-contaminate food when they serve themselves, refill dirty plates or reuse dirty plates as well as picking up food with bare hands. Cross-contamination may lead to serious health risks such as food poisoning or unintended exposure to food allergens. Thus, food vendors and customers must be aware of the risks of contamination in each step of food handling, preparation and storage.

Results of the current study further revealed that customers in the study area admitted that swollen cans contain microorganisms that can cause foodborne disease or poisoning. This finding resonates well with those of Ma *et al*. (2019) in Handan city in China. Pal *et al*. (2014) share the same sentiments. The authors claim that food from swollen cans may contain Botulism and consumption of such food may lead to nausea, vomiting, headache, dizziness, dryness of mouth and even death. Thus, any can with sign of swelling or bulginess must be discarded immediately to curb foodborne disease pandemic.

The fact that customers in the study area new that reheating of cooked foods may results in food contamination is worth applauding because customers in Ho Chi Minh city in Vietnam were not aware of this issue (Samapundo *et al*., 2016). Following WHO (2015) recommendations, food should be reheated thoroughly at 75 ^{0}C through otherwise bacteria introduced after cooking may multiply if reheating is inadequate. Thus, making food unsafe for human consumption. This justifies that customers of street-vended foods should receive basic education and training on food poisoning and prevention.

In line with the findings of Tortoe *et al*. (2013), customers in the current study had limited knowledge of foodborne diseases. However, results revealed that customers were aware that diarrhoea or dysentery, listeriosis, cholera and typhoid were foodborne diseases. Apparently, this could be due to the prior knowledge of foodborne disease outbreaks caused by bacteria (Asiegbue *et al*., 2007). Besides, foodborne diseases caused by microorganisms are an increasingly recognised problem involving a wide spectrum of illnesses such as acute effects

on the gastrointestinal tract (Chauhan *et al*., 2015). Respondents also admitted that *Salmonella* and *staphylococcus* cause foodborne diseases. This validates the results of a study conducted in Johannesburg, South Africa (Asiegbu *et al*., 2016). This knowledge could be as a result of the reported outbreaks of *Salmonella* and *E. coli* in the media. *Salmonellosis* is a major health problem in South African region where broiler farms and slaughterhouses have been regarded as major sources of contamination (Akhtar *et al*., 2014). Little *et al.* (2007) also report a prevalence of *Salmonella* in Northern Portugal

The knowledge that foodborne diseases can cause pregnant women to abort was crucial. However, the finding is in conflicts with those of Samapundo *et al*. (2016) who report that 60 % of the customers in Ho Chi Minh city of Vietnam did not know that abortion can be induced by foodborne disease. Hormonal changes that occur during pregnancy decrease cell-mediated immune function, thus, increasing the susceptibility of pregnant women to certain types of infections (Tam *et al*. (2010). Respondents further agreed that children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning. This agrees with the findings of Stratev *et al*. (2017) in Bulgaria. This could be due to the fact that their immune system is weaker.

Virtually, customers the present study did not know that *hepatitis A* virus, and flu are pathogens responsible for foodborne diseases respectively. This is similar to the results of the studies carried out in Jordan, Haiti and South Africa (Osaili *et al*.,2013; Samapundo *et al*., 2015; Asiegbu *et al*., 2016). The fact that customers in the present study admitted that AIDS can be transmitted via food is worrisome. Lack of knowledge about foodborne diseases represents a barrier for customers to acquire safe handling behaviours. This justifies the that fact that customers should be receive training to improve their knowledge of food safety.

South Africa like any other country has food safety policies that are intended to safeguard customers against possible danger of contracting food poisoning or foodborne diseases (Gordon-Davis, 2011; Khuluse, 2016). However, these policies were not intended for street food vending business. This justifies why customers of small-scale vended foods in the study area had inadequate knowledge about the rules and regulations related to food safety. As mentioned in earlier chapters, policies and regulations for safe street food trade are week and poorly enforced in most developing countries including South Africa (Liu *et al*., 2014; Samapundo *et al*., 2015). Thus, there is a need for strengthening and proper enforcement of safety policies in street food trade to minimise hazards of food poisoning.

This will require the involvement of all the affected stakeholders such as food vendors themselves, customers of street vended food, hawkers association officers and environmental health practitioners.

The fact that respondents in this study indicated that they have positive attitude towards personal hygiene is worth applauding. This agrees with previous studies carried out in Haiti and China (Samapundo *et al*., 2015; Ma *et al*., 2019). Temitayo (2016) is views that personal hygiene is an important global public health issue while Dlova (2018) regard it as the most preventive measure for the prevention of pathogens transmission in food service establishment. On the other hand, Lee & Greiga (2010) allude that poor personal hygiene practices may be the potential transmitters of foodborne diseases. Therefore, good hygienic practices may contribute to a large extent on factors relating to a healthful living and prevention of hazards from diseases.

Customers in the present study agreed that food vendors used one hand towel to dry their hands. This could be because there is limited hand washing facilities in the study area. This observation is worrying because inadequate hand washing is one of contributing factors of cross contamination which may expose customers at risk of foodborne illnesses. Sharif *et al*. (2013) posit that organisms such as *Salmonella typhi, no-typhi salmonella, compylo bacteria spp* and *E coli* can survive on fingers and other surfaces even after hand washing. Lee & Greiga (2010) opine that effective hand washing techniques and appropriate detergents may be reduced bacterial count. Dlova (2018) further indicates that proper hand washing can help to eliminate the possibility of transmitting foodborne diseases to the customers

Customers further agreed that food vendors in the current study pour waste water on the road indicating that there is no adequate waste disposal facilities in the vending sites. This trend was similarly observed in previous studies done in India and Kenya (Tambekar *et al.,* 2009; Nyamagwa, 2012). The scholars claim that samples of vendors who sold their food items in such areas were contaminated because the conditions were conducive for the breeding of insects and rodents, which may carry foodborne pathogens. This matter raises public concern and thus, requires an urgent attention of the local authorities to come up with the intervention plan or a system that will assist in reducing further spreading of foodborne diseases.

Results revealed that respondents in this study had a positive attitude towards food hygiene. They believed that it is important to maintain the correct temperature at which food is stored to reduce the risk of food contamination. This is in line with WHO (1996) recommendations

which state that prepared foods should be at least served hot at 60 ^{0}C to prevent microbial growth, particularly if the sales period extends over 4-5 hours. Similarly, the author indicates that prepared foods that are to be served cold, should be stored at less than 10 ^{0}C, that is if cooling capacity is available. However, If cooling capacity is not available, street food vendors should regulate preparation and holding time before consumption to limit the opportunity for pathogens to reproduce. Preparation of food long before its consumption coupled with storage at ambient temperature, inadequate cooling and reheating among others are identified as the key factors that contribute to food poisoning outbreak (Rane, 2011).

It is worth reporting that customers in this study were aware that food should be prepared two hours before lunch to minimize food spoilage. This is in line with WHO (1996) recommendations which indicate that food cooked immediately prior to consumption is safer for consumption. Holding foods at high ambient temperatures for a long period has been reported to be a major contributor to the occurrences of food poisoning outbreak in Accra Ghana (Mensah *et al*., 2002). Lianghui *et al*. (1993) and Rane (2011) postulate that food which is held for several hours after cooking at ambient temperatures harbour high microbial population. Bryan (1997) and Natural Resource institute (NRI) (2000) reveal that unacceptable levels of *E. coli, S. aureus, B. cereus* and *Clostridium perfringens* were isolated in food stored in such conditions. These practices or observations raised by the respondents have a serious public concern which calls for training of small-scale food vendors and their customers on basic health and food safety education.

The fact that the customers agreed that food vendors in the study area did not sell leftover food is worth applauding. This is similar to the findings of the studies conducted in various countries such as Kenya, Sudan and Ghana (Muinde & Kuria, 2005; Abdalla *et al*., 2009; Apanga *et al*., 2014). However, these findings are at variance with those of a study carried out India (Reang & Bhattacharjya, 2013). The scholars reveal that customers of small-scale vended foods admitted that small-scale food vendors stored leftovers in the refrigerators for next day sales. Against this point, respondents in the current study suggested that enough food should be prepared which will be sold at in a short period because of the inadequate storage facilities in small-scale food trade.

Utensils for cooking and storage of prepared food is critical to the safety of small-scale vended foods. Stratev *et al*. (2017) allude that cooking utensils particularly cutlery should be properly sanitized to prevent cross contamination. Similar results were reported in the current study. Customers complained that food vendors in the study area rarely used clean water to wash

cooking utensils, arguing that it was difficult to access potable water. A similar behaviour was observed in the earlier studies conducted in Uganda (Muyanja *et al*., 2011) and in Durban, South Africa (Kok & Balkaran, 2014). In both cases, food vendors repeatedly washed utensils with water that has been previously used. This unhygienic behaviour may encourage cross-contamination from utensils to cooked food thus causing health risks to customers. Further, customers in this study complained that roadside food vendors did not covering the utensils claiming that dust was everywhere and thus would always make them dirty anyway. This finding agrees with those of Onyango *et al*. (2012) in Kenya and Mnyone *at al.* (2018) in Tanzania.

4.9 Conclusion

The results revealed that majority of the customers were young married female in the ages between 20-40 years. The majority of them had secondary school qualifications. Most customers considered affordability rather than safety of food when buying foods. This justifies the provision of education and food safety awareness campaigns to the customers of small-scale vended food in the study area. The fact that customers possessed sufficient knowledge of food and personal hygiene is worth applauding. Just like the food vendors, customers in this study had limited knowledge of foodborne diseases and their transmission. They were not aware that Hepatitis A virus and flu are pathogens that are responsible for foodborne diseases respectively. Customers also admitted that AIDS can be transmitted via food. These findings validate the fact that over half (57 %) of them did not consider safety issues when they bought food. Affordability and taste factors were the main reasons why customers bought the street-vended food which may have a serious implication in their health. This implies the need for enhancing the system of protecting them. It is therefore recommended that customers of the street-vended foods must be trained on food safety, hygiene, foodborne illnesses and their transmission to ensure their safety. Respondents disregarded knowledge of rules and regulations that guides food vending business. Thus, this study recommends that small-scale food vending policies should be strengthened and properly enforced to ensure significant reduction in the hazards of street food consumption. Lastly, various sources of information such as workshops and awareness campaigns should be used to increase customers awareness of food safety.

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CHAPTER 5: THE STATE OF FOOD HANDLING PRACTICE IN THULAMELA MUNICIPALITY

5.1 Abstract

The objective of this study was to assess the state of food handling practice among the roadside food vendors in Thulamela Municipality, South Africa. A survey underpinned exploratory sequentially mixed method research design was adopted for the study. Fifty-four respondents were selected to participate in phase 1 of the study in which qualitative data were collected through focus group discussion and administering a semi-structured interview guide to key informants. Quantitative data were collected using observation checklist that was administered to 124 roadside food vendors. All questions required responses on a Likert-type scale ranging from 1 (yes) to 2 (no). Qualitative data were analysed using Atlas.ti version 8.0. Quantitative data were analysed using Statistical Package for Social Sciences (SPSS) version 25.0 . Mean for scores, Hierarchical cluster analysis was carried out to identify unique clusters of handling practices that had common characteristics. A scree plot was constructed to determine the two-cluster solutions. Then, Mann-Whitney U test was conducted to test the relative stability of the generated two cluster solutions. Ordinal Least Squares Regression analysis was carried out to test the fitness of the model.

The findings revealed six major themes that defined the state of food handling practice. These included stalls condition, personal hygiene, environmental and waste management, hygiene related-behaviour, food storage and utensils management. Personal hygiene especially wearing of protective clothing was scored high ($\overline{x}$ = 1.8) by the respondents. Condition of the stalls received the least score ($\overline{x}$ = 1.2). The two main clusters determined were unique and independent to each other ($P < 0.01$). Generally, cluster 1 performed better ($\overline{x}$ = 1.9) than cluster 2 ($\overline{x}$ = 1.8) regarding handling practice. Out of the six identified themes, protective clothing ($P < 0.05$) and stalls condition ($P < 0.05$) were the most significant variables that defined the state of handling practice. The results revealed that an improvement in protective clothing and stalls condition would significantly result in a better food handling practices. Thus, provision of basic training in food handling practice is recommended to ensure the safety of customers. Thulamela Local Municipality must establish street food vending centres that have adequate facilities and utility

services. Such shelters should be provided with essential public utilities such as potable water and garbage collection. Lastly, environmental health practitioners should exercise strict surveillance over food vendors and monitor the conditions under which food is prepared and sold regularly to prevent the risk of foodborne disease outbreak

Key words: Clusters, food handler, handling practices, hygiene; working environment

5.2 Introduction

Access to safe food is a basic human right and is central to good health, productivity and a platform for sustainable development and poverty alleviation (Aluko *et al*., 2014). The safety of small-scale food vending depends on the quality of raw materials, food preparation, handling and storage practices. Thus, Isara & Isah (2009) define food vendor as any person who handles food regardless of whether he or she prepares or serves it. The food vendors are closely associated with poor food handling. Consequently, food handlers with poor food handling practices are likely to be the potential sources of food contamination. McGill *et al*. (2015) argue that food handlers have inadequate food safety knowledge which may result in unsafe food handling practices and cross-contamination in food establishments. Jianu & Golet (2414) in Western Romania and Afolaranmi *et al*. (2015) in Nigeria posit that some food handlers in food establishment often lack basic food safety knowledge in areas such as temperature control, personal hygiene, and the prevention of cross-contamination. The World Health Organization (WHO) (2013) also view that human actions are the leading cause of food contamination during food preparation. This is because small-scale food handlers are often untrained in food safety, food hygiene and sanitation (Chukuezi, 2010) and thus do not adhere to good hygiene practices.

Food handling and safety is a critical issue globally and every person is at risk of foodborne illnesses. Foodborne diseases are major health problems in both developed and developing countries. On a nationwide basis, over 91 million people are sickened as a consequences of foodborne pathogens and associated illnesses (Kubde *et al*., 2016; Abdelrazing *et al*., 2017). In the USA for example, more than 48 million reported cases of illnesses per year are associated with foodborne pathogens (Olanya *et al*., 2019) whereas in Sub-Saharan Africa (South Africa included) foodborne diseases are responsible for over 142 000 mortalities a year. People get sick all over the world either because they have eaten contaminated food or mishandled food.

(Tessema *et al*., 2014). In Ghana for example, four persons died after eating contaminated meat (Money *et al*., 2014). In South Africa, 180 people died after consuming contaminated sausages while 3 people died in Australia after consuming contaminated melon (Alanya *et al*., 2018).

Tessema *et al*. (2014) claim that in Africa (South Africa included), poverty is the underlying cause of the consumption of unsafe food. Limited resources such as finance may prevent poor people from consuming a decent meal. The situation is further exacerbated by many factors such as lack of access to potable water, poor governmental structural arrangement, communicable diseases, trade pressure and inconvenient environmental conditions. Thus, food safety assurance in food service establishments depends heavily on the availability of adequate infrastructure, appropriate management support and commitment as well as knowledgeable and skilled food handlers. Therefore, this chapter was designed to assess the state of food handling practice among the small-scale food vendors in Thulamela Municipality in South Africa.

5.3 Research Methodology

5.3.1 Introduction

The description of the study area was explained in detail in Chapter 1 section 1.2. Also, specific information about the research design processes is presented in Chapter 3 section 3.3.2. Exploratory sequential mixed methods research design was adopted in this survey as already alluded to in Chapter 3 section 3.3.2.

5.3.2 Population and sampling procedure

Population of the study included small-scale food vendors who sell ready-to-eat cooked food in Thulamela Municipality. Added to these were stakeholders who work closely with small-scale food vendors. Those who sell fruit and vegetables as well as packaged food were not included. Purposive sampling technique was employed to select four locations in Thulamela Municipality viz., Thulamela, Mvusuludzo, Venda Plaza and Sibasa taxi rank. Purposive sampling technique was appropriate because the researcher wanted to focus on particular characteristics of a population that are of interest, which best enabled the researcher to answer the research questions (Palys & Atchison, 2008). Given that, the locations were purposefully selected because

they constituted part of the concentration points of small-scale vended foods in the study area. Purposive sampling techniques was further employed to select 50 food vendors who participated in phase 1 of the study. Further, stakeholders who work closely with vendors were recruited using a snowball sampling technique borrowed from Etikan *et al*. (2015). The former scholars define snowball sampling as a technique of finding research subjects through referrals. The following four stakeholders were recruited: Local Economic Development officer, Compliance Unit officer under the Community Service Department, Environmental Health inspector and Hawkers' Association committee. This was done in order to get other people's views other than the views of the food vendors. Besides, various stakeholders were involved in order to guard against biases in the behaviour of the food vendors studied. Out of 136 food vendors, only 124 stalls were observed in phase 2 of the study. this means that 12 food vendors excused themselves from the study and their decision was respected. This was because this study was carried out after the preceding studies and thus, some food vendors were reluctant and therefore refused to participate. The main reason advanced was that the whole process was time consuming and tedious. Of the 124 respondents, 31 (equally spread) were operating in each of the following taxi ranks: Sibasa, Thulamela, Venda plaza and Mvusuludzo.

5.3.3 Data collection methods and techniques

Qualitative and quantitative data were collected through a two-phase sequential integrated study.

Qualitative data collection methods and techniques

Qualitative data were collected through key informant interviews and focus group discussions. Key informant interviews preceded focus group discussions. Fifty food vendors and four stakeholders participated in interviews. The focus groups were constituted as follows: two focus groups each with 10 food vendors. The remaining food vendors were excluded from the focus group discussion because they complained that it was taking away time for the business. The third group consisted of a Local Economic Development officer, Compliance Unit officer under the Community Service Department, Environmental Health inspector and chairperson of the Hawkers Association committee. The following question was used to guide the key informant interviews and focus group discussions: What are the handling practices of the small-scale food vendors that you appreciated most?. A facilitator was assigned to probe for more responses from

the participants during key informant interviews and focus group discussions.

Quantitative data collection method and techniques

During phase two, data obtained through the confirmatory key informant interviews and focus group discussion were used to construct an observational checklist tool (Appendix F) which guided the points to be observed. Also, the information obtained from the international technical documents (FAO/WHO, 2009; FAO/WHO, 2001; WHO, 2006) was used to guide construction of an observational checklist tool. The guide was administered to 124 small-scale food vendors. The guide mainly consisted of closed-ended questions that required 1 which denoted “no” and 2 which denoted “yes” responses. The following variables were included in the observation checklist guide: demographic information, food stall condition, environmental hygiene, personal hygiene, hygienic related behaviour and, food storage and utensils management.

Before its use in data collection, the observation checklist guide was pre-tested with 10 randomly selected food stalls 8 km away from Thohoyandou central business. This was done to allow for better application of the instrument and to ensure validity and reliability. None of the stalls participated in the pre-testing was included in the final survey. The results of the pre-test were only used to revise the draft observation checklist. Data were collected through direct observation and interviews. Interviews were done to obtain the demographic information of the food vendors. During the survey, vending surroundings, personal and food hygiene practices, disposal of waste and cleanliness were observed and recorded. Assistive devices such as cameras and tape recorders were used with the consent of the participants. The data were triangulated meaning that different data collection methods were used to present an overall picture of the state of handling practices in the study area. Heale & Forbes (2013) view that triangulation is done to increase the confidence in the findings through the confirmation of a proposition of findings from two or more independent methods.

5.3.4 Data analysis

For qualitative data, thematic content analysis was used. Data obtained through key informant interviews were cleaned, transcribed and entered into Microsoft excel. Thereafter, data were imported into ATLAS.ti version 8.0 software for analysis. Data segments (quotations) were

selected and assigned codes. This involved writing memos and commenting on the data. Thereafter themes, patterns and relationships were established. The relationships between the codes were developed under the Network View Manager. The codes were imported as nodes to design a semantic network view. The nodes (codes) were linked with quotations. Quantitative data were analysed using Statistical Package for Social Sciences (SPSS) version 25.0 (SPSS, 2017). Descriptive analysis was carried out. This involved calculating the means for scores for the state of handling practice study constructs.

The analysis of the means

Data collected through the observation stage made use of a structured observation template that used several measurement scales on a state of food handling variables. To make sense out of the generated study results the means were calculated as a summary measure. The analysis of means then helped to summarize what would have been otherwise large quantities of data into a few understandable observations. Where measurement scales were not equal, the study made use of standardized mean z-score values to allow for a comparative analysis of study results based on different measurement scales. Their calculation was based on the following formula borrowed from (Behboadian & Asgharzadeh, 2008).

$$z = \frac{x - \mu}{\sigma}$$

$\mu =$ Mean
$\sigma =$ Standard Deviation

Hierarchical Cluster Analysis (HCA)

Hierarchical Cluster Analysis (HCA) was computed to identify unique clusters of handling practice which had common characteristics in terms of the six main study constructs proposed in the study. Hierarchical cluster analysis was preferred because of its ability to classify several objects into some groups (clusters) according to their similarities (Penkova, 2017). The study assumed that handling practice dynamics were largely a function of a host of food handling practices such as food stall conditions, environmental hygiene, hand hygiene, protective clothing, hygiene related behaviour, food storage and utensils management system. The interaction of these variables was

assumed to result in unique and measurable common groups of handling practices. Conceptually, the analysis denoted associated food handling practice outcomes for food handling practice variable i in food stall j as Yij. This outcome is represented in the equation below as a function of the individual food handling practice characteristics, Xqij, and a model error rij (Bryk & Raudenbush, 1992). Such interaction and the resultant clusters under HCA was governed by the following formula:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{1ij} + \beta_{2j}X_{2ij} + \ldots + \beta_{nj}X_{nij} + r_{ij}$$

where $r_{ij} \sim N(0,\sigma^2)$.

Where Y = a dummy variable indicating the state of food handling practices

Since HCA assumes that study variables follow a normal distribution, normality test of study constructs was conducted using statistical tools such as computing measures of skewness and measures of Kurtosis.

Multiple Regression Analysis (MRA)

The study hypothesised that the state of food handling practice in Thulamela is a function of six major study constructs including food stall conditions environmental hygiene, hand hygiene, protective clothing, hygiene related behaviour, food storage and utensils management. Such cause effect relationship was quantified statistically using Ordinal Least Squares (OLS) regression analysis. Ordinal Least Squares was chosen because of the nature of the dependent variable which in this case is assumed to be a continuous normal variable. OLS regression analysis was performed to identify the variables, which are critical in defining the state of food handling practices dynamics in Thulamela Municipality and their relationship with other variables. The models were first evaluated for the goodness of fit using Analysis of Variance (ANOVA).

(a) Model Parameters

Regression analysis was used to quantify the relationships between the variables and to help in understanding the importance of variables and the study constructs as they relate to the state of food handling practices. Regression analysis was deemed appropriate in this study because it is a reliable method of identifying which variables have impact on a topic of interest. Aiken & West, 1991). Thus, the process of performing a regression allows the researcher to confidently

determine which factors matter most, which factors can be ignored, and how these factors influence each other. In addition, Ordinal Least Squares (OLS) Regression was preferred over other types of regression methods because of the nature of the dependent variable. The continuous nature of the dependent variable required the use of OLS regression. The following regression formula was used to measure the significance of the study constructs in explaining the state of food handling practices.

$$\mathbf{Y = \beta_0 + \beta\ 1X_1 + \beta\ 2X_2 + \beta\ 3X_3 + \beta\ 4X_4 + \beta\ 5X_5 + \beta 6X_6}$$

Where;

Y = state of food handling practices

$\mathbf{X_1}$= stall condition

$\mathbf{X_2}$= Environmental hygiene

$\mathbf{X_3}$= Hand hygiene

$\mathbf{X_4}$= Protective clothing

$\mathbf{X_5}$= Hygiene related behaviour

$\mathbf{X_6}$= Food storage and utensils management

The above regression model hypothesised that the state of food handling practices is largely a function of a food safety related variables that include stall condition, environmental hygiene, hand hygiene, protective clothing, hygiene-related behaviour and food storage and utensils management. The independent variables were largely the proposed study constructs that were identified qualitatively and after a critical review of literature on food handling practices.

(b) Model evaluation

Before the use of results from OLS, the regression model was evaluated for the goodness of fitness using the Analysis of Variance test. Also, model was diagnosed for the problems of multicollinearity using a collinearity diagnostic test.

5.4. Ethical Considerations

As mentioned earlier, this study was carried out after getting ethical clearance from the University of Venda Ethics Committee. Also, approval and permission to interview food vendors were sought from the Hawkers Association and Municipal Manager of Thulamela local Municipality. Informed consent and the right to participate was adhered to. The consent form was given to each participant who agreed to take part in the study. After signing, the consent forms were collected and kept safely. Also, the participants had the right to abstain or withdraw from the study at any time. Before using media (cameras and tape recorders), consent of the participants was secured. This was important to ensure that the participants are acquainted in advance with every aspect of the study. The participants were also assured that photographs taken during the interviews would be stored in a safe place. For this reason, the participants were assured that the information collected through observing the food stalls would be confidential and used for the sole purpose of this study.

5.5 Results

Figure 5.1 presents the results of the perceived state of food handling practice. This was categorized into the following subthemes: food stalls condition, personal and food hygiene, hygiene-related behaviour, environmental hygiene, storage and utensils management.

5.5.1 Food stalls condition

In this study the respondents were asked about the condition of their vending stalls and they revealed that they maintained their stalls in good condition. For instance, one respondent indicated that:

> *"I clean the stall to ensure that customers like the place*.

Table 5.1 presents the results of food stalls conditions in Thulamela Municipality. Out of the 13 variables that define the condition of the food stalls, stall protected from the sun was ranked first. The rest of the variables were ranked below the average mean.

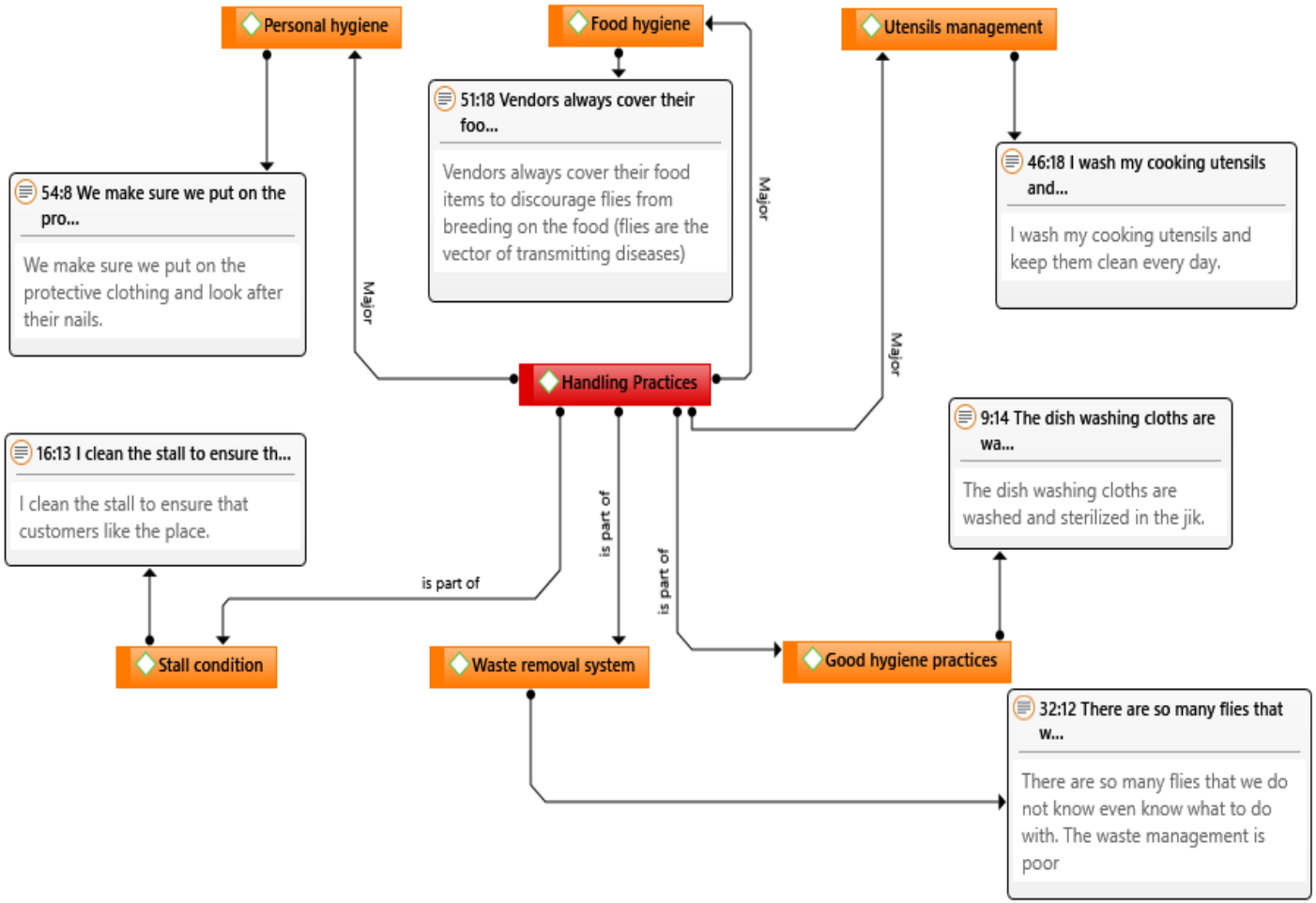

Figure 5.1: Schematic presentation of the state of food handling practice in Thohoyandou and Sibasa, Thulamela Municipality

*Key: Red = Main theme; Orange = major determinants of the state handling practice

Table 5.1: Results of food stalls conditions in Thulamela Municipality

Food stall condition			
Variables	***Mean score**	**Standard deviation**	**Ranking**
Average	**1.2**		
Stall protected from sun	2.0	0.15	1
Vending stall maintained in a clean condition	1.5	0.50	2
Food prepared on site	1.4	0.82	3
Adequate hand washing facilities available	1.3	0.48	4
Animals or pests evident around the vending stall	1.3	0.47	5
Adequate waste food disposal facilities available	1.3	0.45	6
Access to potable water at the site or close to the site	1.1	0.27	7
Adequate waste water disposal facilities available	1.0	0.13	9
Access to community-operated waste water disposal sites	1.0	0.15	8
Access to community-operated general waste disposal sites	1.0	0.13	9
Stall made of temporary structure	1.0	0.00	11
Stall protected from dust	1.0	0.00	11
Stall protected from wind	1.0	0.00	11

In general, the average mean of 1.23 depicts that the condition of food stalls in the study area were generally poor as shown in Table 5.1 and Figure 5.2.

5.5.2 Personal hygiene

Personal hygiene was subdivided into protective clothing and hand hygiene.

a) Protective clothing

Respondents in Sibasa and Venda plaza location indicated that they wear protective clothing (aprons and head covering) when handling food. For example, one food vendor at Sibasa taxi rank revealed that

"I make sure that my hair is completely covered when handling food so that hair does not fall in the food. this will not be good for my customers".

While the one operating at Venda plaza reiterated that

"*I cover my hair and wear an apron at work to avoid hair getting inside the food".*

Respondents further revealed that they were not supposed to handle food when sick. This was mentioned by a food vendor from Thulamela taxi rank who indicated that:
"*If a person is having flu he/she shouldn't cough carelessly in front of the food, or touch the food after touching the mouth"*

In addition, a food vendor from Mvusuludzo taxi rank revealed that

> "*Vha vhafumakadzi a vhatendelwi u da mushumoni musi vhe maduvhani*". This means that "*female workers who are menstruating are not supposed to come to work*".

Table 5.2 presents the mean scores and rank orders for priorities of variables that measured personal hygiene. Personal hygiene was measured in terms of protective clothing, hand hygiene and hygiene-related behaviour. In the protective clothing category the variables that received high scores were "food vendors cover hair when serving of food" "food vendors cover hair during food preparation", "vendors wore aprons when serving, handling and preparing food". The least ranked variables under this category were "food vendors' clothes are clean and presentable"

Figure 5.2: Photos depicting condition of the food stalls in Thulamela Municipality

Table 5.2: Results of personal hygiene of small-scale food vendors

Personal hygiene			
	***Mean score**	**Standard deviation**	**Ranking**
Protective clothing			
Food vendor covers hair when serving food	1.9	0.31	**1**
Food vendor covers hair during food preparation	1.8	0.34	6
Food vendor wear an apron when serving food	1.8	0.35	5
Food vendor covers hair when handling food	1.8	0.38	3
Food vendor wear an apron when preparing food	1.8	0.38	3
Food vendors clothes are clean and presentable	1.8	0.43	2
Hand hygiene practices			
Food vendors handle food with bare hands	2.0	0.00	1
Food vendors handle money while serving food	2.0	0.00	1
Food vendors have clean short nails	2.0	0.13	1
Food vendors wash their hands in clean water each time before handling food	1.7	0.46	4
Food vendors wash their hands in clean water each time after visiting the toilet	1.5	0.50	5
Jewellery adequately covered	1.2	0.39	6
Food vendors wash hands after handling money before handling food again	1.0	0.00	7
Food vendors use disposable or reusable gloves	1.0	0.00	7
Food vendor wear jewelry during food handling	1.0	0.00	7
Hygiene related behaviour			
Dirt or dust removed by means of a dirt cloth or bare hands	2.0	0.35	1
The same utensil was used to prepare raw and cooked food products	1.5	0.50	2
The operator blow air into polythene bag before use	1.1	0.33	3
Food vendor handle food while sick	1.1	0.25	4
Blowing of nose into hands and continue to work without washing the hands	1.0	0.18	6
Vendor smoke during the handling and preparation of food	1.0	0.15	7
Coughing into hands and continuing to work without washing the hands	1.0	0.90	5

b) Hand hygiene

Hand hygiene was considered important for improved safety of small-scale vended food in the study area. Most vendors revealed that they wash their hands before and after handling food as well as after visiting the toilet. This was revealed by food vendors from Venda plaza and Sibasa taxi ranks. Respondents from Mvusuludzo, Venda plaza and Sibasa taxi ranks also indicated that they provide water for hand wash to customers before they eat For instance, food vendor from Sibasa taxi rank indicated that

> *"I give clean water to my customers to wash their hands before and after meals".*

Some vendors in this current study were aware that finger nails may habour microorganisms that may infect food. This fact was confirmed by a food vendor from Thulamela taxi rank who stated that

> "*I keep my nails short and I do not put nail polish (hezwi ndo fundedzwa nga vhothitshere vha Home Economics tshikoloni).* Meaning that*, I was taught by my Home economics teacher at school".*

The explanatory results revealed that out of the nine variables that measured hand hygiene "food vendors handled food with bare hands" variable was ranked first (Table 5.2). This was followed by "food vendors handled money while serving food". Other variables that received high scores were "food vendors had clean short nails, "food vendors washed their hands with clean water each time before handling food" and "food vendors washed their hands in clean water each time after visiting the toilet". Variables that were ranked the least were "jewellery was adequately covered", vendors washed hands after handling money before handling food again", "vendors used disposable or reusable gloves" and vendors wore jewellery during food handling"

c) Hygiene-related behaviour

Small-scale food vendors responded positively to hygienic related behaviour. For example, a respondent at Mvusuludzo taxi rank indicated that:

> "*I removed dirt from the table with a separate cloth to prevent cross contamination*

We provide our customers with tooth picks so that they do not use their fingers to pick food from their teeth".

Another one from Venda plaza added that

"I frequently washed my utensils with kitchen towels and sterilized them in water mixed with jik to kill the bacteria

As presented in Table 5.2, the hygiene related variables that received high scores were "dirt or dust removed by using dirt cloth and bare hands" and "the same utensils used to prepare raw and cooked food products". The least ranked variables were "the operator blew air into polythene bag", "vendor handled food while sick", vendor blew nose into hands and handled food without washing hands", vendors smoked during handling food" and "vendor coughed into hands and continuing to work without washing hands".

5.5.3 Food hygiene

Food vendors in the present study claimed that they practiced good food hygiene. For instance, a food vendor from Thulamela location mentioned that

"*before I cook my food especially vegetables I wash with clean water to remove soil and chemicals that were used during food production to prevent customers from falling sick"*

This was also indicated by food vendors from Sibasa and Venda plaza taxi ranks. Food vendors also claim that they do not sell leftover food to customers. This was evidenced by one of the food vendors from Sibasa taxi rank who indicated that

"*I do not sell leftover food. if it happens that there is leftover food, I throw into the dustbin"*.

This was supported by another food vendor in the same location who echoed that

"I cook enough food for my clients every day. Food which is not bought I sell to those with dogs or take home and eat with my household members".

5.5.4 Food storage and utensils management

Some vendors showed that they practice good food storage and utensils management system. One of them from Venda plaza taxi rank claimed that

> "*after* preparation *I put my food in buckets and containers and cover them with lids to keep them warm and prevent dust and flies from entering the food".*

Regarding utensils management, one respondent revealed that

> "*I wash my utensils such as pots, plates and serving bowls and keep them clean every day".*

Table 5.3 presents the observation results of food storage and utensils management system in Thulamela Municipality. Out of variable that defined food storage, "containers covered with tight-fitting lids" was ranked first, followed by "containers covered with clean kitchen towels". The variable that received the least scores were "food stored openly in the stalls", "containers covered with soled kitchen towels", "raw, partially and cooked food products kept separately", food stored in containers with lids that do not fit properly" and "previously cooked food kept cool (i.e. ice box or refrigerated). On the variables that measured utensils management, "utensils cleaned with warm soapy water" was ranked first.

Other variables that received high scores were "utensils washed with dirty water", "utensils washed with cold water", utensils cleaned adequately every time after use" and "utensils cleaned with water with no soap".

5.5.5 Environmental hygiene and waste management system

Food vendors in the study area considered environmental hygiene and waste management system as important in defining the state of handling practice in the study area. For example, a food vendor who was operating at Venda plaza mentioned that

> "*I buy refuse bags to throw the rubbish while preparing food".*

Also, another respondent at Sibasa claimed that

> "*I put the rubbish in a refuse bag and put it away from my stall*"

Table 5.3: Food storage and utensils management system in Thulamela Municipality

Food storage and utensils management system			
Food storage	**Mean score**	**Standard. deviation**	**Ranking**
Food storage			
Food stored in containers with tight-fitting lids	2.0	0.35	1
Food stored in containers covered with clean kitchen towels	1.5	0.50	2
Food stored openly in the stalls	1.1	0.33	3
Food stored in containers covered with soiled kitchen towels	1.1	0.25	3
Raw, partially and cooked food products kept separately	1.0	0.18	5
Food stored in containers with lids that do not fit properly	1.0	0.15	5
Previously cooked food kept cool (i.e. ice box or refrigerated	1.0	0.09	5
Utensils management			
Utensils cleaned with warm soapy water	3.0	1.21	1
Utensils cleaned with dirty water with soap	2.7	0.99	2
Utensils cleaned with cold soapy water	1.8	0.38	3
Utensils cleaned adequately every time after use	1.3	0.48	4
Utensils covered properly	1.1	0.33	5
Utensils cleaned with water with no soap	1.0	0.09	6

However, a food vendor at Venda plaza complained that dirty stinking water was running near the selling stall to the drainage which was almost blocked (Figure 5.3).

The observation results revealed that “environment around the stalls was far from the toilet facilities” was ranked first. This was followed by “environment around the observed stalls was far from the open drains” and “animals far from the vending stalls”. Variables that attracted low mean sore values were “environment around the stall far from the waste water”; “environment around the stall far from the rubbish bins” and “environment around the stalls clean”.

5.6 Hierarchical Cluster Analysis (HCA) Results

Hierarchical Cluster Analysis (HCA) was computed to identify unique clusters of handling practice which had common characteristics in terms of the six main study constructs proposed in the study. Figure 5.4 presents the results of the scree plot. The scree plot results suggest that the point of elbow is found at case 121 meaning this is a two-cluster solution (that is, 123-121 = 2 cluster solution). Responses for 124 participants were analysed. However, the analysis accounted for 99 % of the variance in items . Thus, 123 was used to determine the two cluster solutions. Further, to ensure that there was no overlap between the identified clusters, a Mann-Whitney U test was conducted to test the relative stability of the generated two cluster solution. The results revealed that the two clusters were unique and independent of each other ($P < 0.05$) (Appendix G).

5.6.1 Cluster description

Table 5.4 presents the results of the cluster membership. The results revealed that the description of the characteristics of each cluster was made at two levels namely, the general overview and a detailed description. Also, the specific locations and the ranked performance of each cluster group based on all the study constructs are shown in Table 5.4. The two-cluster solution revealed that 107 (86 %) of the food stalls belonged to cluster 1 while 17 (14 %) of them belonged to cluster 2. The majority of the food stalls (35 %) were located at Venda plaza taxi rank which belonged to cluster 2. Ten percent of the them were located at Mvusuludzo taxi rank which belonged to cluster 1.

Figure 5.3: Water drainage systems blocked by food vendors' waste products in Thulamela Municipality

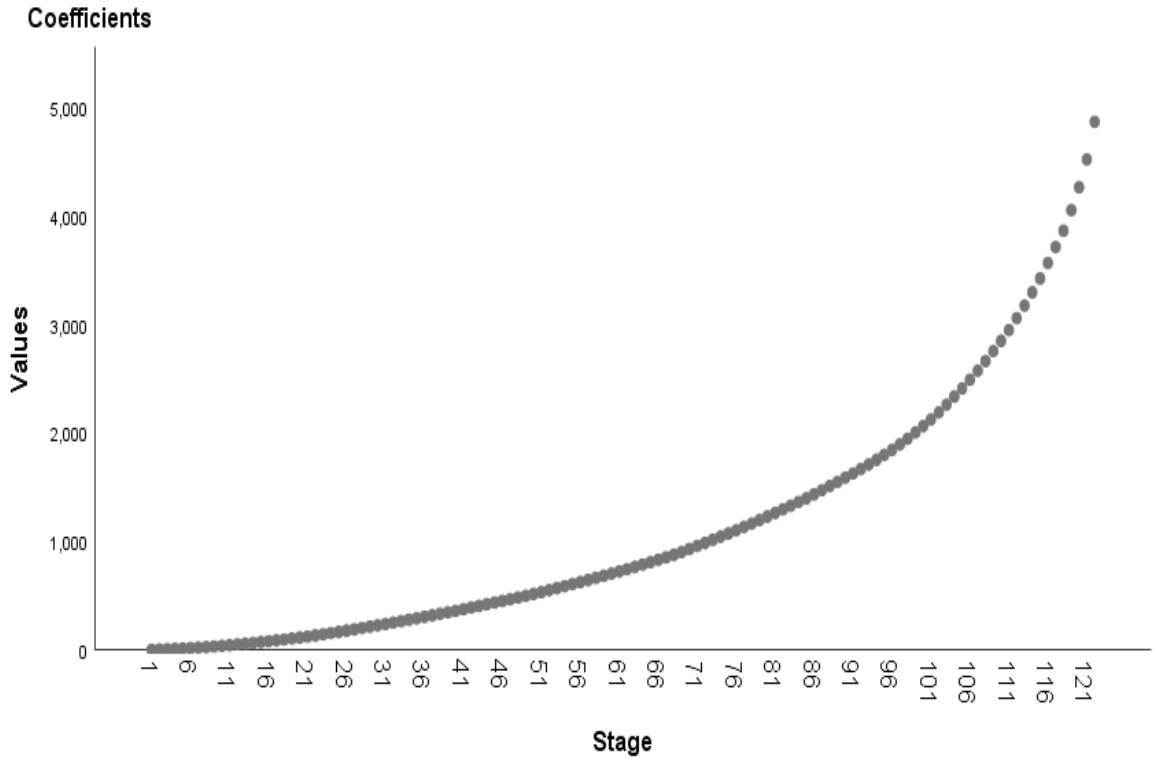

Figure 5.4: Scree plot showing a two cluster solution

NB: the point of the elbow is at case 121-implying a two cluster solution (i.e. 123-121=2)

Table 5.4: Cluster membership and associated food handling practice

Clusters	food stalls	Locations				Food handling practices						Ranking
								Personal hygiene				
		Thulamela	Mvusuludzo	Venda plaza	Sibasa	*Stall condition	Environmental hygiene	**Hand hygiene	Protective clothing	Hygiene related behaviour	Food storage and utensils management	
1	107(86%)	26(24.30%)	29(27.10%)	25(23.36%)	27(25.23%)	0.0084	-0.0202	0.0340	1.9057	0.0069	-0.006	1.95
2	17(14%)	4(23.53%)	3 (17.65%)	6(35.29%)	4(23,53%	-0.0027	0.0895	-0.2087	1.2706	-.0190	0.0517	1.84

*Two variables were removed from stall condition study construct as their standardized coefficient could not be computed owing to the similarity in observations. The two variables were “vending stall protected from dust” and “vending stall protected from wind”.

** Two variables were removed from hand hygiene study construct as their standardized coefficient could not be computed owing to the similarity in observations. The two variables were “food vendor have clean short nails” and “food vendor handle money while serving food”

5.6.2 Cluster performance: general overview

The results reveal that cluster 1 performed better in terms of protective clothing $\bar{x}$ = 1.9057), hand hygiene ($\bar{x}$ = 0.0340), stall condition ($\bar{x}$ = 0.0084) and hygiene related behaviour ($\bar{x}$ = 0.0069) study constructs. On the other hand, cluster 1 performed poorly in terms of environmental hygiene ($\bar{x}$ = -0.0202) and food storage management ($\bar{x}$ = -0.0061) study constructs. Cluster 2 performed better in the following study constructs: protective clothing ($\bar{x}$ = 1.2706), environmental hygiene ($\bar{x}$ = 0.0895) and food storage and management ($\bar{x}$ = 0.0517). On the contrary, cluster 2 conformed negatively in the following study constructs: hand hygiene ($\bar{x}$ = -0.2087), hygiene related behaviour ($\bar{x}$ = -0.0190) and stall condition ($\bar{x}$ = -0.0027). Overall, cluster1 performed better ($\bar{x}$ = 1.9473) regarding handling practices than cluster 2 ($\bar{x}$ = 1.8355).

5.6.3. Cluster performance: detailed cluster description

This section looked at the performance of each variable on each of the clusters. Thus, Table 5.5 presents a more detailed description of each cluster.

a) Cluster performance according to stall conditions

The current results reveal that food stalls conditions in cluster 1 were better compared to those in cluster 2. Stalls in cluster 1 had better access to potable water at the site and were protected from the sun. However, in cluster 2 there was evidence of animals and pests around the stalls, adequate waste food disposal, protection from the sun and stalls were maintained in clean condition.

b) Cluster performance according to environmental hygiene

As presented in Table 5.5, environmental hygiene around the food stalls was better in cluster 2 than in cluster 1. In cluster 2 environment around the food stall was far from the waste water, maintained clean, far from the animals and rubbish bins. On other hand cluste1 environment around the food stalls was far from the open drain and the toilet facilities. Generally, stall in cluster 2 performed better than those in cluster 1.

Table 5.5: Results of detailed description of clusters in Thulamela Municipality

Cluster performance: detailed description	Cluster type			
	1		2	
	Mean score	Standard deviation	Mean score	Standard deviation
Stall condition				
Food prepared on site	0.00	0.997	0.03	1.067
Vending stall protected from the sun	0.03	0.892	0.16	0.00
Evidence of animals or pests around the stalls	-0.06	0.974	0.44	1.096
Stall maintained in clean condition	-0.01	1.000	0.11	1.026
Access to portable water at the vending site	0.05	1.074	-0.29	0.000
Adequate hand washing facilities available	0.02	1.080	-0.23	0.915
Adequate waste water disposal facilities available	0.02	1.081	-0.13	0.000
Adequate waste food disposal facilities available	-0.02	0.989	0.17	1.100
Access to community-operated waste water	0.03	1.080	-0.16	0.000
Access to general community-operated waste water disposal sites	0.02	1.081	-0.13	0.000
Environmental hygiene				
Environment around the stall clean	-0.04	0.980	0.29	1.122
Environment around the stall far from rubbish bin	-0.03	0.990	0.10	1.051
Environment around the stall far from toilet facilities	0.01	1.001	-0.14	1.011
Environment around the stall far from the waste water	-0.05	1.072	0.33	0.000
Environment around the stall far from the open drain	0.03	0.989	-0.21	1.088
Environment around the stall far from the animals	-0.04	0.999	0.17	1.010
Hand hygiene				
Vendors wash hands in clean water before handling food	0.05	0.975	-0.37	1.120
Vendor wash hands in clean water after visiting toilet;	0.04	0.998	-0.21	1.011
Food vendor handle food with bare hands	0.04	1.077	-0.24	0.000
Food vendors use disposable or reusable gloves	-0.01	1.081	0.09	0.000
Food vendors have clean short nails	0.13	0.000	-0.80	2.626
Food vendor handle money while serving food	0.05	0.962	-0.35	1.205
Jewellery adequately covered	-0.06	0.945	0.43	1.262
Protective clothing				
food vendors clothes are clean and presentable	0.36	0.978	-0.26	1.308
Food vendor wear an apron when handling food	0.34	0.555	-0.214	0.686
Food vendor wear an apron when preparing food	0.34	0.508	-2.20	0.000
Food vendor wear an apron when serving food	0.36	0.386	-2.25	0.000
Food vendor covers hair when handling food	0.74	0.930	-0.49	1.145
Hygiene related behavior				
Food vendor blow air into polythene bag before use	0.00	1.007	-0.01	1.014
Dirt or dust removed by using dirty cloth or bare hands	0.07	1.067	-0.41	0.000
Vendor smoke during handling of food	0.03	1.080	-0.16	0.000
Food vendor use the same utensil to prepare raw and cooked food products	-0.97	1.1005	0.67	0.665
Food vendor handle food while sick	0.01	1.011	-0.02	0.983
Blowing nose into hands and continuing to work without washing hands	0.03	1.076	0.18	0.000
Food storage and utensils management				
Food stored in sealed transparent containers	0.01	1.034	-0.09	0.818
Raw, partially cooked and cooked food products kept separate	-0.03	1.023	0.14	0.882
Previously cooked foods kept cool ice box or refrigerated	0.02	1.081	-0.09	0.000
Utensils cleaned with warm soapy water	-0.05	0.993	0.28	1.043
Utensils covered properly	0.03	1.039	-0.19	0.741
Utensils cleaned adequately every time after use	-0.03	0.990	0.26	1.077

c) Cluster performance according to hand hygiene

Cluster 1 conformed to hand hygiene practices better than cluster 2 (Table 5.5). Cluster 1 had better performed in the following: “food vendors kept the nails short”, “handling money while serving food”, washing hands in clean water each time when handling food, after visiting toilet” and handling food with bare hands”. However, cluster 2 only performed better in “adequately covering the jewelry” and “using of disposal or reusable gloves”.

d) Cluster performance according to protective clothing

Cluster 1 performed well in all the variables that measured protective clothing study construct (Table 5.5). For instance, vendors wore protective clothing, clothes were clean and presentable, wore aprons when serving, handling and preparing food. On the contrary, food vendors under cluster 2 performed poorly in all the variables that measured protective clothing.

e**) Cluster Performance according to Hygiene Related Behaviour**

Cluster 1 performed better as compared to cluster 2 regarding hygiene-related behaviour (Table 5.5). The results revealed that cluster 1 performed better in “dirt or dust removed by using an apron, dirty cloth or bare hands”, “vendor smoke during the handling and preparation of food”, Blowing nose into hands and continuing to work without washing hands and handle food while sick. However, in cluster 2, food vendor used the same utensil to prepare raw and cooked food products and blew the nose into hands and continuing to work without washing hands.

f) Cluster performance according to food storage and utensils management

The results of this study revealed that cluster 1 performed better in “covering utensils properly” and “keeping the previously cooked food cool” and “storing cooked food in sealed transparent containers”. However, cluster 2 performed better in “cleaning utensils with warm soapy water”, “utensils cleaned adequately every time after use”, “keeping raw, partially and cooked products separately”.

5.7 Major determinants of food handling practice

It was hypothesised that the state of food handling practice in Thulamela Municipality is a

function of six major study constructs including food stall conditions, environmental hygiene, hand hygiene, protective clothing, hygiene-related behaviour, food storage and utensils management. Such cause-effect relationship was quantified statistically using Ordinary Least Squares (OLS) regression analysis to identify the variables, which are critical in defining the state of food handling practice dynamics in Thulamela Municipality and their relationship with other variables. Such a relationship is conceptualised diagrammatically as shown in Figure 5.5. ANOVA test results revealed that R square value was 63 % meaning that the model had a good model fit in which 63 % of the variations in food handling practice were explained by the study explanatory variables including food stall conditions, environmental hygiene, hand hygiene, protective clothing, hygiene-related behaviour, food storage and utensils management system (Appendix H). The F change statistics indicated a good model fit ($P < 0.05$) (Appendix I) Therefore, the model was fitting well and results were significant at $P < 0.05$.

The results of the regression coefficients revealed that the most significant variables defining the state of food handling practices in the two-cluster solutions were protective clothing ($P < 0.05$) and stall condition ($P < 0.05$) (Appendix I). The beta coefficient ($B= -1.023$) means that an improvement in protective clothing will significantly results in better food handling practices. This is because a two Likert-scale were 1= yes and 2 = no was used to capture data on protective clothing. The positive beta coefficient on stall condition ($B= 0.304$) means that an improvement in stalls condition will significantly result in better food handling practices. There was however, no significant association between the state of food handling practices and other critical variables normally reported in literature such as hygiene-related behaviour, food storage and utensils management, hand hygiene and environmental hygiene.

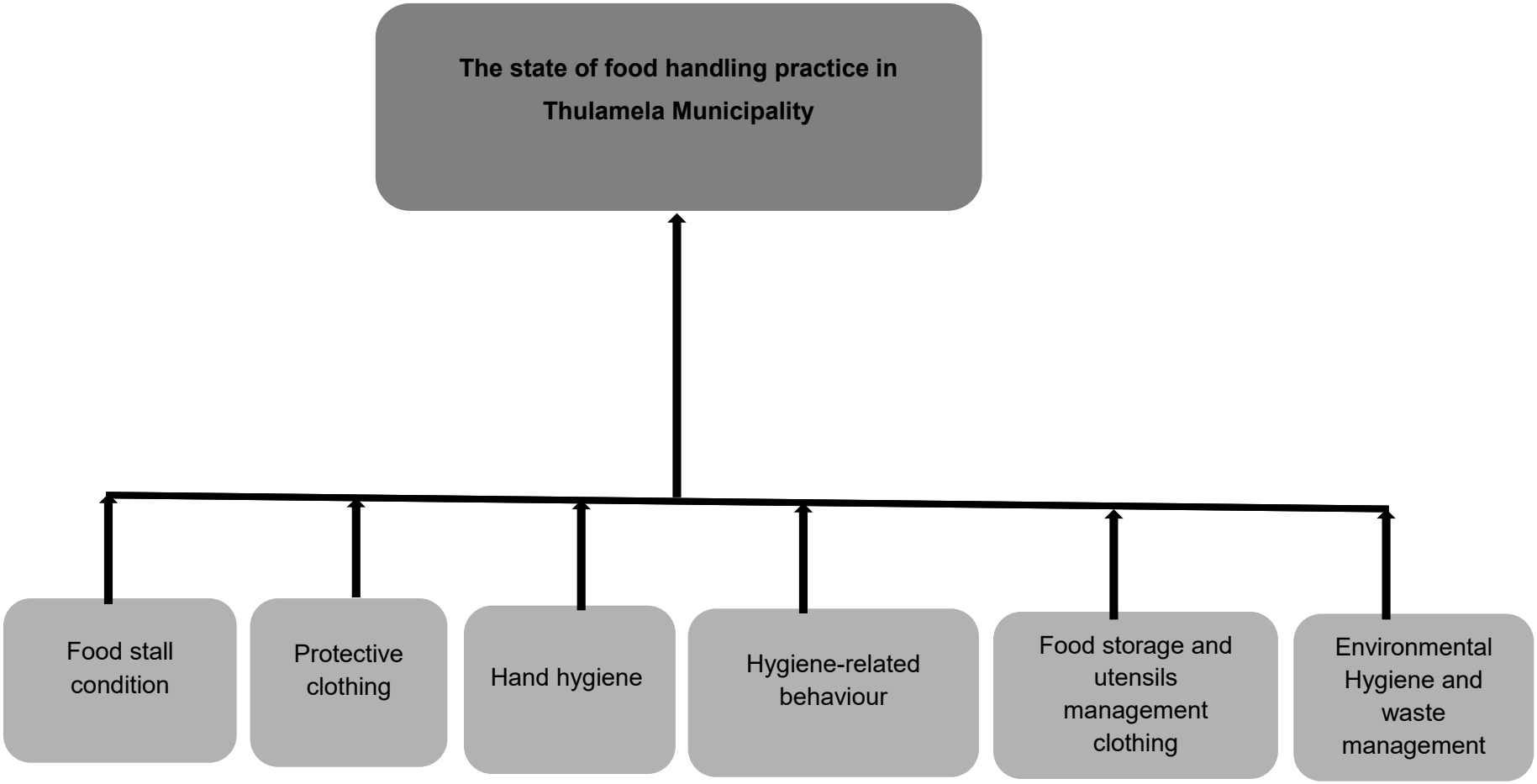

Figure 5.5: Conceptual diagram depicting determinants of state of food handling practice in Thulamela Municipality

5.8 Discussion

Hygienic aspects of small-scale food vending are of major concern. Most street food vendors and/or handlers in Africa or the developing world at large are ignorant of basic food safety issues (Lubos, 2014). Consequently, small-scale vended foods are commonly exposed to dangerous abuses often at all stages of handling. In most cases, vending stalls are often crude structures with inadequate infrastructure such as water and sanitation. The study in Kaduna State Nigeria, reported that small-scale food vendors operated under a shade (Umar *et al*., 2018). WHO (2013) alludes that street-vended foods are prepared in different places which can be broadly grouped as follows: food prepared in small-scale food factories, or traditional workshops, food prepared at home, food prepared in markets and food prepared on the street. These categories reflect a growing difficulty to provide adequate infrastructure and environmental hygiene to ensure the safe production of food (FAO, 2001; WHO, 2013).

In the current study food stalls observed were made of temporary structures. This was in line with Thulamela Municipality requirements of conditions of service stipulated on the street vendors' working permit which stated that "no erection of non-removable structure, structure must be removed completely after work". A similar trend was observed in Nigeria, Hait and Philippines (Chukuezi, 2010; Samapundo *et al.*, 2015; Alamo-Tonelada *et al*., 2018). This is not surprising because street vendors' businesses are in most cases situated on the street sides, at taxi or bus ranks, and along pavements. The majority of the food vendors in the present study prepared foods at the vending sites. A similar practice was observed in Bangladesh and Vietnam (Khairuzzaman *et al*., 2014; Thanh, 2015).

The Hierarchical cluster analysis divided food vending stalls into two clusters. Cluster 1 comprised 86 % of the total food stalls observed while cluster 2 constituted only 14 % of them. Generally, food stalls in cluster 1 were in better condition than those in cluster 2. The results revealed that food stalls in cluster 1 were better protected from the sun. However, in both clusters stalls were not protected from the wind and dust due to the nature of construction materials used. The dust has the potential of carrying pathogens and may therefore, become a vector for the transmission to prepared foods. This is somehow disconcerting given that FAO and WHO (Monney *et al*., 2013) recommend that food should be adequately protected from airborne contaminants in such a way as not to pose a threat to food safety. Muinde & Kuria (2005) view that food vending stalls should be constructed using material that is easily cleaned and maintained. Thus, the local government should design appropriate food vending stalls that would protect the food vending stalls from sun, wind and dust.

Food vendors in cluster 1 had better access to potable water close to the vending site. This finding agrees with the results of Muinde (2005) in Kenya; Muyanja (2011) in Uganda and Cortese *et al.* (2017) in Brazil. However, in cluster 2 there was limited access of water. This confirms WHO (1996) claim that street food vendors in various parts of the world are known to wash utensils, including those in which food has been served, in water which has been used previously. Shortage of water is one of the most critical challenges in street food vending which needs the attention of those responsible. Proietti *et al*. (2014) and Cortese *et al.* (2017) posit that food safety can only be attainable if water is available in sufficient quantities for washing hands, utensils and equipment and for proper food preparation procedures. World Bank (1995) alludes that safe water is an essential pillar for health. Without enough water, hygiene and sanitary practices cannot be exercised correctly. Therefore, the vendors need to have sufficient potable water for drinking, preparation of all kinds of foods and washing operations.

Results of the current study revealed that food vending stalls in the study area were poorly maintained. Most of them belonged to cluster 2. Similar practices were observed in Brazil, Vietnam and Ghana (Nunes *et al*, 2010; Thanh, 2015; Amaami *et al*, 2017). The fact that food stalls in the above studies were not maintained in clean condition raises a serious public concern. These findings are however, contradicting those of a study conducted in Nigeria where 60 % of the stalls observed were tidy (Donkor *et al.*, 2009). This practice is in line with the FAO (2011) report which recommends that food should be prepared in a place set aside exclusively for that purpose and the place of food preparation should be kept clean at all times for the safety of the customers who patronise street vended food. This would require the commitment of food handlers with appropriate knowledge on food safety especially on issues related to food, environment and personal hygiene.

In this study personal hygiene was measured in terms of protective clothing and hand hygiene practices. Marriot (1995) alludes that personal hygiene is important because human beings are the largest contamination source of food. Small-scale food vendors in this study were observed to predominately have good levels of personal hygiene. However, food vendors in cluster 1 outperformed those in cluster 2 in terms of wearing protective clothing. For instance, food vendors in cluster 1 wore aprons when handling, preparing and serving food. Their clothes were kept clean and presentable while their hair was covered during food handling.

The assertions shared above should indicate the willingness of the food vendors to provide service in a hygienically manner. The practice of wearing clean clothes, aprons and head covers during food handling is vendors' responsibility as recommended by World Health

Organisations (WHO, 1996). However, Thanh (2015) argues that wearing of clean aprons and hair covering has more to do with food aesthetics and consumer assurance than safer food. Thus, the local authorities working closely with small-scale food vendors should make sure that poor hygiene practices are eliminated though it is not an easy task.

Food vendors and food handlers play an important role in ensuring food safety throughout the food production chain (Adebukola *et al*. 2015; Andy *et al.*, 2015; Thanh, 2015). In particular, food vendors who have poor handling practices or disregard hygienic practices may increase the risk of pathogens coming into contact with foods. In this study, a considerable number of food vendors disregarded hand hygiene as a measure of safety for small-scale vended food. However, respondents in cluster 1 performed much better regarding hand hygiene practices than those who belonged to cluster 2. Results revealed that food vendors in cluster 1 were performing better on hand washing after visiting toilet, before handling food and had kept their nails short and clean. This agrees with the findings of Singh *et al*. (2018) in India and Mnyone *et al*. (2018) in Tanzania. WHO (1996) also recommends that food handlers should wash their hands with soap and water before and after engaging in any activities that are likely to introduce biological, chemical or physical hazards. However, respondents in cluster 1 conformed negatively to the use of disposable or reusable gloves while handling food. Moreover, those in cluster 2 were performing poorly on hand hygiene.

Handling food with bare hands was common in the current study. Muinde & Kuria (2005) view that cooked foods should not be handled with bare hands but with clean tongs, spoons and disposable gloves. Handling food with bare hands may result in cross contamination and, therefore, the introduction of microbes in food. The fact that food vendors in the current study disregarded washing hand after handling money is worrying. The practice is commonly reported in other countries such as Kenya, Brazil, Haiti and Tanzania whereby street vendors, tend to omit or bypass the washing of hands after touching money (Muinde & Kuria, 2005; Da Sliva *et al*., 2014; Samapundo *et al*., 2015; Mnyone *et al*., 2018). Several reasoning of these practice could include the fact that each vendor carries multiple tasks with in a limited time, i.e. food preparation, serving meals as well as collecting payments from customers. Literature has found money to be one of the vehicles to transfer microorganisms, since it passes through the hands of many people and may therefore, lead to food contamination (Chaulliac & Gerbouin-Renolle, 1996). Thus, the failure to wash hands during food handling may contribute to the unfortunate occurrence of food-borne illness.

In the present study, food vendors belonged to cluster 1 had better performance regarding hygienic-related behaviour. However, in this study it was observed that food vendors removed dust using either bare hands or apron. This is a major public concern because it was mentioned earlier that respondents in the present study, disregarded good hand hygiene practices. Also, food vendors were observed using the same utensils during food preparation. For example, same knife and cutting board were used for cutting raw vegetables and meat. This practice could be due to limited knowledge of good food hygiene practices or lack of resources. FAO (2002) advised that animals may carry human pathogens without any clinical manifestations, similarly fresh vegetables can harbour pathogens or mycotoxins without any discernible loss of quality. Based on the latter, the observed practice may lead to cross contamination of the microorganisms from one food to another thus, placing customers' health in danger. Thus, local government in Thulamela Municipality should provide basic training on environmental, environmental hygiene included to improve the safety of small-scale vended food.

Environmental hygiene was measured in terms of the cleanliness of environment around the stall, environment around the stall far from the rubbish bin, waste water, toilet facilities, open drain and animals. Cluster 1 performed poorly regarding environmental hygiene practices as compared to cluster 2. Although it performed better regarding the toilet facilities being far away from the vending environment and food stalls far from the open drains, other variables that defined environmental hygiene attracted negative mean score values. This was an indication of poor performance regarding those variables. Such variables included the environment around the stalls that was poorly maintained. Added to this was inadequate waste disposal facilities. Method of waste disposal was deplorable because food vendors used streets, major roads and drainages as their waste disposal points. Other studies conducted in Mauritius (Subratty *et al.,* 2004), Vietnam (Thanh, 2015) and Ghana (Amaami, 2017) also observed the similar situation. These authors reported that food vendors did not have garbage receptacles, hence they disposed of their garbage and waste water just near the stalls and along the road side. In a separate study carried out in Nairobi, proper garbage collection and disposal were lacking and food vendors had to put garbage in their own place (Muinde & Kuria, 2005).

The poor hygiene practices revealed in this study should be discouraged because such behaviour may attract animals and pests with disease-causing microbes which can be transferred and contaminate food (Heyman *et al*., 2017). Inadequate refuse disposal facilities lead to the accumulation of refuse at food vending sites. This may lead to an increased pest population and the risk of food contamination. In most instances, vending sites are not

included within the town plans, and therefore amenities such as refuse collection are not available. This calls for increased attention by the food vendors since mostly contamination of food could be prevented by keeping the stalls and location clean. Besides, adequate drainage waste disposal system should be provided in the small-scale food vending industry because in street food vending, food and cooking utensils are displayed openly due to absence of proper storage facilities. These should be designed properly such that the risk of food contamination is reduced.

Although food vendors in both clusters performed better regarding food storage and utensils management, majority of them were observed washing utensils with cold dirty soapy water which may result in unsatisfactory cleaning. The severity of contamination seemed to multiply when same water was used multiple times (Ahmed, 2017). Such a practice provides an excellent environment for cross-contamination (Munyanja *et al*., 2011). Further, washed utensils were stored openly on table tops, plastic bags especially disposable plates and in card boxes, leading to recontamination of the plates. The considerable proportion of food vendors did not cover their utensils. A similar practice was observed in Pakistan and Vietnam where over 61 % of the food vendors did not cover their utensils as well as foodstuffs (Samapundo *et al*., 2015). This practice optimize opportunities for dust to settle and for flies to make the place their home. If such an environment is not well attended to, this creates the vulnerability and increases risk for contamination. The situation becomes even more critical if there is limited hygiene practices taken to counteract the effects and opportunities.

Proper storage facilities and careful management of leftover foods play a significant role in the safety of small-scale vended foods. The fact that food vendors in the current study had limited proper storage facilities is worrying. A similar situation was observed in previous studies conducted in Pakistan, Bangladesh and Indonesia where food vendors had no storage facilities (Vollaard *et al*., 2004; Rahman *et al*., 2014; Ahmed *et al.,* 2017). This practice could lead to food contamination as a result of dust and microorganisms. FAO (1995) and Muinde & Kuria (2005) point out that utensils in which food is displayed for sale, must always be clean, covered and protected as they may easily be contaminated if left unprotected. Thus, foodstuffs of all kinds should be kept covered as much as possible to prevent contamination from flies and dust.

Food vendors also lamented about lack of refrigerators to keep their food such as salads, drinks and leftovers. Lack of refrigeration in vending stalls contradicted the one of the recommendations made by WHO (2019) regarding street-vended food. The author requires

that “prepared food which are to be served cold and which may support the growth of pathogens should be stored in a refrigerator or ice of appropriate quality at less than 10^0 C”. Poor storage conditions depicted above compelled food vendors to prepare and sell food in one day to avoid spoilage. However, the results of these studies are at variance with the results of the study conducted in Vietnam where almost three quarters of the food vendors kept previously cooked foods in refrigerators for vending in the following day (Thanh, 2015). With proper cooking, most microbial hazards may be eliminated making food to be safe for human consumption.

5.9 Conclusion

The current study highlighted the major themes that defined the state of handling practices in Thulamela Municipality. These included stalls condition, personal hygiene, environmental and waste management, hygiene-related behaviour, food storage and utensils management. Personal hygiene especially wearing of protective clothing was scored high by the majority of respondents. This was followed by utensils management. Condition of the stalls received the least score. The two main clusters determined were unique and independent to each other. Cluster 1 performed better than cluster 2 regarding handling practice. Out of the six identified themes, protective clothing and stalls condition were the most significant variables that defined the state of handling practice. This means that an improvement in protective clothing and stalls condition will significantly result in a better food handling practices. There was however, no significant association between the state of food handling practices and other critical variables normally reported in literature such as hygiene-related behaviour, food storage and utensils management, hand hygiene and environmental hygiene. It is therefore recommended that small-scale food vendors must be provided with basic training to ensure that they adhere to the required rules for proper personal hygiene and sanitation. Also, Thulamela Local Municipality must establish street food vending centres that have adequate facilities and utility services. Such shelters should be provided with essential public utilities such as potable water, garbage collection, electricity and portable toilets. Lastly, environmental health practitioners should exercise strict surveillance over food vendors and monitor the conditions under which food is prepared and sold regularly to prevent the risk of foodborne disease outbreak

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CHAPTER 6: MICROBIOLOGICAL QUALITY OF STREET-VENDED FOODS SOLD IN THULAMELA MUNICIPALITY OF SOUTH AFRICA

6.1 Abstract

The objective of the study was to examine the microbial quality of street-vended foods in Sibasa and Thohoyandou markets of South Africa. Gravy, salad, beef and chicken stews were randomly sampled from seven markets. Standard microbiological methods were used for the total plate counts (TPC), coliform bacteria, *Salmonella* species, *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus*, yeast and mould counts. The microbial counts (log_{10} cfu/g) of foods sold at both locations ranged from 2.0 ± 2.08 to numerous to count (TNTC) for TPC, 2.0 ± 1.00 to 6.6 ± 7.57 for *Salmonella spp*, 2.0 ± 2.64 to 3.9 ± 6.03 for *S. aureus*, 2.1 ± 1.73 to TNTC for yeast. At Sibasa, microbial counts (log_{10} cfu/g) ranged from 2.0 ± 0.00 to 3.8 ± 10.00 for coliform bacteria and 2.0 ± 1.15 to 4.9 ± 21.66 for *B. aureus*. Coliform bacteria and *B. cereus* were not found in foods sold at Thohoyandou markets while mould was not detected in foods collected at both locations. Total plate count differed significantly ($P < 0.05$) between salads and chicken stews. *Salmonella spp,* significantly differed ($P < 0.05$) between salads and beef stews. For *S. aureus*, a significant difference was found in salads ($P < 0.05$). For yeast, significant differences ($P < 0.05$) were observed between salads and beef stews. The isolation of various and varies microorganisms in street-vended foods may constitute potential health hazard to customers. Thus, there is a need for routine monitoring of street-vended food by health agencies.

Key words: Contaminants, food safety, informal markets, ready-to-eat foods

6.2 Introduction

The contribution of the small-scale food sector to socio-economic growth is considerable. Therefore, the requirement of safety in this sector must be emphasized especially in developing countries (Metiboba & Kakwagh, 2014). Otherwise, small-scale vended food consumption by a large population may increase the burden for public health. Many studies on the microbiological quality of small-scale foods in Brazil (Da Silver *et al*., 2014); Vietnam (Thanh, 2015); Nigeria (Akusu *et al*., 2016) identify high levels of Coliforms and the presence of various pathogens such as *Escherichia coli, Salmonella* spp., *Staphylococcus aureus, Bacillus cereus, Clostridium perfringens* and *Vibrio cholerae*. Moreover, small-scale vended

foods have been reported to be an appropriate medium for the transmission of antimicrobial-resistant pathogenic bacteria including *Salmonella* spp*, E. coli*, and *S. aureus* to people.

The safety of small-scale vended foods is a major concern worldwide (Kubde *et al*., 2016). Abakari *et al*. (2019) view that small-scale vending business remains a serious issue and a challenge of health concern to experts and international bodies due to the unhygienic ways in which these foods are handled. Apparently, the outbreak of foodborne illnesses does not impact negatively only on people's health but also on the economic activities and output leading to economic loss which adversely affect countries nationwide (Thurston, 2006; Amoah, 2014). In Africa with reference to Ghana, $69 million USD is spent yearly to deal with the outbreak of foodborne diseases (Abakari *et al*., 2019). The authors further indicated that United State also spends $152 billion dollars on this same problem yearly.

Mazizi *et al.* (2017) indicate that SV foods are appreciated because they are readily available, unique flavours, inexpensive and generate income for those involved. Low salaries and limited social programmes to cushion poor and vulnerable families force some people to resort to SV foods for their livelihoods (Mafune *et al*., 2016). Moreover, as they sell SV foods the vendors provide vital services to workers, travelers and people whose incomes are low. Customers of SV foods mainly consider convenience or ease of access rather than quality, safety and hygiene aspects (Bakobie *et al*., 2017). In South Africa, there are different types of small-scale vended foods which are commonly sold by small-scale vendors. These include pap, beef, chicken, salad, gravy, fat cakes, fish, potato chips among others. Like in other developing countries, those foods have become popular for both the urban and rural lifestyle.

Throughout the world, public health experts and international bodies are concerned about the safety of SV foods, mainly due to the commonly observed unhygienic handling practices (Kubde *et al.,* 2016). It is acknowledged that outbreaks of foodborne illnesses have a negative impact on people's health and adverse economic performance (Amoah, 2014). For example, Ghana and the United States of America spend $69 million and $152 billion per year respectively, to run programmes designed to combat outbreaks of foodborne diseases (Abakari *et al*., 2019). Food safety is crucial in achieving better human nutrition through healthy nutritious diets. Improving food safety is thus a key in achieving Sustainable Development Goals. Governments should make food safety a public health priority, as they play a pivotal role in developing policies and regulatory frameworks. Thus, strengthening SV food policies and proper enforcement would undoubtedly ensure significant reduction in the hazards of street food consumption.

Contamination of SV foods is mainly attributed to negligence and inadequate or non-enforcement of legislations governing safety and vending establishments. Thus, the sale of food in small-scale markets raises health concerns. Microbial contamination is the main health hazard associated with the foods. High microbial counts of *Salmonella spp., Bacillus cereus* and *Staphylococcus aureus* are often detected in SV foods (Abakari, 2019). Contaminated foods expose customers to risks of foodborne illnesses such as diarrhoea, *Salmonellosis*, listeriosis and cholera (Liu *et al*., 2014). Thus, good safety and hygiene practices are crucial in preventing the foodborne diseases as contamination can occur at any stage from purchasing to consuming of food.

Outbreaks of bacterial foodborne diseases can be controlled if food health experts carry out frequent inspection. Incorporation of safety as a supporting component that influences food security and consumer nutrition may result in healthy livelihoods for customers (Mazizi *et al*., 2017). It is important to note that implementing food safety principles is most feasible if the public is educated about the risks of not adhering to laid down protocols (Bereda *et al.*, 2016). Although consumption of SV foods is widespread in South Africa, not much research has been conducted to unravel the microbial status of gravy, salad, chicken and beef stew, which are commonly sold. Yet knowledge of microbial quality of the foods may help formulate appropriate safety enhancement interventions. Thus, the purpose of the current study was to examine the microbial quality of commonly consumed foods sold in small-scale food vending markets within Thulamela Municipality of South Africa.

6.3 MATERIAL AND METHODS

6.3.1 Study area and sampling procedure

The study was conducted in Sibasa and Thohoyandou, which are both located in Thulamela Local Municipality in Limpopo Province of South Africa. Twenty-eight (28) ready-to-eat food samples were collected from three markets in Sibasa and four, Thohoyandou. Gravy, salad, and beef and chicken stews were collected from August to November 2018 between 12:00 pm to 2:00 pm using random sampling procedure. Serving utensils obtained from the vendors were used to place food samples into sterilized containers. Samples were placed into a Rotomolded cooler box with ice packs and transported to the food microbiology laboratory of the University of Venda's Department of Food Science and Technology. The food samples were stored in the refrigerator at 4°C. Microbial analyses were conducted within 2 hours after

collection (Mafune *et al*., 2016; Abakari *et al*., 2019).

6.3.2 Sample preparation

Table 6.1 presents the six reference strains of commonly encountered bacterial strains used in thus study. The reference strains were purchased from Analytical Technology (Anatech), Olivedale, Gauteng.

a) Total plate count

Plate count agar (PCA) and BPW were prepared. Approximately, 15 ml of PCA was pour plated into petri dishes and mixed with 1 ml of each dilution. After setting, plates were incubated at 37°C for 72 hours. A colony counter was used for estimating the number of colonies and expressed in colony-forming unit (log_{10} cfu/g) in line with the ISO method 4833 (ISO, 2003).

b) Estimation of coliform bacteria and *Escherichia coli*

Chromocult coliform agar and BPW were prepared. Approximately, 15 ml of Chromocult was pour plated into petri dishes and mixed 1 ml of each dilution. The plates were inverted when set and incubated at 37°C for 24 hours, following instructions stipulated in ISO method 4832 (ISO, 1991). Colonies were counted, taking into account that pink and blue colonies represented coliforms and *E. coli*, respectively. The results were expressed as log_{10} cfu/g.

c) Estimation of *Salmonella spp*

Xylose lysine deoxycholate agar (XLD) and BPW were prepared and used as a diluent. Approximately, 15 ml of XLD agar was poured into petri dishes and mixed 1 ml of each dilution. The prepared dishes were incubated at 37°C for 24 hours. After the incubation period, plates were colony counted following instructions on ISO method 6579 (ISO, 2002). The results were expressed as log_{10} cfu/g.

d) Estimation of *Staphylococcus aureus*

In each diluted food sample, the streak method was used on plates of Baird Parker agar left to solidify overnight as indicated in the ISO method 4833 (ISO, 2003).

Table 6 1: Selected reference strains

Bacterial Reference Strains	Designation	Media
Escherichia coli ATCC 25922	SABS	Rapid *E. coli* medium
Staphylococcus aureus ATCC 25923	Anatech	Baird parker
Candia albicans ATCC 10231	Anatech	Potato Dextrose agar
Bacillus subtilis ATCC 6633	Anatech	*Bacillus cereus* selective agar
Salmonella enterica. Subsp entric ATCC 14028	Anatech	Brilliant *Salmonella* selective agar
Bacillus cereus ATCC 10876	Anatech	*Bacillus cereus* selective agar

SABS = South African Bureau of Standards, ATCC= American type culture collection

About 0.5 ml of each food sample was transferred in triplicates into petri dishes using a sterile pipette. Plates were incubated at 37°C for 48 hours. The colonies were counted and results expressed as $\log_{10}$ cfu/g.

e) Estimation of *Bacillus cereus*

Bacillus cereus (BC) agar and BPW were prepared and used as a diluent. About 15 ml of BC agar were pour plated into petri dishes and mixed 1 ml of each dilution as stated in ISO method 7932 (ISO, 2004). The plates were inverted when set and incubated at 37°C for 48 hours. The colonies were counted and results expressed as $\log_{10}$ cfu/g.

f) Estimation of yeast and mould

Potato dextrose agar (PDA) and BPW were prepared following the Merck manufacturer's instruction. Each dilution (1 ml) was transferred into petri dishes in triplicates. An estimated 15 ml of PDA was poured into petri dishes and mixed 1 ml of each dilution. Plates were inverted when set. They were incubated at 25°C for 5 days. Colonies were counted. The results were expressed as $\log_{10}$ cfu/g in line with the ISO method 7954 (ISO, 1987).

6.3.3. Data analysis

Data obtained from the experiments were first tested for normality before the ANOVA and T-test were performed. The results revealed that data were normally distributed. Thereafter, the data were subjected to the analysis of variance (ANOVA) using the IBM Statistical Package for Social Sciences (SPSS) version 25.0. The significance test level was set at ($P < 0.05$). Duncan's multiple range test (DMRT) was used to separate means of microbial load (Tallarida & Murray 1987). This test was deemed appropriate because of its ability to measure specific differences between pairs of means. Also, DMRT was preferred because of its usefulness when larger pairs of means are being compared. Just as was the case with ANOVA, significance was set at $P < 0.05$. The t-test was used to compare the means obtained from the two locations, namely Sibasa and Thohoyandou vending sites. T-test is a type of inferential statistics (Kim, 2015). It was employed in this study because of its ability to determine if there is a significant difference between the means of two groups, which may be related in certain features. All the microbiological analyses were carried out in triplicate and the results were expressed as $\log_{10}$ cfu/g.

6.4 Results

6.4.1 Total plate count

Tables 6.2 and 6.3 show the results of the mean microbial counts (log_{10} cfu/g) of the cooked ready-to-eat SV foods sold at Thohoyandou and Sibasa markets. Mean microbial counts (log_{10} cfu/g) of samples sold at Thohoyandou ranged from 2.0 ± 2.08 to too numerous to count for TPC. A significant difference ($P < 0.05$) was found in gravy sold at Thohoyandou market 4 while the lowest was found in gravy sold at market 2. No statistically significant differences in TPC was observed in the gravy sampled at markets 1 and 3 (2.6335 ± 10.53 log_{10} cfu/g). At Sibasa markets, the mean count of TPC ranged from 2.1 ± 6.24 cfu/g to 6.9 ± 5.30 cfu/g. The significant difference was observed in chicken stew sold at market 1 compared to markets 2 and 3.

6.4.2 Coliform bacteria

Coliform bacteria were not found in all the food samples sold in the Thohoyandou markets (Table 6.2). Nor were they observed in gravy sampled at Sibasa market 1 (Table 6.3). However, gravy collected at Sibasa markets 2 (3.8451 ± 10.00 log_{10} cfu/g) and 3 (2.3010 ± 1.73 log_{10} cfu/g) were contaminated with coliform bacteria. The latter results were significantly different ($P < 0.05$) from each other. High mean coliform bacteria concentrations were found in salad prepared at market 2 (2.2304 ± 2.08 log_{10} cfu/g) with the lowest being at market 1 (2.000 ± 6.24 log_{10} cfu/g). High mean coliform counts (3.45 ± 11.37 log_{10} cfu/g) were also observed in chicken stew sold at market 2 ($P < 0.05$) than from the other markets. The lowest coliform count was detected at market 3 (2.00 ± 0.00 log_{10} cfu/g). Coliform bacteria were not found in all beef stews sold at Sibasa markets.

6.4.3 Escherichia coli

Escherichia coli was not detected in all food samples sold at Sibasa markets including gravy samples prepared at Thohoyandou markets 1 and 2. Mean microbial counts (log_{10} cfu/g) of samples sold at Thohoyandou ranged from 2.6 ± 5.20 to 7.0 ± 8.08 for *E. coli*. The highest *E. coli* count was detected in salad sold at market 4 and was significantly different ($P < 0.05$) compared to markets 1, 2 and 3. The lowest *E. coli* count was found in gravy purchased at market 3.

Table 6.2: Microbial analysis (log_{10} cfu/g) of street-vended foods (n = 4) sampled in different markets at Thohoyandou

Location	Gravy	Salad	Chicken	Beef
		Total plate count		
Thohoyandou market 1	$2.6^{a} \pm 10.53$	$7.3^{a} \pm 11.85$	$6.6^{b} \pm 4.51$	$5.9^{c} \pm 5.77$
Thohoyandou market 2	$2.0^{b} \pm 2.08$	$3.9^{c} \pm 11.59$	$3.7^{c} \pm 5.86$	$2.9^{d} \pm 5.00$
Thohoyandou market 3	$2.6^{a} \pm 10.53$	$2.4^{d} \pm 5.69$	$2.2^{d} \pm 6.08$	$6.7^{b} \pm 9.45$
Thohoyandou market 4	TNTC	$6.8^{b} \pm 2.52$	$6.8^{a} \pm 9.07$	$6.9^{a} \pm 11.01$
		Escherichia coli		
Thohoyandou market 1	ND	$4.9^{b} \pm 3.51$	ND	ND
Thohoyandou market 2	ND	ND	ND	ND
Thohoyandou market 3	$2.6^{b} \pm 5.20$	ND	ND	$3.7^{b} \pm 3.78$
Thohoyandou market 4	$6.8^{a} \pm 15.31$	$7.0^{a} \pm 8.08$	6.5 ± 4.04	$6.8^{a} \pm 6.11$
		Salmonella spp.		
Thohoyandou market 1	ND	$4.6^{b} \pm 3.00$	$5.81^{a} \pm 11.15$	$2.7^{b} \pm 2.64$
Thohoyandou market 2	ND	ND	ND	ND
Thohoyandou market 3	ND	$2.5^{c} \pm 3.51$	$2.0^{c} \pm 1.00$	$2.5^{c} \pm 6.56$
Thohoyandou market 4	ND	$5.9^{a} \pm 2.52$	$4.9^{b} \pm 1.73$	$6.6^{a} \pm 7.37$
		Yeast		
Thohoyandou market 1	$3.8^{b} \pm 7.02$	$3.7^{a} \pm 16.52$	$3.8^{a} \pm 5.51$	$4.7^{a} \pm 14.52$
Thohoyandou market 2	$2.4^{d} \pm 3.21$	$2.3^{b} \pm 2.00$	$3.8^{a} \pm 7.50$	$2.7^{c} \pm 4.04$
Thohoyandou market 3	$2.7^{c} \pm 9.02$	$2.3^{b} \pm 1.73$	$3.6^{b} \pm 4.00$	$2.9^{b} \pm 4.51$
Thohoyandou market 4	$5.8^{a} \pm 4.58$	$3.7^{a} \pm 7.64$	TNTC	$2.9^{b} \pm 3.60$

Values are mean ± standard deviation, n = 3. Values followed by the same letters in the same column are not significantly different (P > 0.05), cfu* = colony forming unit, ND* = not detected, Coliform bacteria, *B. cereus* and mould were not detected in all samples.

Table 6.3: Microbial analysis (log_{10} cfu/g) of street-vended foods (n =4) sampled in different markets at Sibasa

Location	Gravy	Salad	Chicken	Beef
		Total plate count		
Sibasa market 1	4.9^{a} ± 10.02	2.1^{b} ± 6.24	6.9^{a} ± 5.30	2.7^{c} ± 6.66
Sibasa market 2	4.8^{b} ± 9.02	2.2^{b} ± 1.73	3.9^{c} ±11.00	4.9^{a} ± 11.50
Sibasa market 3	4.8^{b} ± 8.02	5.6^{a} ± 3.78	5.7^{b} ± 13.58	3.6^{b} ± 10.82
		Coliform bacteria		
Sibasa market 1	ND	2.0^{c} ± 6.24	ND	ND
Sibasa market 2	3.8^{a} ± 10.00	2.2^{b} ± 2.08	3.5^{a} ± 11.37	ND
Sibasa market 3	2.3^{b} ±1.73	2.1^{b} ± 1.53	2.0^{b} ± 0.00	ND
		Salmonella spp.		
Sibasa market 1	2.1^{b} ± 0.58	ND	2.6^{b} ± 2.31	2.0^{b} ± 2.64
Sibasa market 2	3.7^{a} ± 7.00	2.3^{b} ± 2.00	4.7^{a} ±8.33	2.5^{a} ± 2.00
Sibasa market 3	2.1^{b}± 0.58	2.8^{a} ± 0.58	2.4^{c} ±0.58	2.5^{a} ± 1.73
		Yeast		
Sibasa market 1	2.6^{b} ± 0.58	ND	ND	ND
Sibasa market 2	3.7^{a} ± 39.58	2.4^{b} ± 2.08	ND	2.1 ± 1.00
Sibasa market 3	ND	2.7^{a} ± 2.00	ND	ND
		Bacillus aureus		
Sibasa market 1	ND	2.3^{b} ± 0.58	2.0^{c} ± 1.15	ND
Sibasa market 2	3.9^{a} ± 12.50	ND	3.8^{a} ± 5.77	4.9 ± 21.66
Sibasa market 3	2.2^{b} ± 0.58	2.6^{a} ± 14. 22	2.4^{b} ± 6.66	ND

Values are mean ± standard deviation, n = 3. Values followed by the same letters in the same column are not significantly different (P > 0.05), cfu* = colony forming unit, ND* = not detected. *Escherichia coli* and mould were not detected in all samples

6.4.4 Salmonella spp

The mean microbial counts (log_{10} cfu/g) in food samples sold at Thohoyandou markets varied from 2.0 ± 1.00 to 6.6 ± 7.37 for *Salmonella spp*. The highest mean count (log_{10} cfu/g) was observed in beef stew (6.6 ± 7.37) sold followed by salad (5.9 ± 2.52) sold at market 4 ,respectively. At Sibasa markets the mean microbial counts (log_{10} cfu/g) for *Salmonella spp* ranged from 2.0 ± 2.64 to 4.7 ± 8.33. The highest mean count was found in chicken stew sold at market 2, which was significantly different from all other markets ($P < 0.05$). No statistically significant differences ($P > 0.05$) were observed in gravy purchased at markets 1 and 3 (2.1 ± 0.58 cfu/g) and in beef stews sold at market 2 (2.4 ± 2.00) and market 3 (2.4 ± 1.73).

6.4.5 *Staphylococcus aureus*

Fig 6.1 and Fig 6.2 show the results of the mean microbial counts (log_{10} cfu/g) for *S. aureus* found in the cooked ready-to-eat SSV foods sold at Thohoyandou and Sibasa markets. The mean microbial (log_{10} cfu/g) counts varied from 2.0 ± 0.00 to 3.9 ± 6.03 across Thohoyandou food markets. The highest mean count (log_{10}cfu/g) was found in the gravy (3.9 ± 6.03) followed by chicken stew (3.7 ± 19.09) sold at market 1 and were statistically different ($P < 0.05$). There was no significant difference ($P > 0.05$) in *S. aureus* concentrations in the salads sold at markets 1 and 3. There was no *S. aureus* in the salad sold at market 2 and chicken stews at markets 3 and 4. At Sibasa markets, mean microbial (log_{10} cfu/g) counts for *S. aureus* ranged from 2.0 ± 6.03 to 3.9 ± 6.03. The highest mean count (log_{10}cfu/g) was found in chicken stew (3.9 ± 6.03) sold at market 2. Thus, market 2 was significantly different ($P < 0.05$) from the others. Tests for *S. aureus* in gravy beef stews in Sibasa yielded negative rests.

6.4.6 Bacillus cereus

As indicated in Table 6.2, *B. cereus* was not present in all food items purchased from Thohoyandou markets. The mean microbial counts (log_{10} cfu/g) for *B. cereus* ranged from 2.0 ± 1.15 to 4.9 ± 21.66 across all the Sibasa markets. The mean counts (log10 cfu/g) for *B. cereus* were the highest in beef stew (4.9 ± 21.66) followed by gravy (3.9 ± 12.50) and chicken stew (3.8 ±.5.77) sold at market 2. However, *B. cereus* was not isolated in gravy sold at market 1 and salad sold at market 2. Similar results were obtained for beef stews sold at markets 1 and 3 in Sibasa.

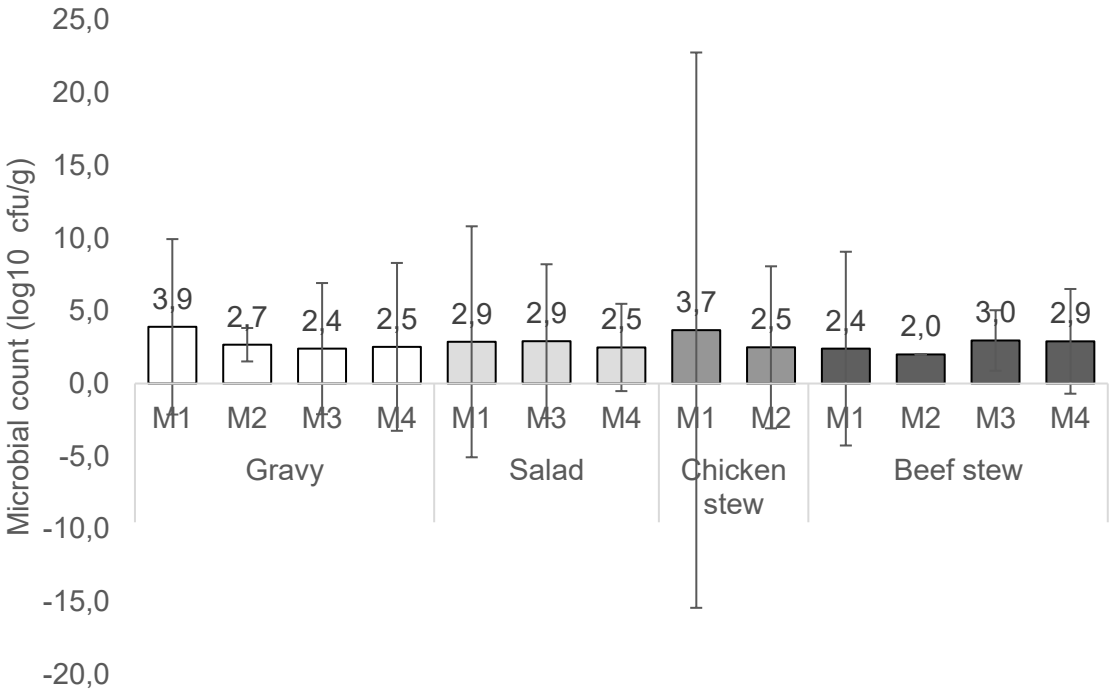

Figure 6.1: Mean counts (log_{10} cfu/g) of *S. aureus* isolates in gravy, salad, chicken and beef stews sold at different markets at Thohoyandou. **Staphylococcus aureus* was not found in salad sample sold at market 2, chicken samples at markets 2 and 4; values followed by the same letters are not significantly different (P > 0.05)

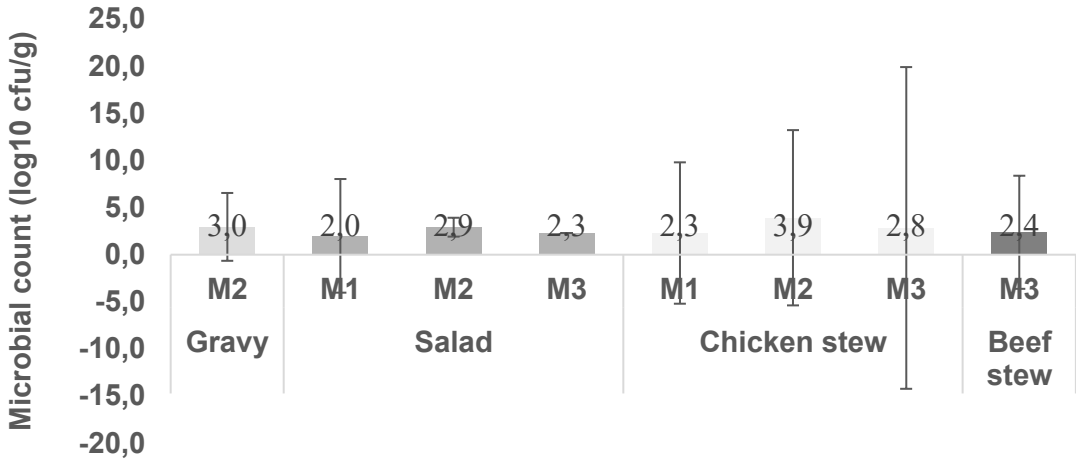

Figure 6.2: Mean counts (log_{10} cfu/g) of *S. aureus* in gravy, salad, chicken and beef stew sold at different markets at Sibasa. **Staphylococcus aureus* was not found in gravy samples sold at market 1 and 2; beef stew sample sold at market 1 and 2

6.4.7 Yeast and mould

Mould was not detected in all food items sold in both Sibasa and Thohoyandou. The mean microbial counts (log_{10} cfu/g) for yeast extended from 2.3 ± 1.73 to too numerous to count across all the markets in Thohoyandou (Table 6.1). Chicken stew sold at market 4 was found to have the highest mean count (log_{10} cfu/g) of yeast compared to all the other markets ($P < 0.05$). The lowest was in salad (2.3 ± 1.73) prepared at market 3.

There was no difference in yeast counts in salads sold at markets 2 (2.3 ± 2.00 log_{10} cfu/g) and 3 (2.3 ± 1.73 log_{10} cfu/g). The mean counts (log_{10} cfu/g) for yeast varied from 2.1 ± 1.00 to 3.7 ± 39.58 across all the markets in Sibasa ($P < 0.05$). Gravy (3.7 ± 39.58 sold at market 2 was found to have the highest mean count of yeast compared to all the other markets ($P < 0.05$). In contrast, there was no yeast in the gravy sold at market 3 and other Sibasa selling points. Nor was there any yeast detected in beef stews prepared at markets 1 and 3.

6.5 Microbial comparison of food samples purchased at Sibasa and Thohoyandou markets

Table 6.4 presents a comparison of microbial concentrations in foods sampled in Sibasa and Thohoyandou. As shown in Table 6.3, for TPC significant differences were observed in salads ($P < 0.05$) and chicken stews ($P < 0.05$). However, no significant differences were observed in gravy and beef stew samples obtained from both locations. Regarding *Salmonella spp.,* significant differences were observed in salad ($P < 0.05$) and beef stew ($P < 0.05$) samples. The results for gravy and chicken stew sample analyses were the same. Significant differences in *S. aureus* were found in salads ($P < 0.05$).

Contrasting observations were made for gravy, chicken and beef stew samples collected from both Sibasa and Thohoyandou. With respect to yeast, significant differences ($P < 0.05$) were observed in salad and beef stew samples. No statistically significant differences existed for gravy and chicken stew collected from selling points in both sites.

Table 6.4: Microbial load comparison of food samples from Thohoyandou and Sibasa locations

		TPC			*Salmonella spp.*			*Staphylococcus aureus*			Yeast		
Food sample	**Location**	n	Mean	P value	n	Mean	P value	n	Mean	P value	n	Mean	P value
Gravy	Thohoyandou	12	99.33	0.49	6	30.33	0.45	10	35.30	0.06	12	53.08	0.09
	Sibasa	9	70.44		9	18.56		6	4.83		6	29.67	
Salad	Thohoyandou	12	97.25	**0.01***	9	40.33	**0.00***	9	62.00	**0.00***	12	36.08	**0.00***
	Sibasa	9	24.22		9	3.22		9	9.78		6	3.50	
Chicken	Thohoyandou	12	43.42	**0.00***	9	51.56	0.07	10	34.70	0.06	12	114.75	0.17
	Sibasa	9	74.67		9	20.44		9	58.00		6	44.50	
Beef	Thohoyandou	12	69.92	0.06	9	28.11	**0.00***	12	29.00	0.34	12	54.75	**0.01***
	Sibasa	9	56.33		9	5.67		6	15.50		6	14.00	

*Significant at P < 0.05, n = Number, TPC = Total plate count.

6.6.Discusion

The mean TPC, 2.0 ± 2.08 to TNTC observed in the current study is in agreement with the findings of studies conducted in Nigeria (Odu & Akano, 2012) and South Africa (Njenje *et al*., 2012). In South Africa, the Department of Health, 2000) guidelines for ready-to-eat cooked foods reveal that TPC of $<10^4$ cfu/g, 10^4 to 10^5 cfu/g and $>10^5$ cfu/g signify satisfactory, acceptable and unsatisfactory results, respectively. This implies that the mean counts of gravy, salad, beef and chicken stew obtained in the current study were within the acceptable level (10^5 cfu/g) range and thus, fit for human consumption. Soepranianondo & Wardhana (2019) report similar results (1.62 $\log_{10}$ cfu/g) from their beef sample-based studies in East Java, Indonesia.

The high TPC for some salads and chicken stew sampled from some markets in Sibasa and Thohoyandou are a serious cause for concern. Such foods were not fit for human consumption given that they failed the Department of Health recommended standards of safety. Njenje *et al*. (2012) made similar observations in their study conducted in Eastern Cape in South Africa. In that study, the scholars observed unsatisfactory mean value (6.8 $\log_{10}$ cfu/g) of aerobic bacterial count in vegetable salad. High microbial counts of ≥ 6.0 log cfu/g were also reported in a study conducted in Dhaka Metropolis, Bangladesh (Akter *et al.,* 2019).

The evidence of bacterial count in food samples in the above studies indicate that they were contaminated after cooking during handling procedures, thus suggesting overall substandard hygiene practices of food vendors. High TPC in salad is attributable to it being eaten raw, without heat processing. Differences in TPC among different markets reflect variations in hygiene in the vending environments and practices of the food vendors. Furthermore, it is possible that raw materials in perishable products were contaminated or unsuitable time, temperature and storage conditions were used in the vending sites. The highest counts for Thohoyandou markets may be due to the vendors operating in crowded areas where garbage disposal was poorly managed.

The absence of coliform bacteria in all food samples sold at Thohoyandou markets, beef stew purchased in some markets at Sibasa, gravy and chicken stew sold at one Sibasa market is a reflection of sound hygiene practices and adequate food processing. In this regard, clean water was most likely to be used for washing dishes and cooking food.

Mafune *et al.* (2016) conducted studies in South Africa in which none of street-vended foods samples they tested contained coliform bacteria.

Coliform bacteria counts in salad, gravy and chicken stews sold at Sibasa markets were higher than the minimum standards of quality that the Department of Health (2000) recommends for fitness of foods for human consumption. Similar observations were made in a study conducted in Bangladesh (Jahan *et al.,* 2018). Taking into account the Akindile *et al.* (2016) contention, presence of coliform bacteria in food samples suggests there was faecal contamination. In the current study, food vendors were observed cleaning chicken intestines within the vending stalls. They even handled food without thorough washing of hands. This means that the coliform bacteria emanated from contamination from chicken intestines. Substandard hygiene practices during food handling in the vending sites cannot be ruled out. Pets frequented vending sites and coliforms in meat was likely to be due to animal skin contamination.

Absence of *E. coli* in samples collected at Sibasa markets and the most food items sold at Thohoyandou markets suggested that hygiene practices were effective. However, of concern was the observation that there were foodstuffs with high concentrations of *E. coli* which rendered them unfit for human consumption. The Centre for Food Safety 2014 classifies *E. coli* counts <20, 20 to ≤ 10^2 and >10^2 as satisfactory, borderline and unsatisfactory, respectively. Results obtained in the current study confirm those of Amissah & Owusu (2012) who report high levels (>10^2) of *E. coli* in fufu collected from street vendors in Ghana. Kwiri *et al.* (2014) report even higher (8 × 10^4 cfu/g) counts of *E. coli* in 77 % of street-vended soup in Mbare Musika in Harare, Zimbabwe.

In the current study, the results for *E. coli* counts in foodstuffs varied considerably among the vending markets. The Bakobie *et al*. (2017) contention that trading location, street vendor's hygiene regime and environmental conditions in the vending site influence extent of *E. coli* contamination of foods might explain these results. Cross-contamination after cooking often explains the presence of *E. coli* in food. It is also worth noting that presence of *E. coli* in the food may indicate that faecal contamination was occurring during preparation or from material used. In support of the preceding argument, street food vendors in the current study were concerned that some people who passed by relieved themselves around the food stalls, especially after trading hours. Componding this problem was the fact that food vendors did not have adequate water to wash their hands.

It has been observed that some foodstuffs that street vendors sold in both Sibasa and Thohoyandou were contaminated with *Salmonella spp*. and thus unfit for human consumption (Centre for Food Safety, 2014). Available literature confirms that this problem is found elsewhere. For instance, in Tamale Metropolis of Ghana *Salmonella spp*. were found in 63 % of soup samples tested and their concentrations were as high as 9.6×10^4 cfu/g (Abakari *et al*., 2019). *Salmonella spp.* are usually implicated in most foodborne diseases (Hull-Jackson *et al.,* 2019). Even a small number of the pathogens in foods have the potential to cause severe illness (Health Protection Agency, 2009; Hull-Jackson *et al*., 2019). In the current study, presence of *Salmonella spp* in foods may have been due to poor hygiene practices and cross contamination. As reported above, food vendors were observed using the same equipment to serve different types of foods without proper washing in between. Limited water in the vending stalls compelled vendors to wash hands in previously used water after handling raw food and visiting the toilet. Such risky practices predispose food to recontamination with eventual devastating consequences on customers' health.

Absence of *Salmonella spp* in gravy samples purchased at Thohoyandou markets, salad, chicken and beef stews agrees with the results of a study conducted in Eastern Cape Province of South Africa (Mazizi *et al*., 2017). It suggested that food vendors applied good hygiene practices such as thorough washing of hands after visiting toilets and handling non-food materials. Health Protection Agency (2009) also explains absence of *Salmonella spp*. in foods as confirmation of food vendors managing to control temperature and time during food production and sales, which prevents cross-contamination and its multiplication.

Although the concentration of *S. aureus* detected in foods included in the current study fell within the acceptable range ($<10^4$ cfu/g) (Centre for Food Safety, 2014), it was higher than what was observed in the Eastern Cape Province of South Africa (Mazizi *et al*., 2017). However, it was lower compared to the results of Abakari *et al.* (2019) study in which 83.3 % of soup samples had high *S. aureus* (9.2×10^4 cfu/g) count. In Bangladesh, Jahan *et al.* (2018) found higher counts ($\geq 10^5$ cfu/g) of *S. aureus* in street-vended foods. This is a major concern in public health.

Presence of *S. aureus* in food is a significant warning of potential hazardous situation and also an indication of contamination from skin, mouth or nose of food vendors (Bereda *et al*., 2016). Inadequately cleaned utensils or raw animal products may also be a source of contamination.

Apart from this, it might reveal that there is poor hygiene and temperature control (Naas *et al*., 2019). In the current study, raw and cooked food were stored together, mainly because storage facilities were inadequate Given that water facilities were inadequate the possibility of food vendors being compelled to wash their hands and cooking utensils in used water cannot be dismissed. Most vendors handled food with their bare hands, in addition to using dirty cloths when cleaning utensils and covering containers. Stefano & Marina (2018) report that *S. aureus* in foods may secrete toxins that cause poisoning. Small-scale vended foods are widely consumed, readily available and affordable to most customers. Thus, presence of *S. aureus* in should not be tolerated because of the possibility of widespread food poisoning it can cause.

The microbial counts (log_{10} cfu/g) of *Bacillus cereus* were within the levels ($<10^5$ cfu/g) that recommended for foods to be fit for human consumption (Centre for Food Safety 2014). Similar findings were observed in a study conducted in Nigeria (Oluwafemi *et al*. 2013). The results level of *B. cereus* were higher when compared to those from Johannesburg, South Africa (Mosupye & von Holy, 2013) and Ethiopia (Nemo *et al.,* 2017). However, they contrasted those from the Himalaya (Kharel *et al.,* 2016) where unacceptable levels ($>10^6$ log cfu/g) of *Bacillus* were found in SSV foods. High levels of *B cereus* suggest poor handling controls. Consumption of such contaminated foods may result in foodborne illnesses (Centre for Food Safety, 2014).

It is worth noting that presence of *B. cereus* in foods as reported in the current study is possibly confirming the presence of spores in raw materials such as meat, spices, onion and pepper used during processing (Ishaq *et al.,* 2018). Also, poor storage conditions, unsanitary and unhygienic nature of food preparation and service areas may explain the presence of *B. cereus*. Lastly, the isolation of *B. cereus* from prepared foods may mean that its heat-tolerant spores may have survived cooking even though the vegetative form gets eliminated (Nemo *et al*., 2017).

The yeast count (log_{10} cfu/g) reported in the current study agrees with what was observed in Benin city, Nigeria where Osakue *et al.* (2016) found the total yeast count in street-vended chicken to be 1.385 cfu/g × 10^6 to 2.615 × 10^6 cfu/g. Poor handling of food products, coupled with compromised hygiene and sanitary practices employed in the processing and sales of these foods might explain the presence of yeast in the foods. Presence of yeast in the food is of public health concern because spoil it (Garnier *et al.,* 2017).

For those foods found not having yeast in them, considerable time and exposure to high temperatures during cooking processes might explain the situation (Kharel *et al.,* 2016).

6.7 Conclusion

The fact that most SSV foods were contaminated with a wide range of microorganisms is a matter of public concern. The presence of coliforms and *E. coli* confirm that food vendors in this study rely on poor hygiene practices, which make the food prone to faecal contamination. Also worrying is the presence of *Salmonella spp*. in foods. It is often implicated in most foodborne diseases. Its detection indicates that poor hygiene practices and cross-contamination of food occur during sales. Thus, proper hand washing facilities, drainage systems, sanitary waste disposal, coverage of food items and prevention of vector breeding near vending stalls should be practised. Besides these proposed interventions, vendors should undergo practical training specifically focusing on food preparation, safety, environmental hygiene and waste management. Lastly, there is a need for Environmental Health Practitioners to mount a better monitoring system that would contain selling SSV food that is unfit for human consumption.

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CHAPTER 7: PILLARS OF A SAFETY MANAGEMENT SYSTEM FOR SMALL-SCALE VENDED FOODS IN A RURAL-BASED MUNICIPALITY OF SOUTH AFRICA

7.1 Abstract

The study was undertaken in order to propose key pillars of a safety management system for small-scale vended foods in Thulamela Municipality of South Africa. This survey was conducted underpinned through application of an exploratory sequential mixed method research design. Fifty-four respondents were selected to participate in phase 1. Qualitative data were collected through focus groups and administering a semi-structured interview guide to key informants. Quantitative data were collected using a questionnaire administered to 136 small-scale food vendors and 272 customers. All the questions required responses on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Qualitative data were analysed using Atlas.ti version 8.0. The Statistical Package for Social Sciences (SPSS) version 25.0 was used to analyse quantitative data. The mean for scores and standard deviations were computed. Thereafter, the Mann-Whitney U test was carried out to determine whether there was significant differences between respondents' perceptions.

The outcome was the six major components of pillars a safety management system that respondents proposed. These were encored on the hygiene (personal, food and handling practices), training programme, environmental management, infrastructure development and law enforcement. The top most pillar proposed by the food vendors was provision of training ($\bar{x}$ = 4.66), For customers, personal hygiene ($\bar{x}$ = 4.79) received high score. However, there was no significant difference in the way the two groups ranked the perceptions ($P > 0.05$) relating to provision of training ($P > 0.05$). These results suggest the need for providing improved basic infrastructure and services such as sanitation and waste disposal system to ensure the safety of street-vended foods. Moreover, the Local Municipality, food vendors, customers and other relevant stakeholders must work together to ensure that safety of food is achieved. The need for training food vendors on the role of food in transmitting foodborne disease and their obligation to follow good hygiene practices was highlighted. Environmental health practitioners should carry out strict surveillance of street food vendor practices especially the conditions under which foods are prepared and sold.

Key words: Hygiene, infrastructure, interventions, law enforcement, waste management

7.2 Introduction

The safety of street-vended foods is a major global concern because they are often prepared and sold under compromised hygienic conditions. Asiegbu (2015) is of the view that street-vended foods can pose risk to customers due to microbiological contamination. The WHO (1996) posits that the risk may depend on issues such as the type of food, preparation method and how it is held before its consumption. Thus, ensuring safety of street-vended foods can improve public health and hence the growth of roadside food sector. Henry *et al*. (2017) define food safety as a basic human right without which food is contaminated with naturally occurring pathogenic microorganisms. Such pathogens cannot be seen or tasted but can cause diseases of varying severity including death.

Adinolfi *et al*. (2016) allude that food safety is important to customers as well as food industry, policy makers and economy as people get ill and die each year because of consuming unsafe food. In line with the results of this study WHO (1996) indicates that the safety of street-vended foods may be influenced by the factors such as quality of raw materials, food handling and storage practices (WHO, 1996). Also, street-vended foods are exposed to poor environmental conditions where there is evidence of rodents, insects, pets and dust. This is a cause for public concern and calls for strategies to mitigate the hazards encountered in the consumption of street-vended food.

In spite of health hazards associated with this sector of the economy, street food vending is an important component of socio- economic activities in developing countries, South Africa included. Its benefits and contribution elicited recommendations from researchers on ways to mitigate the hazards in its consumption and safeguard the health of customers. Alimi *et al*. (2016) recommends that safety approach to hazards of street foods should start from good agricultural practices and permeate the whole chain of the business. Similarly, Liu *et al*. (2014) and Samapundo *et al*. (2015) recommend that policies and regulations for safe street food trade must be strengthened and proper enforced to ensure significant reduction in the hazards of street food consumption These would involve active participation of all stakeholders in street food trade such as governments, street food vendors, customers' associations, civil society groups and development partners. Badrie *et al*. (2006), Liu *et al*.(2014) and Alimi *et al*. (2016) canvassed for the engagement of professionals in food and health related disciplines to draw-up guidelines for

the management of street food practices, implementation of Hazard Analysis Critical Control Points concept along the entire chain of the business, education of vendors and customers on hygiene and safe food practices.

A logical step towards reducing the risks of foodborne illness from street foods would be controlling the steps in food preparation and sale that may contribute to the contamination, growth and survival of the microbes responsible for foodborne illness. This should focus on educating the food handlers, improving the environmental conditions under which the trade is carried out and providing essential services to the vendors to ensure safety of their commodities (WHO, 1996).

Malaysia, Philippines and India are the three countries which have regulations for protecting street vendors. Malaysia is the only country where licensed street vendors are provided facilities for conducting their trade. An initiative has been taken in Africa where a coalition between local and national authorities, explored the food laws associated with street vending and developed strategies that could be used to control identified food hazards (Natural Resources Institute (NRI) UK, 2004). Another policy was framed in Durban, Africa, where the street vendors were allocated specific areas to operate, issued certificate of acceptability and were also given training on essential food hygiene practices (von Holy, 2006). In India, CII Institute of Quality's Food Safety and Quality has taken an initiative to create awareness among the customers and street food vendors and it has issued a simple informative checklist of hygienic practices which emphasizes on implementation of good hygiene standards by the street vendors (Ekka, 2017).

In Limpopo Province, Thulamela Municipality in particular, there are limited regulations and structures that regulate the street vending sector. Currently, street food vending is being regulated by the Compliance Unit officers under Community Service Department (Thulamela Municipality, 2015). The role of this unit is solely to register all the street food vendors in its area of jurisdiction and collect annual renewal fees. Identification of vending sites is done by the vendors themselves who then report to the Hawkers Association committee for approval. Allocation of basic facilities is currently not done. Thus, the situation revealed above necessitated conducting of the current study in order to propose the key pillars of a safety management system for small-scale vended foods. This was done after assessing the level of small-scale vendors and customers' knowledge, attitudes and handling practices concerning food safety.

7.3 Research Methodology

The study on the proposed pillars of a safety management system for small-scale food vending was carried out in Thulamela Municipality. Specific information about the location of Thulamela Municipality was presented in section 1.2 of Chapter 1. Similarly, research design, sampling procedure and data collection methods and techniques for qualitative study presented in Chapter 3 section 3.3.5 were employed in this chapter. Specific details relating to the ethical considerations were presented in Chapter 3 section 3.4

During quantitative data collection, a face-to-face questionnaire was used to solicit perception of six major components of a safety management system for small-scale vended foods. The questionnaire contained thirty-eight closed-ended questions that required responses on a 5-point Likert-type scale of 1(strongly disagree) to 5 (strongly agree). The questionnaire was administered to 136 purposefully selected food vendors and 272 randomly selected customers. It took at most 45 minutes to administer each questionnaire to each respondent. Before its use in data collection, the questionnaire was pre-tested with 20 randomly selected food vendors operating about 8 km out of Thohoyandou town. None of those who participated in the pre-testing was included in the final survey. The results of the pre-testing were used to revise the draft questionnaire before its use in data collection.

7.3.1 Data analysis

Thematic content analysis was used to analyse the qualitative data. Data obtained through key informant interviews and focus group discussions were cleaned, transcribed and stored as a Microsoft Excel. Thereafter, data were imported into ATLAS.ti version 8.0 software (Konopasek, 2008) for analysis. Verbatim quotations were selected and assigned codes. This involved writing memos and commenting on the data. Thereafter, themes, patterns and relationships were identified. The relationships between the codes were developed using the Network View Manager. Codes were imported as nodes to design a semantic network view before being linked with the quotations.

Quantitative data were analysed using the 2017 Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive statistics were computed, entailing calculating the means and standard deviations of scores for each proposed pillar. Thereafter, the Mann-Whitney test was used to determine whether there were significant differences between the perceptions of small-scale food vendors and customers. The Mann-Whitney is a non-parametric test used to assess significance of the difference in a scale or ordinal dependent variable by a single dichotomous independent variable (Gibbons & Chakraborty, 1991). It is equivalent to the independent samples t-test used in normally distributed parametric data.

7.4 Results

Atlas. Ti results revealed the three major themes that defined the pillars a safety management system for small-scale vended food (Figure 7.1). They included infrastructure development, provision of training and environmental management. Infrastructure development was categorised into infrastructure provision, storage facilities and provision of water and sanitation while provision of training was subdivided into training in food preparation, personal hygiene, food safety and production. Environmental management was unraveled into the following subheadings: waste management, vending environments and flies and pests management. The most important theme identified by majority (53) of respondents was infrastructure development, followed by provision of training (35). Environmental hygiene was suggested by 21 respondents. The synthesis of the whole study (study one, two, three and study four Atlas ti. results), were used to come up with the proposed pillars of a safety management system for small-scale vended foods in Thulamela Municipality (Figure 7.2). The pillars were anchored on hygiene (personal, food hygiene and handling practices), behavioural management, training programme, environmental management, infrastructure development and law enforcement. On the base of the pillars were attitude and behaviour relating to the quality and safety of food for human consumption. The pillar on training programme was scored the highest by the majority of food vendors ($\overline{x}$ = 4.7) while personal hygiene was ranked first by the majority of customers ($\overline{x}$ = 4.8).

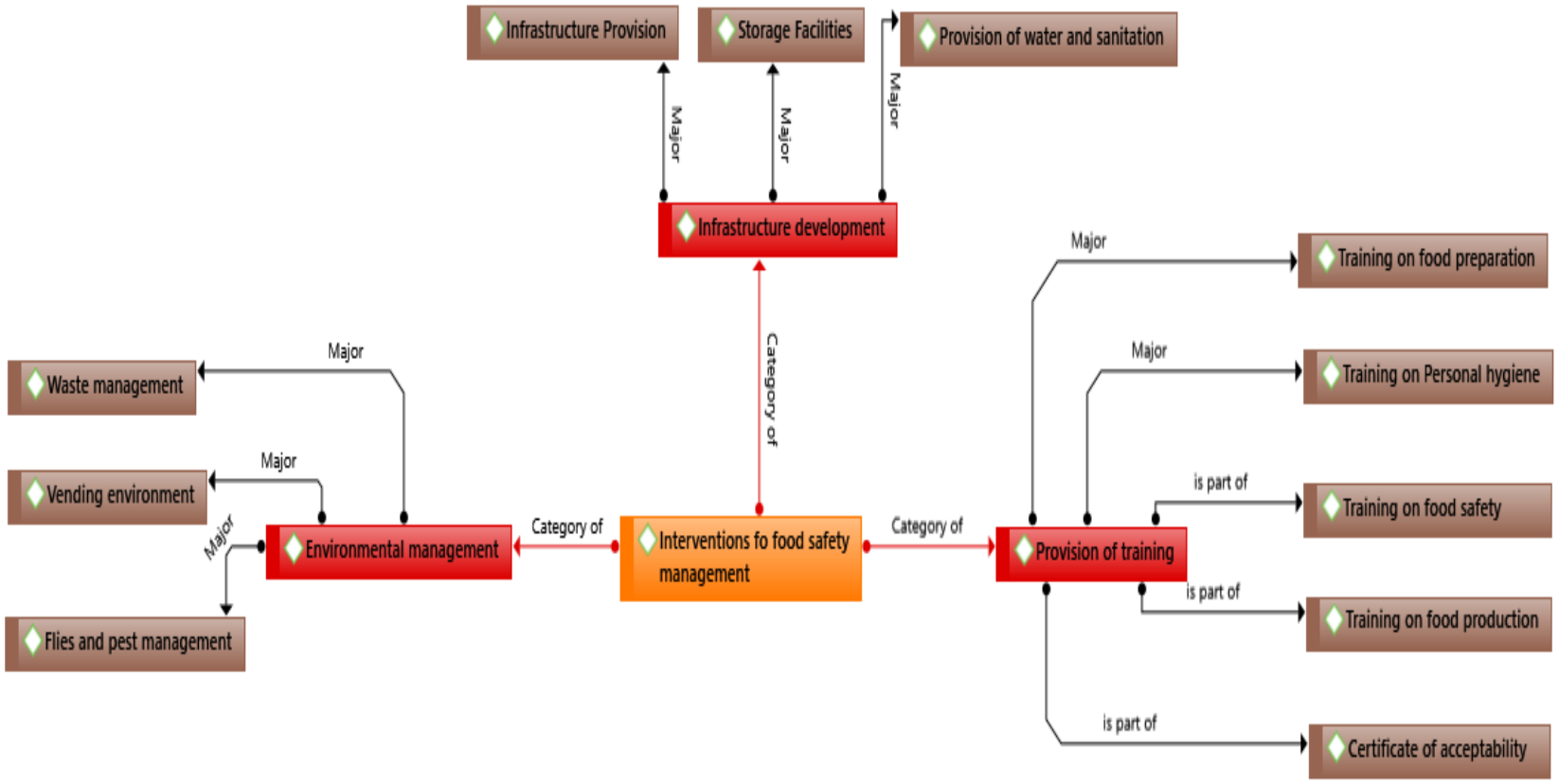

Figure 7.1: Major components of pillars of a safety management system for small-scale vended foods

*Key: Orange= main theme, Red = major pillars of safety management, Brown: sub-components of the major themes

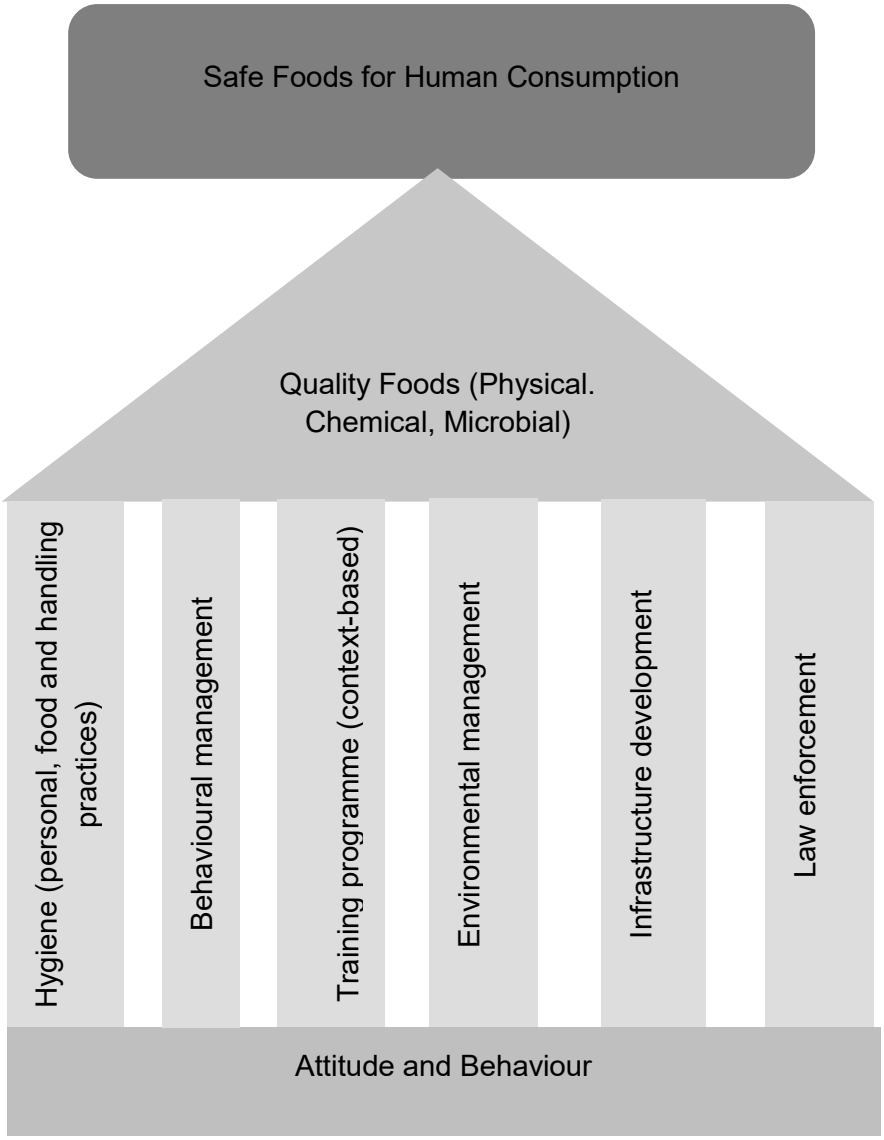

Figure: 7.2: Proposed pillars of a safety management for small-scale vended foods in Thulamela Municipality

7.4.1 Proposed intervention on the provision of training

Respondents of the current study proposed that small-scale food vendors should be trained in food preparation skills. For example, a respondent at the Sibasa taxi rank revealed that:

> "*I never received training on food preparation skills, I used the skill received from home. Training on food preparation skills will help me to gain knowledge on methods of cooking, nutrients preservation and preparation of quality food"*.

A respondent operating at the Thulamela taxi rank indicated that:

> "*training in food preparation will help us to prepare good food. However, it should not be for too long. Otherwise, it will interfere with our business".*

Respondents also indicated training in personal hygiene was crucial for street food vending. This was proposed by food vendors operating at Mvusuludzo and Sibasa taxi ranks.

For example, one respondent at Mvusuludzo taxi rank indicated that:

> "we want to be *trained in personal hygiene so that we may provide safe and quality food to customers"*

Both food vendors and customers agreed with all the variables that defined the proposed intervention on provision of training. These included train food vendors in basic food and personal hygiene throughout the value chain i.e. production, transportation, food pre-preparation, food preparation, food serving and after food serving; provide training in appropriate food preparation methods; mount food safety awareness campaigns through workshops, seminars and media; develop a food safety programme that focuses on personal and food hygiene; run environmental hygiene and public health education campaigns to mobilize communities to take appropriate action to ensure maintenance of food safety and mount effective health education programme or campaigns targeting the broad members of society. However, there was no significant difference in the way the two groups ranked the perceptions ($P > 0.05$) relating to training provision. The top most ranked proposal for both food vendors and customers was "training food vendors on basic food and personal hygiene throughout the value chain".

7.4.2 Proposed intervention on environmental management

Fly and pest management was proposed as a possible intervention for the improved safety of small-scale vended foods. This was because the respondents at Sibasa, Mvusuludzo and Thulamela taxi ranks complained about the pests which moved around their food stalls. One of the food vendors at the Sibasa taxi rank complained about this in the following way:

> "*I am being troubled by (magoya) wild cats. They like coming near my stall looking for food and I am afraid that they could infect my food".*

Another respondent in the same area revealed that*:*

> *"there are too many dogs and insects such as flies attracted by rubbish. Those responsible for pest control should come and fumigate the areas around our stalls"*.

As a result of the concerns revealed above, it was proposed that there should be a proper waste management system. For instance, a food vendor based at Thulamela taxi rank argued that:

> "*we do not have proper space where we dispose food waste. The Municipality should give us rubbish bins and collect the garbage every day to prevent flies from affecting the quality of our food"*

Both groups strongly agreed with the four variables. These included vendors should have adequate access to waste water and food disposal facilities aligned to vending spaces, good housekeeping is important to prevent breeding of flies and other insects, and also reduce rodent infestation, Municipality should provide food vendors with refuse bags and bins, making sure it removes the waste regularly and Vendors should get rid of all waste or keep it covered until it is disposed of. However, there were no significant differences between the perceptions of food vendors and customers except for variable "food vendors should get rid of all waste or keep it covered until it is disposed of" ($P < 0.05$). The top most ranked perception for both groups was "vendors should have adequate access to waste water and food disposal facilities aligned to vending spaces".

7.4.3 Proposed intervention on infrastructure development

Provision of infrastructure such as shelter, storage facilities was measured in terms of infrastructure, water and sanitation, storage facilities and vending environment/condition. For instance, a respondent at Sibasa taxi rank proposed that

> "*Municipality should provide us with proper infrastructure where we can proudly sell our food in a safe environment. The present temporary structures are giving us problems and also affecting the quality of food we sell*".

Respondents also proposed that small-scale food vendors should be provided with appropriate storage facilities. For example, a respondent at Sibasa taxi rank mentioned that

> "*we do not have storage facilities such as refrigerators and cupboards. In most cases I put both raw and cooked food on the same table. I usually cook my food at 6 am and carry to the stall at 8 am, sometimes the food stand on the table for 6 hrs before being sold"*.

Water and sanitation was also considered as crucial in the development of pillars of a safety management system. For example, a respondent at Thulamela taxi rank complained that

"we do not have easy access to potable water, we buy from the nearby shops. This is affecting the quality of our food. we use little water to wash food and hands. Toilets are far away from the stalls. Thus, we are asking the government to provide taps and toilets near our stalls".

Table 7.1 presents the results of the proposed intervention on infrastructure development for the food vendors and customers. Although the mean scores of customers' perceptions were higher, the results revealed that both groups strongly agreed with the five perceptions relating to infrastructure development. The findings further showed that there were significant differences in the way food vendors and customers ranked the perception relating to infrastructure development ($P < 0.05$). Whilst the customers ranked "town planners should include street food vending when designating business operational spaces" as number 1, both groups ranked the following perceptions as important: "provision of adequate sanitation, especially water and toilet/ablution facilities, to promote recommended hygiene practices for handling and consumption of food" and "Municipality should establish street food vending centres that have adequate facilities and utility services".

Table 7.1: Ranked means for the proposed interventions on infrastructure development

Intervention	Food vendors			Customers			
	Mean	Standard deviation	Ranking	Mean score	Standard deviation	Ranking	Statistical significance
Average	**3.7**			**4.7**			
Municipality should provide adequate sanitation, especially water and toilet/ablution facilities, to promote recommended hygiene practices for handling and consumption of food	4.7	0.57	1	4.8	0.53	1	*
Municipality should establish street food vending centres that have adequate facilities and utility services	4.6	0.59	2	4.7	0.58	3	**
Set up a Hazard Critical Control Point (HACCP) that enables health practitioners to identify the source of any food safety-related problem	4.4	0.71	3	4.5	0.76	5	*
Small-scale vendors should manage how they transport food to operational sites such that the chances of spoilage and/or contamination are reduced considerably	4.4	0.71	4	4.6	0.58	4	**
Town planners should include street food vending when designating business operational spaces	0.6	0.64	5	4.8	0.43	2	**

*Mean score values presented are based on a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree

* = P < 0.05; ** = P < 0.01

7.4.4 Proposed intervention on law enforcement

Results revealed that law enforcement was viewed as a significant pillar of a safety management. For instance, LED officer suggested that:

> "*all street vendors permit holders should comply with all municipal by-laws and small-business Act during the period of operation"*.

An environmental health practitioner proposed that

> "*food vendors should have certificate of acceptability issued by Health Practitioners to authorise vendors to sell food on the roadsides*".

> *"health and food inspectors from the Municipality should regularly inspect the safety of street vended food".*

Table 7.2 shows the eight proposed interventions on law enforcement for both food vendors and customers. Both groups strongly agreed with all the perceptions relating to law enforcement although the average mean score for food vendors was higher than that of the customers. The results further revealed that there were statistically significant differences ($P < 0.05$) between the perceptions of both groups except for "the municipal should work with food vendors to formulate bye-laws, rules and regulations that guide the operations" ($P > 0.05$) and "enforcement of municipal bye-laws and provisions of the Small Business Act 102 of 1996" ($P > 0.05$).

7.4.5 Proposed intervention food hygiene

Results revealed that both groups strongly agreed with the proposed interventions relating to food hygiene (Table 7.3). The significant differences were observed in the following variables: "clean raw fruits and vegetables with running tap water before preparation or serving ($P < 0.05$) and "do not store raw and cooked food together to avoid cross contamination" ($P < 0.05$). However, there were no significant differences in "secure raw food materials from approved or reliable sources" ($P > 0.05$) and "appropriately serve food, specifically ensuring that hot food is served only when hot and cold food when cold" ($P > 0.05$). The top most ranked perception for both groups was "cleaning of raw fruits and vegetables with running tap water before preparation or serving".

Table 7.2: Ranked means for the proposed intervention on law enforcement

Intervention	Food vendors			Customers			
	Mean score	Standard deviation	Ranking	Mean score	Standard deviation	Ranking	Statistical significance
Average	**4.5**			**4.3**			
The Municipal compliance unit should compulsorily license all street vendors	4.6	0.52	6	4.4	0.76	3	**
Municipality should work with food vendors to formulate by-laws, rules and regulations that guide the operations	4.6	0.55	3	4.5	0.68	1	ns
Enforce codes of practice for street food businesses	4.6	0.55	3	4.4	0.74	4	*
Compliance officers and Department of Health personnel should frequently visit food vendors' vending stalls to provide advice and monitor operations	4.6	0.53	5	4.3	0.70	6	*
Conduct regular inspection (monitoring) including unplanned visits by Compliance officers and Department of Health personnel to food vendors' operational sites	4.6	0.59	2	4.3	0.86	5	*
Environmental Health Practitioners should conduct regular medical examinations of food vendors	4.6	0.65	1	4.3	0.84	67	**
Public health officials should regularly sample and test food that street vendors sell	4.5	0.59	8	4.2	0.99	8	**
In line with National Hygiene Regulations, each street vendor should acquire a certificate of acceptability before being allowed to handle and sell food	4.5	0.72	7	4.4	0.85	2	*
Enforce municipal by-laws and provisions of the Small Business Act 102 of 1996	4.3	0.73	9	4.2	0.83	9	ns

*Mean score values presented are based on a 5-point Likert-type scale where 1 = strongly disagree and 5 = strongly agree; * = P < 0.05; ** = P < 0.01, ns = no statistically significant difference in perception

Table 7.3: Ranked means for the proposed intervention on food hygiene

Intervention	Food vendors			Customers			
	Mean score	Standard deviation	Ranking	Mean score	Standard deviation	Ranking	Statistical significance
Clean raw fruits and vegetables with running tap water before preparation or serving	4.6	0.57	2	4.4	0.77	3	**
Do not store raw and cooked food together to avoid cross contamination	4.6	0.55	3	4.7	0.50	1	**
Secure raw food materials from approved or reliable sources	4.6	0.59	1	4.5	0.55	2	ns
Appropriately serve food , specifically ensuring that hot food is served only when hot and cold food when cold	4.3	0.77	4	4.3	0.93	4	ns

* Mean score values presented are based on a 5 point Likert-type scale where 1 = strongly disagree and 5 = strongly agree; * = $P < 0.05$; ** = $P < 0.01$, ns = no statistically significant difference in perception

7.4.6 Proposed intervention on personal hygiene

Table 7.4 presents the ten proposed intervention on personal hygiene for both vendors and customers. Although there were differences in the ranking of the mean scores, both food vendors and customers strongly agreed with the proposed interventions relating to personal hygiene. “All food vendors should wear protective clothing, maintain clean hands, and have short finger nails” was ranked first by food vendors while customers ranked “food vendors must wash hands after using the toilet or ablution facilities” as number 1. The significant differences were observed in the following variables: “all food vendors should wear protective clothing” ($P < 0.05$), “food vendors must wash hands before and after handling food”($p < 0.01$) “food vendors must wash hands after coughing or sneezing into the hands or handkerchief” ($P < 0.01$), “food vendors must wash hands after handling raw foods” ($P < 0.01$) “food vendors must wash hands after handling dirt or refuse” ($P < 0.01$), “food vendor/handlers with colds, sore throats and infected cuts should not handle food, they must go for treatment instead” ($P < 0.01$) and “food vendors must wash hands after touching their faces and/or hair” ($P < 0.01$).

Table 7.4: Ranked means for the proposed intervention on personal hygiene

Intervention	Food vendors			Customers			
	Mean score	Standard deviation	Ranking	Mean score	Standard deviation	Ranking	Statistical significance
All food vendors should wear protective clothing, maintain clean hands, and have short finger nails	4.9	3.42	1	4.8	0.52	2	*
Food vendors must wash hands before and after handling food	4.7	0.53	2	4.8	0.46	5	**
Food vendors must wash hands after coughing or sneezing into the hands or handkerchief	4.6	0.58	5	4.8	0.46	5	**
Food vendors must wash hands after handling raw foods	4.6	0.54	8	4.7	0.75	9	**
Food vendors must wash hands after using the toilet or ablution facilities	4.6	0.56	6	4.9	0.33	1	**
Food vendors must wash hands before entering food preparation areas	4.6	0.56	6	4.7	0.73	10	ns
Food vendors must wash hands before handling cooked foods	4.6	0.59	4	4.8	0.48	3	ns
Food vendors must wash hands after handling dirt or refuse	4.6	0.61	3	4.8	0.46	5	**
Food vendor/handlers with colds, sore throats and infected cuts should not handle food. They must go for treatment instead	4.5	0.72	9	4.8	0.48	3	**
Food vendors must wash hands after touching their faces and/or hair	4.4	0.55	10	4.8	0.39	8	**

* Mean score values presented are based on a 5 point Likert-type scale where 1 = strongly disagree and 5 = strongly agree; * = P < 0.05; ** = P < 0.01, ns = no statistically significant difference in perception

7.5 Discussion

The respondents in the current study proposed a wide range of components that were crucial in defining pillars of a safety management system for small-scale vended foods in Thulamela Municipality in South Africa. They included hygiene (personal, food and handling practices), training programme (context-based), environmental management, infrastructure development and law enforcement. These were in line with the study themes presented in Chapter 1 section 1.8. The study themes indicated how human factors such as age, gender, education, knowledge and attitude on food safety and food handling behaviour relate with the quality and safety of food for human consumption. It was also indicated that to ensure the safety of food requires food governance, in particular coordinated actions across policy, regulations, surveillance and control measures to reduce the risk of foodborne illness. Linked to these were the major determinants of food handling practice identified in Chapter 5 Figure 5.4, Tables 5.6 and 5.7. These included food stall conditions, environmental hygiene and waste management, hand hygiene, protective clothing, hygiene-related behaviour, food storage and utensils management

In support of Omemu & Aderoju (2008) and Liu *et al*. (2014), respondents in the current study perceived provision of training as crucial in defining pillars of a safety management system for small-scale vended foods. The scholars identified education, food safety training as factors that affect knowledge and attitude of food vendors to food safety practice. Results showed that there was no significant difference in the way food vendors and customers ranked the perceptions relating to education and training. Training food vendors in basic food and personal hygiene throughout the value chain that is. production, transportation, storage, food pre-preparation and serving was ranked first by the two groups. This was because majority (94 %) of the food vendors in this study had never received formal training on food safety issues. Training of food vendors will be more effective if it is evidence based, that is, if it is based on specific data and information obtained from the trainee vendors as Donkor *et al*. (2009) suggest. This suggestion is in agreement with the results of a study carried out by Habib (2016) in Dhaka city, Bangladesh. The author reveals that, due to lack of education, training and experience, street food vendors did not know about food safety nor took appropriate measures to keep their vended food free from contamination. In line with Donkor *et al*. (2009) and Mjoka & Selepe (2017) respondents in this study proposed that training on food safety awareness should be promoted through an effective health education programme, workshops, seminars and media as suggested by the respondents in this study.

These authors suggest that, dissemination of food safety information can be done through the use of mass media and audience participatory programmes.

Education and training is crucial in addressing challenges faced by the food vendors. For instance, in Ghana, food vendors hand washing behaviour changed from 57 % to 100 % after training (Rheinländer *et al*., 2008). Umar *et al*. (2018) in Nigeria also report the improvement in the knowledge and practice of food hygiene among food vendors after receiving training in personal and food hygiene. Thus, this study recommends that every small-scale food vendor (customers included) should undergo basic training in food hygiene and safety to ensure that they follow the required and correct procedures of proper hygiene and sanitation relating to food production.

Contrary to the above discussion, Martinsen (2008) opines that the way educational messages are conveyed can steer its failure or success, especially if it does not match the local perspective and knowledge of the recipients. New knowledge does not instantly results into new practices as it might be too difficult, expensive, time consuming or opposed by other people as Bolderston (2012) argues. Favin *et al*. (2004) also argue that knowledge may increase without resulting into Behavioural change Consequently, this can be because “the old habit die hard” especially if the benefits are not immediately visible or are of indirect concern. Thus, it is evident that improvement of street food quality does not directly lie on the hands of the food vendors, but also requires a more concerted and coordinated effort from food safety and municipal officials. Without proper training on food safety, small-scale food vendors may fail to comply with good hygienic behaviour because of the nature of environmental conditions under which they do their businesses.

Both food vendors and customers in the current study proposed that food vendors should have adequate access to waste-water and food disposal facilities aligned to vending spaces. Rane (2011) postulates that refuse is a major source of contamination of food products and vending sites. Studies conducted in various countries such as Ethiopia, South Africa and India have also raised serious concerns regarding the environment under which street food vending is carried out (Eliku, 2016; Tshipamba *et al*., 2018; Faraday *et al*., 2019). Generally, street food vendors prefer to operate in high traffic areas such as taxi tanks, bus/train terminals and public places where there is limited basic facilities such as toilets, portable water, good drainage and waste disposal system (Alim, 2016). Nearness to customers is the primary target of the street food vendors rather than their safety. Hence, the contamination of small-scale vended foods is often linked to the waste generated by food processing, which is usually dumped near the

vending site. The lack of facilities for liquid drainage, wastewater and garbage disposal encourages wastes to be thrown into nearby streets and gutters.

Similarly observation was made in the current study. The absence of waste disposal facilities near the vending stalls encouraged food vendors to threw waste into nearby streets and gutters. Such areas harbour insects and animal pests and promote the growth of microorganisms as Tesfaye (2019) indicates. Pests such as mice as cockroaches are a major threat to food safety and sanitary quality. A pest infestation can occur when there are breeding grounds and a source of food. A study done in Kenya (Muinde & Kuria, 2005) revealed that majority (85 %) of the vendors prepared foods like fish, fruit salads, roasted maize and chips in unhygienic conditions, given that garbage and dirty waste were conspicuously close to the stalls. Unhygienic environments may expose street foods to recontamination and cross-contamination from environmental pollutants. Further, the conditions under which the small-scale foods are prepared and vended are worsened by lack of implementation of relevant environmental and public health regulations (Okojie & Asah, 2014). Effective measures are therefore, needed for the hygiene and sanitation of food preparation and vending sites to prevent the contamination of food and the surroundings.

Respondents in the present study proposed that municipal compliance unit should compulsorily license all small-scale food vendors. Perhaps this was triggered by the fact that small-scale food vendors are not formally recognised in Thulamela Municipality as pointed out by Mafunzwaini (2013) and Mathaulula *et al*. (2016). The scholars indicate that small-scale food vending is mainly informal and also has not yet received adequate attention from policy makers. Food vendors are only permitted to operate which is renewable annually. This system is similar to the one used in Zimbabwe (Njaya, 2014) whereby 98 % of the street food vendors are not registered by the Harare city council. Apparently, this is because their policy did not allow the vending of cooked food on the streets. These findings show consistency with the different literature which supports the notion that small-scale food vending should gain formal recognition like other formal food establishments (Dwumfour-Asare & Agyapong, 2014; Hill, 2016; Zanin *et al*., 2017).

WHO (1996) posits that many countries have licensed the street food vendors although a significant proportion of them commonly remain unlicensed. For instance, the National legislation in Asia requires that street food vendors should be registered with relevant authorities before starting their business (FAO/WHO, 2017). Licensing or registration of food vendors is crucial because authorities can identify persons employed in such enterprises, the

type of food sold, raise revenue and provide opportunity to give food vendors training in food safety. Thus, it is recommended that food vendors should be issued with licenses based on their food safety knowledge and a commitment to producing safer food. In addition, environmental health practitioners should ensure that small-scale food vendors in the present study are trained on Hazard Analysis and Critical Control Point (HACCP) as recommended by WHO (1996). The HACCP system is the most cost-effective approach for assuring food safety at all stages of the food supply. It also provides guidance in selection of enforcement and education priorities, rather than general sanitation and superficial improvements.

In line with FAO/WHO (2017) recommendation, respondents in this study also proposed that the Municipality should work with food vendors to formulate by-laws, rules and regulations that guide their day-to-day operations. This confirmed the findings of this study which revealed that food vendors and the customers had limited knowledge of rules and regulations associated with street food vending. This was so despite the South African government's efforts to develop a number of legislations and allocated various institutions to ensure the hygiene and safety of food. However, this is not surprising because literature reveals that in the majority of developing countries, street food safety policies do not either exist or are poorly enforced (Liu *et al*., 2014; Alano-Tolelada *et al*, 2018). Thus, FAO/WHO (2017) recommend that appropriate rules and regulations should be drafted and developed in response to an integrated consultation with vendors and the customers if it is to meet the needs of each of the partners in food safety.

Malaysia, Colombia and India are examples of the countries which have regulations for protecting street vendors (Rane, 2011). In Malaysia, street vendors are provided with the facilities for conducting their trade. In India, CII Institute of Quality's Food Safety and Quality (FSQ), has taken an initiative to create awareness among the customers and street food vendors and it has issued a simple informative checklist of hygienic practices, called the "CII-14 point checklist on food safety for street vended food" which emphasizes on implementation of good hygiene standards by the street vendors (Ekka, 2017). An initiative has also been taken in Africa where a coalition between the local and national authorities, explored the food laws associated with street food vending and developed strategies that could be used to control identified food hazards. In South Africa, Ehlanzeni District Municipality in Mpumalanga local authorities developed the trading by-laws called Nelspruit Street By-laws (von Holly & Makhoane, 2006). Such by-laws helped the Municipality to register all the street food vendors in its area of jurisdiction and identify specific sites for them strictly as food vending sites. At the vending site food vendors are allocated basic facilities such as cleaning services, running

water, wash basins, storage facilities. A similar initiative was implemented in Ethekwini and Johannesburg Metropolitan Councils.

In Limpopo Province, Thulamela Municipality in particular, street food vending is being regulated by the Compliance Unit officers under Community Service Department (Thulamela Municipality, 2015). The role of this unit is solely to register all the street food vendors in its area of jurisdiction and collect annual renewal fees. Identification of vending sites is done by the vendors themselves who then report to the Hawkers Association committee for approval. Allocation of basic facilities is currently not done. Thus, it is recommended that Thulamela local municipal authorities should consider imitating the initiatives taken by other districts in the country and elsewhere to improve street food vending in their area of jurisdiction.

Street food vending is characterised by poor infrastructure as is the case in the current study (Smith, 2016; Loukieth *et al*., 2017). Besides, access to potable water, sanitation and facilities for washing dishes and waste disposal is another hurdle in street food vending industry (Njaya, 2014; Cortese *et al*., 2016; Umar *et al*., 2018). Lack of such crucial amenities in street food vending may create hazardous environments to both vendors and the customers. The respondents in the present study regarded infrastructure provision as essential in defining key attributes of food safety for small-scale vended foods. This confirmed the results of Regression analysis which revealed that stalls condition ($P < 0.05$) was the most significant variables that defined the state of handling practice in Thulamela Municipality. This implies that an improvement in stalls condition will significantly result in a better food handling practices.

Provision of adequate sanitation, especially water and toilet/ablution facilities, to promote recommended hygiene practices for handling and consumption of food was ranked the most preferred intervention. Respondents further suggested that Thulamela local Municipality should establish street food vending centres that have adequate facilities and utility services. This agrees with the suggestion made by Njaya (2014) in a study conducted in Zimbabwe. The author suggests that the Harare local authorities should construct decent shelters which can be rented by food vendors. Such shelters should be provided with essential public utilities such as potable water, garbage collection, electricity and portable toilets.

The initiative alluded to above has already been in practice in countries like Hong Kong, China, Singapore and Malaysia (Naidoo *et al.,* 2017). The local authorities in these countries constructed hawkers' centres which are open-air complexes that house food stalls selling variety of inexpensive food. Also, such centres likewise helped in addressing the challenge

related to unhygienic food preparation by unlicensed street food vendors. Thus, the provision of an appropriate infrastructure is crucial in improving the quality and hygiene of small-scale vended foods.

Food hygiene is the condition and measure necessary to ensure the safety of food from the production to consumption (Wallace *et al*., 2018). Food can be contaminated at any point during harvesting, processing, storage, distribution, transportation and preparation. Lack of adequate food hygiene can lead to foodborne diseases and the death of the customers (Ruby *et al*., 2019). Both food vendors and customers in the current study strongly agreed that food vendors should clean raw fruits and vegetables with tap water before preparation or serving. Fruits and vegetables are an important part of human diet and are usually consumed raw as salads, garnishes, cut fruits and fruit juices. Hence, it is important to handle them aseptically to prevent contamination through agriculture, harvesting and post-harvest handling such as sorting and storage (Sheikhi *et al*., 2020). Consuming contaminated fruits and vegetables and their juices may lead to foodborne illness. Thus, small-scale food vendors should strive to produce safer food for public consumption. However, with the current state of affairs in street vending it may be impossible to implement this proposal, unless the municipal authorities consider providing tap water within or closer to the vending stalls.

Respondents further proposed that raw and cooked food should not be stored together to avoid cross-contamination. In accordance with Garayoa *et al*. (2018), cross-contamination is the transfer of microorganisms from one item of food to another via non-food surfaces such as human hands, equipment or utensils. In street food vending, cross- contamination usually occurs as a result of inadequate facilities and equipment such as absence of garbage bins and storage. Thus, there is a need to improve the supervision of activities and behaviours of food handlers in order to reduce the risk of cross-contamination in daily work. Food vendors must wash hands after using the toilet or ablution facilities

In line with the regulation 962 of 2012 promulgated under Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972) Republic of South Africa (Department of Health, 2015), food vendors proposed that wearing protective clothing is a key in promoting safety of small-scale vended foods. The above Act states that no person shall be allowed to handle food without wearing suitable protective clothing. Such clothing should a) be clean and neat when such a person begins to handle food, b) at all the times during handling of food be in such a clean condition and of such design and material that it cannot contaminate the food, c) be so designed that the food cannot come into contact with any part of the body excluding hands.

This finding confirmed the results of the Regression analysis which revealed that protective clothing ($P < 0.05$) was the most significant variable that defined the state of handling practice. This implies that an improvement in protective clothing will significantly result in a better food handling practices and behaviour of the food vendors. For instance, in India food vendors were receptive to health education programme and showed significant improvement (31 %) in personal hygiene and cleanliness (Rahul *et al*., 2008). Similarly, in Kaduna State of Nigeria 98 % of the food vendors had inadequate knowledge of personal hygiene. After the intervention, the level of knowledge in personal hygiene increased to 68 % (Umar *et al*., 2018). There was however, a mixed feeling between food vendors and their customers. Murwira *et al*. (2017) opine that food handlers in food service industry have the responsibility of maintaining a high standard of personal cleanliness and observe hygienic and safe handling practices or else they can contaminate food with pathogenic microorganisms.

The results of this study revealed that a considerable number of food vendors disregarded hand hygiene as a measure of safety for small-scale vended food. They handled food with bare hands ($\bar{x} = 2.0$) and did not wash hands after handling money ($\bar{x} = 2.0$). This behaviour is contrary to Starobin *et al*. (2006) definition of a good personal hygiene practice. The authors defines good personal hygiene practices as a proper and adequate hand washing, prevention of hand contamination, access to adequate handwashing facilities and drying devices and hand care products. Based on this, customers in this study proposed that “food vendors must wash hands after using the toilet or ablution facilities”. This is in line with Section 9(i) (ii) and 11(i) (ii) and (iii) regulation 962 of 2012, promulgated under the Foodstuffs, Cosmetics and Disinfectants Act No. 54 of 1972 of Republic of South Africa (Department of Health, 2015) The Act states that the standard requirements regarding hands are that no person is allowed to handle unpacked food, whose fingernails, hands or clothes are not clean, who has not thoroughly washed his or her hands with soap and water.

Various studies report that food vendors are not completely ignorant of basic hygiene practices (Munjaya *et al*., 2011; Alim, 2016; Roy *et al*., 2019). In most cases food vendors are aware that they should wash hands during food preparation, serving, after using toilet, sneezing, coughing, handling money and smoking. However, in reality these are mere rhetoric and statements of minds which are hardly put into actual practices (Rheinländer *et al*., 2008). Food vendors focused more into convenience and economic gains rather than the safety of the customers. Thus, failure to adhere to clean hands by food vendors may impact the public negatively. Therefore, food handlers must ensure proper cleaning of hands with soap and water after every activity that is possible to bring physical, biological and chemical hazards

7.6 Conclusion

The results of this study proposed a wide range of pillars of a safety management system for small-scale vended foods. These were anchored on the provision of training, environmental management, law enforcement, infrastructure development, food and personal hygiene. Majority of food vendors ranked the provision of training as their number 1 whilst personal hygiene was ranked first by the customers. Both groups proposed that food vendors should receive basic training on food and personal hygiene throughout the value chain. It was highlighted that food safety awareness should be promoted through an effective health education programme, workshops, seminars and media. Personal hygiene wearing of protective clothing in particular was considered as key in promoting safety of small-scale vended foods linked to this was the alignment of waste-water and food disposal facilities next to vending spaces. Both groups further proposed that the small-scale food vendors must be licensed so that they gain formal recognition. Infrastructure development especially water and toilet/ablution facilities were regarded as essential in defining key attributes of safety for small-scale vended foods. The results further revealed that there was no significant difference in the way the food vendors and customers ranked the perceptions relating to the provision of training and environmental management. Significant differences were found in the perception relating to infrastructure development ($P < 0.05$), law enforcement ($P < 0.05$) and the majority of the variables that defined personal hygiene. Based on these results, It is envisaged that the proposed system would enhance food vendors knowledge, attitude, handling practices and eventually improve the quality and safety of street-vended foods. The system would also be useful in preventing foodborne illnesses by actively controlling the risks and hazard throughout the flow of food. Thus, it is recommended that Thulamela Municipality should consider the proposed pillars when during policy making and review processes.

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CHAPTER 8: THE SYNTHESIS OF THE STUDY

8.1 Introduction

The current study was carried out in order to establish the level of small-scale food vendors and customers' knowledge, attitudes and handling practices with respect to food safety. This culminated in the key pillars of a safety management system for small-scale vended foods in Thulamela Municipality in South Africa being proposed. In this chapter, a synthesis of the results of the study and their implications for the pillars of a safety management system for small-scale vended foods is presented. Methodological imperatives that sketch the entire research process are presented first with the major findings and implications related to practice, policy and research being covered later. The third section is devoted to a discussion of the contribution of the study to the scholarship of discovery, integration, application and engagement. The conclusions and recommendations drawn from the study are presented immediately before the list of references used in this chapter.

8.2 Methodological Imperatives

An exploratory sequential mixed methods research design was employed in this study. Mixed method paradigm is an intellectual and practical synthesis based on qualitative and quantitative research (Jonson *et al*., 2007). This approach was deemed appropriate because it makes it possible to obtain the most informative, complete, balanced, and useful research results. Mixed research paradigm has its most modern model consists of philosophical assumptions as well as methods of inquiry (Creswell *et al*., 2003). As methodology, it has philosophical assumptions that guide for the collection and analysis of data; and as a method, it focuses on collecting and analyzing data in a single study or series of studies. Mixed research paradigm encompasses both the features of conventional qualitative as well as quantitative research methods and utilizes methodologies with respect to their underlying research questions, rather than preconceived prejudice related to specific paradigm (Onwuegbuzie *et al*., 2003). Through the use of mixed research paradigm, a synergistic effect can be obtained to overcome the weaknesses of another method. It enhances the generalizability of the results in a wider perspective by adding the statistical verification as well as the findings obtained from different strategies. Moreover, the findings obtained from the multiple perspectives are reconfirmed across different approaches so that higher confidence can be given for integrated conclusion. In addition, mixed research paradigm also adds insights and understanding of the identified issue in a holistic perspective that might be missed

when only a monomethod is used.

Purposive and snowball sampling were used to select small-scale food vendors and key stakeholders of small-scale food vendors. Both groups participated in the qualitative study. Purposive sampling was deemed appropriate because the research focused on particular characteristics of a population of interest and meant to answer the underlying questions (Palys & Atchison, 2008). Snowball sampling was appreciated because of its ability to gather research subjects through the identification of an initial subject who is used to provide the names of other actors (Etkan *et al*., 2016). Random sampling technique was used to select seven food markets where 28 food samples were purchased. Random sampling was deemed fit because all the markets in the study area had an equal chance of being selected.

Focus group discussion and key informant interviews were used to collect data during qualitative study. These were underpinned by interpretivist' paradigm. Interpretive approaches rely heavily on naturalistic methods that is, interviewing and observation and analysis of existing texts (Angen, 2000). These methods ensure an adequate dialog between the researchers and those with whom they interact in order to collaboratively construct a meaningful reality. Thus, focus group discussions were used because of its ability to obtain in-depth information on concepts, perceptions and ideas of a group while key informant interviews were used to obtain the first-hand knowledge about a topic of interest. A face to face interviews and observation checklist were to collect quantitative data. These were underpinned by the positivist paradigm. The positivist position is grounded in the theoretical belief that there is an objective reality that can be known if correct methods are used and applied in a correct manner.

Various and varied data analysis tools and techniques were used in this study. ATLAS. ti. version 8.0 for analysis software was used to perform thematic content. Statistical Package for Social Sciences version 25.0 for analysis was used to analyse quantitative data. Tests that were carried out included descriptive statistics, Spearman's rank correlation coefficient (r) , Principal Component analysis ,Hierarchical Cluster Analysis , Mann-Whitney U test ,Ordinal Least Square regression analysis , analysis of variance (ANOVA), Duncan's multiple range test and T-test.

The extensive triangulation of methods and techniques of research design, sampling, data sources, data collection and analysis strengthened originality, uniqueness, rigour and novelty to this study. This enabled triangulation, which coupled with data saturation as Fusch & Ness

(2015) and Hussein (2015) suggest made the study more robust. Triangulation was appropriate because of the need to increase the confidence in the findings. Heale & Forbes (2013) emphasise the need for confirming a proposition of findings from two or more independent methods. Lastly, it is crucial to acknowledge that multiple perspectives contribute to the depth of data, in addition to increasing the reliability and validity of the research.

8.3 Major Findings and Implications

Table 8.1 presents summary of the major issues emerging from the study. The objective of this study was to propose pillars of a safety management system for small-scale vended foods in a rural-based Municipality of South Africa. To form basis of the proposed system, the knowledge level and attitudes of small-scale food vendors and customers, as well as handling practices were assessed. Complementary, the microbiological quality of the commonly consumed small-scale vended foods was determined. The findings of this research ascertained the objectives, study themes and the conceptual framework as laid out in chapter 1 chapter 2.

The findings of this study revealed that majority of food vendors were females. Contrasting representation of gender dominance participating in food vending has not been similar. According to the study findings of Mramba (2015) and Iwu *et al.* (2017) women were in the majority whilst studies conducted by Muinde & Kuria (2005) in Kenya; Pokhrel & Sharma (2016) in Guwahati, Assam; Cortese *et al*. (2017) in Brazil reported the male counterparts dominating the sector. In the South African context, the domination of women populace in food vending is not surprising because, they are popularly involved in street food vending as they depend on it as a means of complementing family income in the midst of a harsh economy (Adane *et al*., 2018). In line with the previous studies, majority of the food vendors in this study had completed primary schooling (Mlay, 2018; Ma *et al*., 2019). This implies their marginalization in the formal sector. This is further justified by the fact that majority (94 %) of the food vendors had no any formal training on food safety and hygiene, which is an important requirement for safe guarding customers. This implies that they may have little or no understanding of the risks of microbial or chemical contamination of food and how to circumvent them. Thus, it would greatly contribute to their poor food safety knowledge levels, attitudes and unhygienic behaviour.

Table 8.1: Summary of major issues emerging from the study

Objective	Research problem	Research Methodology	Major Findings	Implications	Contribution to Knowledge
To determine the depth of knowledge and attitudes of small-scale food vendors and customers on food safety	Little is known about the knowledge and attitude of business people and customers involved in small-scale food vending, even though the business contributes positively to local economies	**Design:** Exploratory sequential mixed method **Population:** food vendors and customers, key stakeholders ≥ 18 years old **Sampling method & techniques:** *Qualitative*: Purposive: 50 vendors; Snowball: 4 stakeholders, **Data collection methods and techniques:** Semi-structured interview guide: focus group discussion, key informant interviews **Data analysis:** Atlas ti. version 08: Thematic content analysis *Quantitative:* **Sampling techniques & method:** **Purposive:** 136 food vendors 272 customers **Data collection tools**: Questionnaire: face-to-face **Data analysis:** **SPSS version 25:** Descriptive statistics: mean scores & standard deviation; Spearman's rank test; Principal Component Analysis	a) Vendors and customers were knowledgeable about personal and food hygiene. b) Vendors and customers rarely considered knowledge of foodborne diseases and rules and regulation in defining the quality and safety of small-scale vended foods. c) Vendors reflected positive attitude towards personal and food hygiene, and utensils management. d) Customers showed positive attitude towards personal food hygiene and utensils management	a) Food vendors and customers have knowledge and positive attitude towards food safety. b) With proper guidance, vendors can be able to provide safe and quality food	The study provide detailed information obtained through a sequential mixed method design regarding the knowledge and attitudes of small-scale food vendors and customers on food safety b)
To assess the food handling practices of the small-scale food vendors	Food handling and safety are the critical issues globally and every person is at risk of foodborne illnesses. People get sick either because they have eaten contaminated food or mishandled food. Limited	**Design:** Same as in Objective number1 **Population:** same as in objective 1 **Sampling method & techniques:** **Qualitative:** same as in objective 1 **Data collection methods and techniques:** same as in objective 1 **Data analysis:** same as reflected in objective 1 **Quantitative:**	a) Personal hygiene especially protective clothing was considered as crucial in defining the state of handling practices. b) Prevalent unsafe and unhygienic practices were: hand hygiene, food storage management, hygiene related behaviour and stalls condition). c) Two cluster solution were identified through Hierarchical cluster analysis. Cluster1 performed better regarding handling	Considerable knowledge and positive attitudes towards food safety revealed in Chapter 3 was not adequately	a) A model on the state of food handling practices which is encored on environmental hygiene, protective clothing, stall conditions, food storage and utensils

Objective	Research problem	Research Methodology	Major Findings	Implications	Contribution to Knowledge
	information regarding the state of handling practices is available in Thulamela Municipality	**Sampling techniques & method:** **Purposive:** 124 food stalls **Data collection tools**: Observation checklist guide **Data analysis:** **SPSS version 25:** Descriptive statistics**:** Mean scores & standard deviation; Hierarchical Cluster Analysis Mann-Whitney test. Ordinal Least Squares regression analysis	practices than cluster 2. d) Major determinants of food handling practices were identified: i) food stall conditions ii) environmental hygiene, iii) hand hygiene, iv) protective clothing, v) hygiene related behaviour and f) food storage and utensils management e) Protective clothing and stalls conditions were the most significant variables that defined the state of handling practices	translated into practice.	management, hand hygiene, hygiene related behaviour.
To determine the microbiological quality of the commonly consumed small-scale vended foods	Microbiological quality of small-scale vended foods is a major concern mainly because vending is done in places that may have poor sanitation. There is dearth of information on the microbial status of gravy, salad, chicken and beef stew sold on the road side.	**Design: Q**uantitative **Sampling techniques and methods: R**andom sampling **Sample size:** 28 food samples **Data analysis:** SPSS: Analysis of variance(ANOVA), Duncan multiple range test and T-test	a) Majority of food samples collected from Thohoyandou and Sibasa were contaminated with various microorganisms namely: Coliform bacteria, *Escherichia coli, Salmonella spp, Staphylococcus aureus and yeast.* Total plate count was significantly high ($P < 0.05$) in most of the food samples. b) Coliform bacteria, *B. cereus* and mould were not detected in Thohoyandou markets c) *E. coli* and mould were not isolated in Sibasa	The level of microbial contaminatio n of small-scale vended foods may present a potential health hazard to customers.	The study provide information on the microbiological quality of the commonly consumed small-scale vended foods
To propose a safety management system for small-scale vended foods	Although there are legislations that control the sale of food in South Africa, there is no food safety management system in place that safeguard the safety of small-scale vended foods particularly in Thulamela Municipality	**Design**: Same as in objective 1 Population: same as in objective 1 Sampling method & techniques: **Qualitative**: Data collection techniques and methods: Same as in objective 1 Data analysis: Same as in objective 1 **Quantitative**: Sampling techniques & method: Same as in objective 1 Data collection techniques and methods: Same as in objective 1	a) The top most pillars proposed by the food vendors were education and training, environmental hygiene and waste management system and personal hygiene. b) For customers, personal hygiene; infrastructure provision and environmental hygiene and waste management system were the major pillars.	Implementati on of the proposed pillars of a safety management system in small-scale vending may results in the provision of quality and safety of	Proposed pillars of a safety management system for small-scale vended foods which are encored on education and training, environmental hygiene and waste management system,

Objective	Research problem	Research Methodology	Major Findings	Implications	Contribution to Knowledge
		Data analysis: SPSS version 25: Descriptive statistics: mean scores & standard deviation; Mann-Whitney test.		foods	infrastructure provision, law provision, personal and food hygiene

In line with the results of the studies carried out in Kwazulu-Natal, South Africa (Mjoka & Selepe, 2017) and Ghana (Akabanda *et al.,* 2017), majority of the food vendors were knowledgeable about personal hygiene and food hygiene. They were aware that they were not supposed to touch unwrapped food with abrasions or cuts on their hands. Also, food vendors knew that washing hands before work reduce the risk of food contamination, sanitising the cooking utensils such as cutlery and cutting boards would prevent cross contamination and that swollen cans contain microorganisms can cause foodborne disease or food poisoning. This implies that food vendors were only partially and not completing ignorant of the very basic food hygienic practices.

Although food vendors had knowledge of foodborne diseases, majority of them were not aware that typhoid can be transmitted via food; *Salmonella* and *S. aureus* can cause foodborne illnesses and hepatitis A is a foodborne disease. Food vendors also believed that AIDS can be transmitted through food. A similar observation was documented by Kubde *et al*. (2016) who revealed that out of 86 food vendors interviewed, only 28 % knew foodborne diseases. However, these findings are at variance with those of a study conducted in Ghana where majority of food vendors (87 %) had knowledge of foodborne diseases and their contamination route (Elvis & Addo, 2016). Limited knowledge of foodborne diseases by food vendors in this study could be a consequence of their relatively poor education levels. Thus, it would greatly contribute to their poor food safety knowledge levels, attitudes and unhygienic behaviour. As food safety guarantors, the attention paid by food vendors to food safety is not enough, which requires the relevant government departments to strengthen the training and knowledge dissemination to the food vendors. Thus, this study recommends that food vendors training should be prioritized to improve street food safety.

Food vendors in this study reflected positive attitude towards personal hygiene, food hygiene and utensils management. However, the majority of them agreed that they used soiled towels to dry their hands and those of customers, rarely used clean water to wash utensils, pour waste-water on the road because there were no adequate waste disposal facilities. These attitudes may greatly expose the customers of the street-vended food to foodborne illnesses which could lead to epidemic if not promptly controlled as was the case in Trinidad, West Indies (Surujlal & Badrie, 2003). These scholars revealed that 55 % of the customers experienced illnesses traceable to street food consumption.

The findings of this study also revealed that food vendors had limited knowledge of rules and regulation associated with street food vending despite the South African government ‘s efforts

to develop a number of legislations and allocated various institutions to ensure the hygiene and safety of food from farm to fork. This is not surprising because literature reveals that in the majority of developing countries, street food safety policies do not either exist or are poorly enforced (Liu *et al*., 2014; Alano-Tolelada *et al*, 2018). Therefore, strengthening of the polices and proper enforcement would undoubtably ensure the reduction in the hazards of street food consumption.

This study highlighted that, the majority of the customers had adequate knowledge of food safety. They regarded knowledge of food and personal hygiene as important in defining the safety of small-scale vended food. Also, the respondents reflected positive attitude towards personal, food hygiene and utensils management. However, the results revealed that, customers rarely considered knowledge of foodborne diseases in defining the quality and safety of small-scale vended foods. Samapundo *et al* (2015) made similar observations in their study conducted in Port-au-Prince, Haiti. In that study, the scholars reported that over 80 % of the customers were not aware that hepatitis A virus, and *S. aureus* are the major pathogens responsible for food related diseases outbreak. These findings validate the fact that over half (57 %) of the customers in this study did not consider safety issues when they bought food. Affordability and taste factors were the main reasons why customers bought the street-vended food which may have a serious implication in their health. The results also revealed that customers were not aware of the rules and regulation associated with street food vending as was the case with food vendors.

The results of the handling practice survey highlighted the major themes that defined the state of handling practices in Thulamela Municipality. These included stalls condition, personal hygiene, environmental and waste management, hygiene-related behaviour, food storage and utensils management. Food vendors in this study reflected good performance regarding personal hygiene and utensils management. The majority of them wore aprons and hair covering while handling, preparing and serving food. Similarly, food vendors covered the cooked food with tight fitting lids and washed utensils with warm soapy water. These findings are at variance with those of a study conducted in Malaysia where food vendors regarded wearing of head covering, apron and gloves as cumbersome and their regular removal as time wasting (Pang & Toh, 2008). However, the reality on the ground showed that these were mere rhetoric and the state of minds which were rarely put into practices by most of the food vendors in this study. Convenience and economic factors were the main reasons why food vendors were not implementing their knowledge of food safety. It was physically observed that vending stalls were maintained in poor condition, inadequate access to potable water,

limited hand washing and waste disposal facilities. A considerable number of food vendors disregarded hand hygiene as a measure of safety for small-scale vended food. They handled food with bare hands and did not wash hands after handling money. These may result in cross-contamination and, therefore, the introduction of microbes in food. Majority of food vendors disregarded good hygiene-related behaviour. For instance, they removed dust with bare hands or dirty cloth, handled money while serving food, used the same utensils to prepare raw and cooked food products. Such practice may lead to cross-contamination of the microorganisms from one food to another thus, placing customers' health in danger.

Hierarchical cluster analysis revealed that cluster 1 performed better regarding protective clothing than cluster 2. The Regression analysis results revealed that, out of the six identified themes, protective clothing ($P < 0.05$) and stalls condition ($P < 0.05$) were the most significant variables that defined the state of handling practice in Thulamela Municipality. This implies that an improvement in protective clothing and stalls condition will significantly result in a better food handling practice. There was however, no significant association between the state of food handling practices and other critical variables normally reported in literature such as hygiene-related behaviour, food storage and utensils management, hand hygiene and environmental hygiene (Choudhury *et al*., 2011; Muyanja *et al.*, 2011; Omemu & Aderoju, 2008; Liu *et al*., 2014).

The presence of a wide range of microorganisms in SSV foods confirmed the state of poor handling practice in the study area. Moreover, the presence of coliforms and *E. coli* was evident enough to indicating that food vendors rely on poor hygiene practices, which make the food prone to faecal contamination. Similarly, the detection of *Salmonella spp*. implies that cross-contamination of food occurred during food sales. These results justify the fact that food vendors in this study had limited knowledge of foodborne diseases and their transmission. This calls for public concern because the risk of serious food poisoning outbreaks linked to street foods remains a threat in many parts of the world, with microbiological contamination being one of the most significant problems.

Based on the results presented above, this study proposed various and varied major components of pillars a safety management system for small-scale vended food were proposed. These were encored on the provision of training, infrastructure development, law enforcement and environmental management. Provision of training was further unraveled into training in personal and food hygiene. Infrastructure development was categorised into infrastructure provision, storage facilities and water and sanitation while environmental

management was subdivided into waste management and vending environment. Linked to these were the major determinants of the state of handling practice identified in chapter 5 Figure 5.4, Tables 5.6 and 5.7. These included food stall conditions, environmental hygiene, hand hygiene, protective clothing, hygiene-related behaviour, food storage and utensils management. The results of the Regression analysis revealed that protective clothing ($P < 0.01$) and stall condition ($P < 0.01$) were the most significant variables that defined the state of handling practice in Thulamela Municipality. This means that an improvement in protective clothing and stalls condition will significantly results in better food handling practices.

In line with Omemu & Aderoju (2008) and Liu *et al*. (2014), food vendors and customers in the present study agreed that food vendors should be trained on basic food and personal hygiene throughout the value chain that is. production, transportation, storage, food preparation and serving. This was because majority of the food vendors in the current study indicated that they never received formal training on food safety issues. It was clear from the results that both vendors and customers had considerable knowledge and positive attitude towards food safety. However, such knowledge was not adequately translated into practice as evidenced by the poor state of handling practices in the study area. Habib (2016) argues that without proper education, training and experience street food vendors may have limited knowledge of food safety and therefore, disregard appropriate measures to keep their vended food free of contamination. Therefore, the training of food vendors particularly regarding the hazards confronting their products, its safe handling, and the preparation of food following good hygienic practices, as practicable under local street-vending conditions, is an essential part of any strategy to improve the safety and quality of street-vended food (WHO, 1996). This should be performed in conjunction with licensing, but ongoing education and training sessions at intervals are strongly suggested. However, for the training to be effective it should be evidence based, that is, it should be based on specific data and information obtained from the trainee vendors to meet their needs and situations. Such training can be promoted through an effective health education programme, workshops, seminars and media as highlighted in this study.

Another pillar that was considered as crucial in defining the safety of small-scale vended foods was environmental management. Both food vendors and customers agreed that small-scale food vendors should have adequate access to waste-water and food disposal facilities aligned to vending spaces. This was based on the notion that, generally, food vendors prefer to operate in high traffic areas such as taxi ranks and public places where there is limited basic facilities such as toilets, potable water, good drainage and waste disposal system (Alimi,

2016). Apparently, nearness to customers is the primary target of the street food vendors rather than their safety. These hygienic environments may expose street foods to recontamination and cross-contamination from environmental pollutants. Okojie & Asah (2014) posit that, the condition in which small-scale foods is prepared and sold is worsened by lack of implementation of relevant environmental and public health regulations. Effective measures are therefore, needed for the hygiene and sanitation of food preparation and vending sites to prevent the contamination of food and the surroundings.

Linked to the theoretical framework developed by Henson & Heasman (1998), respondents in this study proposed law enforcement as another pillar that could support the small-scale food sector. This is based on the premise that small businesses have little capacity to carry out compliance process themselves. Rather there is a complete reliance on others for information about regulations and their effect. The strength of this pillar therefore, lies in the fact that much as food safety practices of food vendors would be looked at, it would also give room for the evaluation of enforcement approaches used by the regulatory agencies as they collectively impact on food safety. Currently, small-scale food vending operations are poorly regulated in Thulamela Municipality. This raises food safety issues and put into question hygiene standards which should be monitored and action taken by relevant stakeholders. Thus, the adoption of law enforcement as one of pillars for a safety management system would be useful in ensuring effective and sustainable practices of food vending regulations. Also, roping in of the relevant stakeholders would assist in raising awareness through training, monitoring and evaluation of food vending activities. The inclusion of Environmental Health practitioners as suggested by the respondents in this study would help to penalize food vendors who do not adhere to food vending regulations. Thus, Thulamela local authorities should consider inclusion of small-scale food vending sector in its trading by-laws. Such by-laws may assist the Municipality to register all the small-scale food vendors in its area of jurisdiction and identify specific sites for them.

In support of Malasan (2019) and Obayelu & Osho (2017), the results of this study revealed that small-scale food business is characterised by poor infrastructure. Access of tap water, sanitation and facilities for washing dishes and waste disposal was another hurdle in street food vending industry as indicated by Njaya (2014), Cortese *et al.* (2016) and Umar *et al*. (2018). Lack of such crucial amenities in street food vending may create hazardous environments to both vendors and the customers. Thus, infrastructure provision was regarded as essential in defining key attributes of food safety for small-scale vended foods. Both vendors and customers agreed that provision of adequate sanitation especially water and

toilet/ablution facilities would promote the hygiene practices for handling and consumption of small-scale vended foods. Respondents further suggested that Thulamela local Municipality should establish street food vending centres that have adequate facilities and utility services as recommended by Njaya (2014). Such shelters should be provided with essential public utilities such as potable water, garbage collection, electricity and portable toilets. The provision of appropriate infrastructure is crucial in improving the quality of small-scale vended foods.

8.4 Contribution of the Study to Body of Knowledge on Rural Development

This study helped to understand the dimensions of a theoretical framework developed by Henson & Heasman (1998). The model is based on the premise that small businesses have little capacity to carry out compliance process themselves. Rather there is a complete reliance on others for information about regulations and their effect. The strength of this model therefore lies in the fact that much as food safety practices of food handlers would be looked at, it would also give room for the evaluation of enforcement approaches used by the regulatory agencies as they collectively impact on food safety. In this study detailed information obtained through a sequential mixed method design regarding the knowledge and attitudes of small-scale food vendors and customers towards food safety was provided. The study also came up with a model on the major determinants of state of food handling practice. This model is anchored on the environmental hygiene, protective clothing, stall conditions, food storage and utensils, hand hygiene and hygiene related behaviour. Detailed information on microbiological quality of the most consumed small-scale vended foods in the study area was provided. More importantly, the main objective on this study which was to propose pillars of a safety management system for small-scale vended foods was successfully achieved. These pillars are anchored on infrastructure development, provision of training, environmental management, law provision, food and personal hygiene. Thus, the proposed pillars snugly fits in into Henson & Heasman compliance process model.

It is envisaged that the findings of this study will contributes to the body of knowledge particularly to the literature on the safety and quality of small-scale vended foods and food vending sector at large. Information obtained in this study will be disseminated to the general public through and not limited to:

a. Feedback sessions with key stakeholders, small-scale food vendors and the customers;
b. Structured deliberations (seminars, workshops, awareness campaigns) campaigns
c. Television and radio talk shows

d. Local newspapers and magazines
e. Collaborative research of scholars, Health practitioners and small-scale food vendors
f. Publication of scientific papers in peer-reviewed journals, policy brief, conference proceedings

8.5 Contribution to Scholarship

The study made the following contributions:

a) Major determinants of handling practices, viz. stalls conditions, hand hygiene, environmental management, protective clothing, hygiene-related behaviour and storage and utensils management identified;
b) Profiled the main microbial species which pose health risks to humans, including major hotspots in both Sibasa and Thohoyandou and;
c) Pillars of a safety management system for small-scale vended foods, namely provision of training, infrastructure development, law enforcement, environmental management, food hygiene and personal hygiene.

8.6 Conclusion

It is clear that the main objectives of this study which was to propose the pillars of a safety management system for small-scale vended foods after assessing the level of small-scale vendors and customers' knowledge, attitudes and handling practices in Thulamela Municipality in south Africa was achieved. Although small-scale food vendors and their customers have considerable knowledge and positive attitude towards food safety these were not translated into action. Personal hygiene especially protective clothing and stalls conditions were considered crucial in defining the state of food handling practices. The following unsafe and unhygienic practices were prevalent among the food vendors: hand hygiene, food storage management, hygiene-related behaviour and stalls condition. The findings of this study also highlighted the presence of pathogenic bacteria in the majority of food samples tested viz.: Coliform bacteria, *E. coli, salmonella spp, S. aureus, B. cereus* and yeast. The mean values for total plate count in most food samples were considerably high and exceeded the standard guideline set by the South African Department of Health. However, mould was not present in all food samples. Lastly, the information obtained from this study was used to develop the propose pillars of a safety management system for small-scale vended foods. These were anchored on education and training, environmental and waste management, law provision and infrastructure development

8.7 Recommendations

In light of the findings of this research, the following recommendations can be drawn with a view of improving the safety and sustainability of Thulamela Municipality small-scale food vending sector.

8.7.1 Recommendations for policy

a. The pillars of a safety management system for small-scale vended food have been distilled in the current study. There is need to consider them during policy making and review processes. Taking them into account, does the current legislative environment enable growth and development of small-scale food vending adequately?
b. The need for Environmental Health Practitioners to mount better monitoring that would contain selling small-scale vended food that is unfit for human consumption was highlighted. It was evident that regulatory measures enshrined in Health Act, No. 63 of 1977 and section 2(1) of the Foodstuffs Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972) and the Codex Code of Ethics for International Trade in Food must be enforced.
c. Support from Thulamela local authorities in the form of adequate infrastructure with services such as water supply, toilets, refuse disposal and waste water disposal facilities is needed.
d. Training of small-scale food vendors should be tailored to meet their needs and situations. Focal attention should be placed on an understanding of the rationale for the observed behaviours that reflected that knowledge was not always translated into practice.
e. A more effective monitoring and routine based awareness campaign through social media, food professionals, health experts and traders is worth introducing so as to strengthen the quality management.

8.7.2 Recommendations for practice

a. Engage relevant stakeholders like key stakeholders, food vendors, customers and general public to develop sustainable pillars of a safety management system which will be crucial in improving the quality and safety of small-scale vended foods.
b. Development of laws and regulations should integrate interests and ideas of street vendors, key stakeholders and relevant policy makers in order to develop a sustainable

model of street food vending that would secure and strengthen the livelihoods of the vendors.

c. There is a need to recognise small-scale food vending as a vital community development tool as it plays a critical socio-economic role in today's Thulamela Municipality in particular and South Africa in general.

8.7.3 Recommendations for further research

a. A study that examines the application of the proposed pillars of a safety management system developed in this study in practice in different contexts is necessary. Presumably such a study would help provide answers relating to the applicability of the proposed pillars beyond Thulamela Municipality.
b. Further research on microbial analysis on other types of foods from different food service establishments should be conducted in other parts of South Africa to establish a comprehensive profile of microbial risk and/or safety of various food products.
c. It is necessary to explore the nature and form of a training curriculum that takes on board the interests and needs of small-scale food vendors and customers.

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APPENDICES

Appendix A: Ethical Consideration Certificate

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Mrs MA Mathaulula

Student No:
11534210

PROJECT TITLE: **Pillars of a safety management system for small-scale vended foods in a rural area-based Municipality of South Africa.**

PROJECT NO: SARDF/16/IRD/14/2111

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Prof J Francis	University of Venda	Promoter
Dr M Manjoro	University of Venda	Co- Promoter
Prof AIO Jideani	University of Venda	Co- Promoter
Mrs MA Mathaulula	University of Venda	Investigator - Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: November 2016
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: .....
Name of the Chairperson of the Committee: Prof. G.E. Ekosse

UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2016 -11- 22
Private Bag X5050
Thohoyandou 0950

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950, LIMPOPO PROVINCE, SOUTH AFRICA
TELEPHONE (015) 962 8504/8313 FAX (015) 962 9060
"A quality driven financially sustainable, rural-based Comprehensive University"

Appendix B: Application letter for permission to carry out research in Thulamela Municipality

To: The Municipal Manager

Thulamela Municipality

Thohoyandou

Through: Prof J Francis

Director, Institute for Rural Development

University of Venda

Date: 17 May 2016

Dear Sir/Madam

REQUEST TO CARRY OUT RESEARCH TOWARDS PHD IN RURAL DEVELOPMENT DEGREE THESIS WITH THE UNIVERSITY OF VENDA

This communication serves to confirm that Mrs. M.A Mathaulula (11534210) is our PhD in Rural Development candidate who intends carrying out research entitled **pillars of a safety management system for small-scale vended foods in Thulamela Municipality, South Africa.** She plans to interview the leadership of the Hawkers' Association, street vendors and their customers and municipal officials in the Local Economic Development Unit. It is an anticipated that the results of this study will provide empirical information that might help inform the policy on this popular means of earning livelihoods by a considerable segment of the Thulamela Municipal population.

Through this letter the Institute for Rural Development humbly requests your office to grant approval for this study to be carried out.

Sincerely,

…… ……

Mathaulula M.A Prof J. Francis

Appendix C: Consent Form

Volunteer Agreement Form

Title: Pillars of a safety management system for small-scale vended foods in Thulamela Municipality, South Africa

General Information about Research

The main objective of this study is to develop a safety management system for small-scale vended foods in Thulamela Municipality of South Africa

Possible Benefits, Risks and Discomforts

There are no direct benefits to be gained from this study immediately, neither are there any risks associated with it. The only inconvenience might come from the time you will spend completing the questionnaire. The data from this study will be used only for the purpose of the study. (PhD Thesis)

Confidentiality

Your identity and your participation in this study will be treated strictly confidential. The information that we obtain from you will not be shared with anybody, except the study investigators. Your identity remains secret since your personal information will only be designated by a unique participant number. Your name will not appear in any reports or publications resulting from this study. After the study is completed, you may request information about the study results.

Voluntary Participation and Right to Leave the Research

You participate entirely voluntarily in this study. You have the right to refuse to participate in the study**.** You also have the right to stop your participation in the study at any time, even after you have signed this informed consent form. The withdrawal of your consent will not cause any disadvantage or loss of advantages/privileges.

Contacts for Additional Information

Any questions or any further clarifications concerning the study can be directed to:
Contact of the promoters:

Prof. J Francis, Institute for Rural Development, Tel: 015 962 8804, Email: joseph.francis@univen.ac.za
Dr. M Manjoro, Institute for Rural Development, Tel: 015 962 8809, Email: marizvikuru.manjoro@univen.ac.za
Prof A Jideani, Department of Food Science and Technology, Tel 015 962, Email: afam.jideani@univen.ac.za

Contact of researcher
Mushaisano Agnes Mathaulula, Institute for Rural Development, Tel: 015 962 8808 Email: agnes.mathaulula@univen.ac.za

VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research title ***(*Pillars of a safety management system for small-scale vended foods in Thulamela Municipality, South Africa*)*** has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

Date…… Name of volunteer…….

If volunteers cannot read the form themselves, a witness must sign here:
I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

Date……. Name of Witness……

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.
Date Signature of Person Who Obtained Consent

Appendix D: Small-scale food vendors questionnaire

INSTITUTE FOR RURAL DEVELOPMENT

UNIVERSITY OF VENDA

Small-scale food vendors' Questionnaire **Questionnaire No : --------**

Private Bag X 5050

Thohoyandou

0950

Telephone number: 015 962 8808/9045

Contact person: Mrs MA Mathaulula

Strict Confidence in Handling Data

The information you shall provide will be treated with the strictest of confidence. Note that your name and address will not be divulged to anyone or organisation.

Street Food Vendors

Name of business: ----------

Business address or area: ----------

Telephone Number: ----------

Cell Number: ----------

Interviewer's remarks: ----------

Interviewer: ---------- Date completed: ----------

Section A: Demographic Details of Respondents

1. Background Information

NB. Please circle (O) or tick (✓) the correct box.

1.1 Gender

Female	1
Male	2

1.2 What is your age group?

20-30 years	1
31-40 years	2
41-50 years	3
51-60 Years	4
More than 61 years	5

1.3 What is your marital status?

Never married	1
Married	2
Living together with spouse though not married	3
Divorced	4
Widowed	5
Single	6

1.4 What is the highest level of education you attained?

None	1
Primary	2
Secondary	3
Tertiary	4

1.5. Location of your vending business operation

Thulamela taxi rank	1
Mvusuludzo taxi rank	2
Venda plaza taxi rank	3
Sibasa taxi rank	4

1.6 For how many years have you been involved in small-scale food vending?

>5	1
6-10	2
11-15	3
More than16	4

1.7 Why did you start your food vending business? You may tick more than one responses?

a) To improve household income	1
b) Had been unemployed (for more than six months) and decided to do something that would help raise income	2
c) To support my family in meeting needs for improved livelihoods	3
d) My spouse was unemployed and had to look for possible sources of income to sustain the family	5
e) Other, specify	7

1.8 Source of knowledge on food preparation

Observing others in the same business	1
Formal training	2
Taught by family member or friends	
Other (Specify)	3

1.9 Have you ever been trained in food safety?

No	1
Yes	2

1.10 Do you have certificate of acceptability

Yes	1
No	2

1.11 Who are your customers? (You may tick more than one).

a) Passerby	1
b)Employees of established shops and other businesses	2
c) School learners	3
d) University students	4
e) e) Social grant beneficiaries	5
f) Teachers	6
g) Municipal and other government workers	7
h) Other, specify	8

1.12 Why do customers buy from small-scale food vendors?

a) We are friendly to customers	1
b) Because customers need fresh cooked food	2
c) Customers need cheaper food than what is normally available in other outlets	3
d) Customers need food that tastes different from what they buy from established restaurants	4
e) Customers prefer food which is prepared in our traditional way	5
f) Street vended food is more convenient than buying from established restaurants	6

Section B Small-scale Vendors Knowledge of Food Safety

To what extent do you agree with the views expressed below? Place **X** in the box you regard as the most appropriate.

Knowledge of Food Safety	**Level of agreement**	
	No	**Yes**
Personal Hygiene		
1. Washing hands before work reduces the risk of food contamination		
2. Using gloves while handling food reduces the risk of food contamination.		
3. Food handlers who have abrasions or cuts on their hands should not touch unwrapped foods without gloves		
4. There are microbes on the skin, nose and mouth of even healthy food handlers		
Food Hygiene		
1. Reheating cooked foods can result in contamination of food		
2. Cutlery and cutting boards should be properly sanitized to prevent cross contamination		
3. Swollen cans contain microorganisms that can cause food-borne disease or poisoning		
Foodborne Diseases		
1. Children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning		
2. Typhoid fever can be transmitted via food		
3. AIDS can be transmitted via food		
4. Bloody diarrhea can be transmitted via food		
5. Food-borne diseases can cause pregnant women to abort		
6. Salmonella is a serious cause of a fatal food-borne disease.		
7. Hepatitis A virus can cause food-borne disease.		
8. Staphylococcus is a germ that causes food-borne diseases.		
9. Listeriosis is a food-borne disease		
10. Flu is a food-borne disease		
11. Cholera is a food-borne disease		
12. Diarrhoea or dysentery is a food-borne disease		
Rules and Regulation		
1. Small-scale food vendors have adequate knowledge on food safety policy		
2. Customers have adequate knowledge on food safety policy		

Table 2 Attitude towards Food safety

Attitudes	Level of Agreement				
	Strongly disagree **1**	Disagree **2**	Not sure **3**	Agree **4**	Strongly agree **5**
Personal Hygiene					
1. Some vendors use soiled towels to dry their hands					
2. Most of the vendors have only one towel that their customers use to wipe their hands after washing					
3. We see food vendors scratching, picking their noses and serving customers without washing hands					
4. Only a few vendors wear aprons when handling food					
5. It is necessary to take leave from food-based work when one's skin is infected by a disease					
6. Most of us pour waste water on the road because there is no adequate waste disposal facility where we operate from					
Food Hygiene					
1) Using water stored in soiled or unclean buckets does not necessarily result in contamination of food					
7. Food should be prepared two hours before lunch to minimize food spoilage					
8. Well-cooked foods are normally free of contamination					
9. We do not sell leftover food. Rather, we take it home and eat					
10. It is important to maintain correct temperature at which food is stored to reduce the risk of food contamination					
Utensils Management					
1) Food vendors rarely use clean water to wash utensils, arguing that it is difficult to access potable water					
2) We wash our utensils with detergent because it leaves them very free of any contamination					
3) We do not find it necessary to cover utensils because there is dust everywhere and thus will always make them dirty anyway					
4) Limited or inadequate storage facilities make it necessary to prepare enough food that can all be sold within a short period					

THANK YOU

Appendix E: Customers Questionnaire

INSTITUTE FOR RURAL DEVELOPMENT

UNIVERSITY OF VENDA

Customer Survey **Questionnaire Number: --------**

Private Bag X 5050

Thohoyandou

0950

Telephone number: 015 962 8808/9045

Contact person: Mrs MA Mathaulula

Strict Confidence in Handling Data

The information you shall provide will be treated with the strictest of confidence. Note that your name and address will not be divulged to anyone or organisation.

Street Food Vendors 'Customers

Business address or area:----------

Telephone Number:----------

Cell Number: ----------

Interviewer's remarks: ----------

Interviewer:---------- Date completed:----------

Section A: Demographic Details of Respondents

1. Background Information

NB. Please circle (O) or tick (✓) the correct box.

1.1 Gender

Female	1
Male	2

1.3 What is your age group?

20-30 years	1
31-40 years	2
41-50 years	3
51-61 Years	4
More than 61 years	5

1.3 What is your marital status?

Single	1
Married	2
Living together with spouse though not married	3
Divorced	4
Widowed	5

1.5 What is the highest level of education you attained?

None	1
Primary	2
Secondary	3
Tertiary	4

1.5. Location of your vending business operation

Thulamela taxi rank	1
Mvusuludzo taxi rank	2
Venda plaza taxi rank	3
Sibasa taxi rank	4
Other, specify	5

1.6 For how many years have you been involved in small-scale food vending?

>5	1
6-10	2
11-15	3
More than16	4

1.8 Why do buy from small-scale food vendors? You may tick more than one responses.

g)	Vendors are friendly to customers	1
h)	Because vendors prepare fresh cooked food	2
i)	Vendors sell cheaper food than what is normally available in other outlets	3
j)	We need food that tastes different from what they buy from established restaurants	4
k)	We prefer food which is prepared in our traditional way	5
l)	we prefer to buy food from the survivalists as a way of motivating them	6
m)	other, specify	

Section B Small-scale Vendors Knowledge of Food Safety

To what extent do you agree with the views expressed below? Place **X** in the box you regard as the most appropriate.

Customer's knowledge of food safety	**No 1**	**Yes 2**
Personal Hygiene		
5. Washing hands before work reduces the risk of food contamination		
6. Using gloves while handling food reduces the risk of food contamination.		
7. Food handlers who have abrasions or cuts on their hands should not touch unwrapped foods without gloves		
8. There are microbes on the skin, nose and mouth of even healthy food handlers		
Food Hygiene		
1) Reheating cooked foods can result in contamination of food		
2) Cutlery and cutting boards should be properly sanitized to prevent cross contamination		
3) Swollen cans contain microorganisms that can cause food-borne disease or poisoning		
Foodborne Diseases		
1. Children, healthy adults, pregnant women and older individuals are at equal risk of food poisoning		
2. Typhoid fever can be transmitted via food		
3. AIDS can be transmitted via food		
4. Bloody diarrhea can be transmitted via food		
5. Food-borne diseases can cause pregnant women to abort		
6. Salmonella is a serious cause of a fatal food-borne disease.		
7. Hepatitis A virus can cause food-borne disease.		
8. Staphylococcus is a germ that causes food-borne diseases.		
9. Listeriosis is a food-borne disease		
10. Flu is a food-borne disease		
11. Cholera is a food-borne disease		
12. Diarrhoea or dysentery is a food-borne disease		
Rules and Regulation		
1. Small-scale food vendors have adequate knowledge on food safety policy		
2. Customers have adequate knowledge on food safety policy		

Table 2 Attitude towards Food safety

Attitudes	Level of Agreement				
	Strongly disagree 1	**Disagree 2**	**Not sure 3**	**Agree 4**	**Strongly agree 5**
Personal Hygiene					
1) It is necessary to take leave from food-based work when one's skin is infected by a disease					
2) Some vendors use soiled towels to dry their hands					
3) Most of the vendors have only one towel that their customers use to wipe their hands after washing					
4) We see food vendors scratching, picking their noses and serving customers without washing hands					
5) Only a few vendors wear aprons when handling food					
Environmental hygiene					
1) Most of food vendors pour waste water on the road because there is no adequate waste disposal facility where we operate from					
Food Hygiene					
2) Using water stored in soiled or unclean buckets does not necessarily result in contamination of food					
2) Food should be prepared two hours before lunch to minimize food spoilage					
3) Well-cooked foods are normally free of contamination					
4) Food vendors do not sell leftover food. Rather, take it home and eat					
5) It is important to maintain correct temperature at which food is stored to reduce the risk of food contamination					
Utensils Management					
1) Food vendors rarely use clean water to wash utensils, arguing that it is difficult to access potable water					
2) Food vendors wash utensils with detergent because it leaves them very free of any contamination					
3) Food vendors do not find it necessary to cover utensils because there is dust everywhere and thus will always make them dirty anyway					
4) Limited or inadequate storage facilities make it necessary to prepare enough food that can all be sold within a short period					

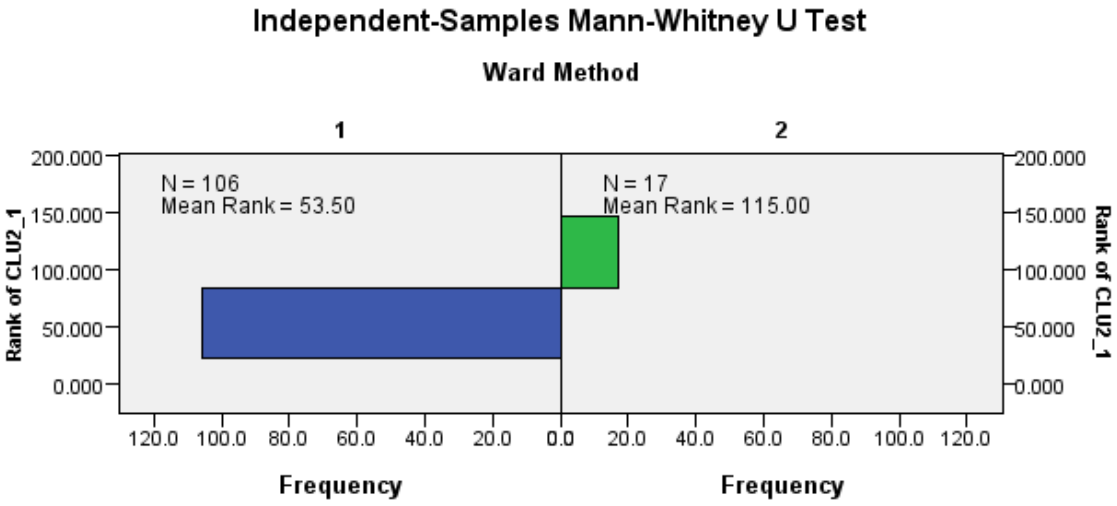
Appendix F: Observation Checklist

Food handling practice study constructs variables and coding

Study constructs	Questionnaire statements	Codes
Demographic Characteristics (DEM)	Location	DEM1
	Age	DEM2
	Gender	DEM3
	Level of Education	DEM4
	Training	DEM5
Stall conditions (FAC)		
	Stall made of tent	FAC1
	food prepared on site	FAC 2
	vending stall protected from sun,	FAC 3
	vending stall protected from dust	FAC 4
	vending stall protected from wind	FAC 5
	animals or pests evident around the vending stall	FAC 6
	vending stall maintained in a clean condition	FAC 7
	access to portable water at the site or close to the site	FAC 8
	adequate hand washing facilities available	FAC 9
	adequate waste water disposal facilities available	FAC 10
	adequate waste food disposal facilities available	FAC 11
	access to community operated waste water disposal sites	FAC 12
	access to community operated general waste disposal sites	FAC 13
Environment around the stall (ENV)	Environment around the stall clean	ENV1
	Environment around the stall far from rubbish bin	ENV2
	Environment around the stall far from the waste water	ENV3
	Environment around the stall far from the toilet facilities	ENV4
	Environment around the stall far from the open drain	ENV5
	Environment around the stall far from the animals	ENV6
Hand hygiene (PHH)	Food vendors wash their hands in clean water each time before the handling of food	PHH1
	Food vendor wash their hands in clean water each time after visiting toilet	PHH2
	food vendor handle food with bare hands	PHH3
	food vendors use disposable or reusable gloves	PHH4
	food vendor have clean short nails	PHH5
	food vendor handle money while serving food	PHH6
	Food vendor wash hands after handling money before handling food again	PHH7
	food vendor wear jewellery during food handling	PHH8
	jewellery adequately covered	PHH9
Protective clothing (PA)	food vendors clothes are clean and presentable	PA1
	Food vendor wear an apron when handling food	PA2
	Food vendor wear an apron when preparation food	PA3
	Food vendor wear an apron when serving of food	PA4
	Food vendor covers hair when handling food	PA5
	Food vendor covers hair during food preparation	PA6
	Food vendor covers hair when serving of food?	PA7
Hygienic related behaviours (HRB)	The operator blow air into polythene bag before use	HRB1
	dirt or dust removed by means of an apron, dirty cloth or bare hands	HRB2
	Vendor smoke during the handling and preparation of food	HRB3
	Food vendor use the same utensil (knives and boards) to prepare raw and cooked food products or to cut raw vegetables and fresh meat and poultry	HRB4
	Food vendor handle food while sick	HRB5
	Blowing of nose into hands and continuing to work without washing the hands	HRB6
	Coughing into hands and continuing to work without washing the hands	HRB7
Food storage and utensils management (FSU)	food stored openly in the stall; on wheelbarrow; sealed transparent containers; in containers that do not fit properly	FSU1
	raw, partially cooked and cooked food products kept separate	FSU2
	previously cooked foods kept cool (i.e. ice box) or refrigerated	FSU3
	utensils cleaned with warm soapy water; cold soapy water; clean water with	FSU4

	no soap; dirty water with no soap	
	utensils covered properly	FSU5
	utensils cleaned adequately every time after use	FSU6

Appendix G: F Independent samples Mann-Whitney U test results



Total N	123
Mann-Whitney U	1,802.000
Wilcoxon W	1,955.000
Test Statistic	1,802.000
Standard Error	81.573
Standardized Test Statistic	11.045
Asymptotic Sig. (2-sided test)	.000

Appendix H: ANOVA test results

State of Food handling Practices									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	df2	Sig. F Change
1	0.805[a]	0.647	0.629	0.211	0.647	35.503	6	116	0.00
a. Predictors: (Constant), Environmental hygiene, protective clothing, stall conditions, food storage and utensils management, hand hygiene, hygiene related behaviour									

Appendix I: Results of Regression

Coefficients							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.765	.449		6.162	.000		
Hygiene related behaviour	-.098	.163	-.035	-.599	.551	.903	1.107
Food storage and utensils management	-.012	.073	-.010	-.169	.866	.959	1.043
Stall conditions	.304	.186	.093	1.641	.004	.945	1.058
Protective clothing	-1.023	.072	-.814	-14.190	.000	.923	1.084
Hand hygiene	.036	.154	.013	.234	.815	.930	1.076
Environmental hygiene	-.034	.088	-.023	-.388	.699	.857	1.166
a. Dependent variable: State of food handling practice							