THE KNOWLEDGE, ATTITUDES AND PRACTICES, AND COMPLIANCE REGARDING THE BASIC PREREQUISITE PROGRAMMES (PRPS) OF FOOD SAFETY MANAGEMENT SYSTEMS OF FOOD SERVICE WORKERS IN BOARDING SCHOOLS AND RESTAURANTS IN MASVINGO PROVINCE, ZIMBABWE.

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A minithesis submitted in partial fulfilment of the requirement for the degree of Masters of Public Health in the Faculty of Community and Health Sciences University of the Western Cape.

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KEY WORDS

Food safety; Compliance; Foodborne diseases; Prerequisite programmes; Food contamination; Personnel hygiene; Knowledge, attitude and practices; Restaurants; Boarding schools; Regulatory inspections; Food safety management systems

ACRONYMS

CAC	Codex Alimentarius Commission
EHP	Environmental Health Practitioner
FAO	Food and Agricultural Organisation
FSMS	Food Safety Management Systems
HACCP	Hazard Analysis Critical Control Point
ICMFS	International Commission on Microbiological Specifications for Foods
ISO	International Organisation of Standards
KAP	Knowledge, Attitudes and Practices
NDSC	National Disease Surveillance Centre
PRPs	Prerequisite Programmes
SI	Statutory Instrument
WHO	World Health Organisation

ABSTRACT

Introduction: Poor Knowledge, Attitudes and Practices (KAP) and lack of compliance with the basic prerequisite programmes (PRPs) of food safety management systems (FSMS) is a major challenge that affects safe food production throughout the world. The problem is more rampant in Africa where foodborne disease outbreaks are common. In Zimbabwe the impact of KAP and compliance on food safety management in schools and restaurants is not well described.

Aim: To determine the knowledge, attitudes, practices and compliance of food service workers with the basic PRPs of the FSMS in boarding schools and restaurants in Masvingo Province, Zimbabwe.

Methods: A cross-sectional descriptive study of basic PRPs of FSMS in restaurants and boarding schools. Data was collected through face-to-face interviews with food handlers and assessing of compliance with the basic PRPs of the FSMS. Data was entered into Excel, cleaned and exported to SPSS for analysis. Numerical data was analysed using descriptive statistics while frequencies were used to analyse categorical data. Bivariate analysis was used to establish difference in KAP and compliance between boarding schools and restaurants. Chi-squre test was used to assess statistical significance in differences between boarding schools and restaurants and among districts. A p-value of less than 0.05 was statistically significant, while anything greater than that was not.

Results: One hundred and thirty nine participants in 70 premises participated in the study. The knowledge of food safety was generally moderate amongst the participants, however practices did not match the knowledge in most cases. Overall, schools were better compared to restaurants in all variables that were assessed. Compliance with basic PRPs of FSMS was not satisfactory. Forty percent (56) of the particpants did not have food handler's medical

certificates and 48.6% (34) of the premises across districts did not have adequate toilet facilities for customers as required by law. Ninety two percent (128) of the participants had not been trained in safe food handling during the previous twelve months. Compliance was low although 65.2% (35) of restaurants and 29.6% (4) of schools had been inspected by EHPs within the past three months. This can be viewed as deliberate disregard of legislation on the part of food service workers and can be attributed to lack of training. Although EHPs are empowered to enforce food safety legislation including withdrawal of trading licenses and closure of non-compliant premises, but in this case these premises were still trading.

Conclusion: In spite of high inspection frequency by EHPs there was poor compliance by food service workers casting doubt on the effectiveness of these inspections. Ineffective enforcement of legislation by EHPs may be attributed to their training curriculum which does not cover practical implementation of food laws, while non compliance by food handlers can also be attributed to lack of training in safe food handling.

DECLARATION

I declare that **'THE KNOWLEDGE, ATTITUDES AND PRACTICES, AND COMPLIANCE REGARDING THE BASIC PREREQUISITE PROGRAMMES (PRPS) OF FOOD SAFETY MANAGEMENT SYSTEMS OF FOOD SERVICE WORKERS IN BOARDING SCHOOLS AND RESTAURANTS IN MASVINGO PROVINCE, ZIMBABWE'**, is my work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Faustino Zvenyika

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Food safety is a critical determinant of public health. Unsafe or contaminated food can be life threatening since food is such a fundamental component of human health (Ushewokunze-Obatolu 2008). Food can be contaminated by bacteria, viruses, parasites and chemical contaminants leading to over two hundred (200) known foodborne diseases (WHO 2006). Foodborne diseases are illnesses of an infectious or toxic nature resulting from the consumption of contaminated food or water (WHO 2006). Studies have demonstrated that the transmission of foodborne diseases is mostly as a result of food contamination due to poor preparation and handling of the food, leading to the introduction of contaminants into the food (Ucar, Yilmaz & Cakiroglu 2016; WHO 2006). The poor preparation and handling of food is due to poor knowledge, attitudes and practices in food handling and the disregard of food safety standards, contributing to most foodborne diseases throughout the world (Clayton *et al*. 2002).

These foodborne diseases mostly manifest as diarrhoeal in nature. Approximately 1.5 billion annual episodes of such diseases have been reported globally, of which 70% are estimated to be caused by contaminated food (FAO/WHO 2002a). These diarrhoeal diseases may in some cases lead to chronic life threatening conditions which include neurological, gynaecological or immunological disorders and in extreme cases multi-organ failure, cancer and death (Okareh & Erhahon 2015). Globally, food and waterborne diseases are estimated to cause more than 1.8 million deaths annually (WHO 2006; WHO 2008). The most severely affected are the sick, the elderly and children under 5 years old. In Africa it is estimated that diarrhoea contributes over 40% of deaths in children below 5 years old (WHO 2008; Ucar *et al*. 2016). The number of deaths related to foodborne diseases are estimated to be more than those

caused by malaria, AIDS, tuberculosis or any other disease. Diseases caused by contaminated food and water may lead to low nutrient intake resulting in malnutrition, thereby forming a vicious cycle of persistent malnutrition, particularly in children (WHO 2015b).

Food safety surveillance conducted in some African countries isolated various microorganisms, warranting public health concern, from significant proportions of food, water, food preparation surface and food handlers' hands (FAO/WHO 2002a). In Zimbabwe, 44.5% of the sampled food failed to meet national standards in a food safety surveillance conducted in 2003 (FAO/WHO 2005a). Thus sporadic outbreaks of food and waterborne diseases such as cholera, dysentery, typhoid and anthrax have been recurring in Zimbabwe on an annual basis (FAO/WHO 2002a; UNICEF 2016). Although there is no comprehensive data regarding foodborne diseases and related deaths in Zimbabwe, it is estimated that 40 deaths per 1000 are due to foodborne diseases (Kahindi 2016). For instance, Zimbabwe suffered a cholera epidemic that recorded an estimated 96 000 cases and claimed 4 000 lives during 2008-2009 due to contaminated food and water (Ahmed *et al*. 2011). It is evident that foodborne diseases continue to pose a significant threat to the public health of this country as highlighted by the persistent and frequent outbreaks of, for example, cholera and typhoid (FAO/WHO 2002a; UNCIEF 2016).

Food handling establishments can improve food safety by complying with the requirements of the prerequisite programmes (PRPs) of the food safety management systems (FSMS) as outlined in ISO (2005). The FSMS provide a set of general food safety requirements that apply to all organisations in the food chain. The PRPs of the FSMS combined with good knowledge, attitudes and practices towards these FSMS are the fundamentals of food safety (NDSC 2004; CAC/RCP 1999; Okareh & Erhahon 2015). The PRPs are described as the

basic conditions and practices that are critical to any food service establishment and the sustenance of a hygienic environment throughout the food chain. These PRPs differ by type of food processes taking place in an establishment (ISO 2005). PRPs such as cleaning and sanitation, food handler's hygiene and pest control among others are applicable to any food establishment in addressing general hygiene issues throughout the organisation (ISO 2005; Santa *et al*. 2013). Complementing the basic PRPs are WHO's five keys to safe food which require maintaining cleanliness, keeping raw and prepared foods separately, using safe water and raw materials, cooking thoroughly and keeping food in the appropriate temperature zones (WHO 2006). Thus it is recommended that every food handling establishment sets up in-house FSMS utilising at least the basic PRPs in order to protect the public from foodborne illnesses (Domech-Sanchez *et al*. 2011). Ushewokunze-Obatolu (2008) asserts that the basic PRPs of the FSMS were designed to safeguard consumers from hazardous practices, however according to her, some of these practices could be categorised as fraudulent in general, resulting in further threats to public health.

On the other hand, basic PRPs provide a foundation for a sustainable food safety system which is based on the principles of a hazard analysis critical control point (HACCP) (ISO 2005). HACCP is a "systematic way of identifying and evaluating potential food contamination points and controlling the hazards that are significant to food safety through implementing proactive preventive strategies" (CAC/RCP 2003) . Studies have however, shown that there are numerous challenges including particular technical expertise in implementing HACCP (FAO/WHO 2002a; Santa 2013; Lockis *et al*. 2011). Although it is not compulsory for food establishments to adopt HACCP in Zimbabwe, national food legislation requires that food establishments comply with the basic PRPs of food safety (FAO/WHO 2002b; WHO 2012; SI5 2015). This food legislation is enforced by the

department of environmental health in the Ministry of Health and Child Care or in local authorities. However, despite the legislative provisions on food safety, food in Zimbabwe continues to be highly contaminated (FAO/WHO 2002b). Foods produced and served in boarding schools and restaurants cannot be spared from vulnerability to contamination.

1.2 PROBLEM STATEMENT

It has been noted that food safety issues receive little attention in Zimbabwe, as in other African countries, due to low priority placed on food safety in these countries' national policies (FAO/WHO 2002a). Consequently, in Africa, foodborne diseases cause more deaths than malaria, AIDS, tuberculosis or any other disease especially in young children, the elderly and the immuno compromised (WHO 2006; WHO 2008). In Zimbabwe, evidence has shown that most of the food is contaminated with pathogens of public health concern despite the fact that, in this country, food and nutrition safety issues are considered to be a basic right for citizens (FAO/WHO 2006; FAO/WHO 2002a). There are a number of food products available on the market which do not adhere to the basic PRPs and compliance with the requirements of the FSMS, disregarding government legislation and thereby potentially endangering the health of consumers (Ushewokunze-Obatolu 2008). These practices continue in spite of compulsory basic PRPs of the FSMS which should be implemented in the food sector to improve food safety (PHA 15:09). Poor knowledge, attitude and practice (KAP) and lack of compliance with the basic PRPs of the FSMS is a major threat to food safety, especially in Zimbabwe where most foodborne infections go unrecorded (FAO/WHO 2002b). However, foodborne disease outbreaks have been reported in the news regarding schools where over 200 pupils suffered from diarrhoea in an outbreak attributed to unsafe food (Kadirire 2015); and a typhoid outbreak at another school was attributed to the consumption of unsafe water at the school (Sithole 2016).

There is a lack of scientific evidence on whether food service workers in restaurants and boarding schools in Masvingo Province comply with the basic PRPs of the FSMS and what the knowledge, attitudes and practices (KAP) of these food service workers are with reference to the basic PRPs.

1.3 PURPOSE

The purpose of this study is to determine the KAP and compliance with regards to the basic PRPs of the FSMS of food service workers in boarding schools and restaurants in Masvingo Province in Zimbabwe. The findings will be used to inform policy makers on the state of food safety in boarding schools and restaurants in this country. The information generated may be used to initiate programmes to improve food safety.

1.3.1. Study aim

The study was aimed at determining the knowledge, attitudes, practices and compliance of food service workers with the basic prerequisite programmes (PRPs) of food safety management systems in boarding schools and restaurants in Masvingo Province, Zimbabwe.

1.3.2. Study objectives

1) To determine the socio-demographic characteristics of food service workers.
2) To determine the knowledge regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools.

3) To determine the attitudes regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools.

4) To determine the practices regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools.

5) To determine the compliance of food service managers with the basic prerequisite programmes (PRPs) of food safety management systems in restaurants and boarding schools.

1.4 STRUCTURE OF THE MINITHESIS

Chapter 1 introduced the background to the research topic. The rationale and statement of the problem behind the research topic were highlighted. In addition to Chapter 1, there are five more chapters: Chapter 2 is the literature review which explores more extensively the background and the context of the research problem; this is achieved through critical appraisal of past and recent studies closely related to the one conducted by the researcher as well as by providing a framework establishing its importance and relevance. Chapter 3 highlights research methodology and design, sampling procedure, data collection methods and instruments, data handling and analysis; study limitations and ethical considerations are presented in this chapter as well. Chapter 4 provides results and interpretation while chapter 5 provides discussion of findings in relation to the literature. Finally Chapter 6 presents conclusions and recommendations emanating from the study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews literature on sources of food contamination, their impact on public health and how they are managed in schools and restaurants. It further provides an overview of the food safety system in Zimbabwe including the legislative provisions.

2.2 FOOD CONTAMINATION

2.2.1 Food contaminants and their impact on human health

Microbiological, chemical and physical agents are the three categories of food contaminants worldwide (IANR n.d.). A food contaminant can be defined as any biological, chemical or physical agent not intentionally added to food which may compromise food safety and suitability (ISO/TS 2009). Biological agents and chemical substances pose the risk of causing foodborne illnesses, while physical contaminants pose food hazards resulting in physical injury to the consumer and/or issues with quality and aesthetics. Microbiological and chemical contaminants are not visible to the naked eye while most physical contaminants are visible (IANR n.d.). Food contaminants cause up to about two hundred (200) known foodborne diseases (WHO 2006). Individually or in combination, these food contaminants subject humans to various diseases that pose varying degrees of threat to human health and life (Okareh & Erhahon 2015).

2.2.1.1 Microbiological contaminants

Microorganisms are found everywhere in the environment particularly in faeces, soil, waste, pests such as rodents and flies, domestic (cats and dogs) and farm animals, moulds on grains, raw materials and people (hands, fingers, nose secretions and skin) (WHO 2015b). Although these microorganisms can be found in large numbers to the extent that an average of one hundred thousand (100 000) bacteria can be found on each square centimetre of human skin, not all of them cause foodborne illnesses (WHO 2006). The indicator bacteria for food contamination are *Enterobacteriacea and Escherichia coli (E. coli).*

Enterobacteracea bacteria is a group of bacteria found in human and animal intestinal tracts. Examples are *Shigella and Salmonella*, where more than 10^4 per gram or 100 per milligram of ready-to-eat food is not acceptable. On the other hand if *E.coli* is found in food, it should not exceed 3 per gram of ready-to-eat food. The presence of these indicator bacteria in ready-to-eat food is a sign of contamination as a result of poor hygiene (WHO 2006). There are many biological causes of food contamination, gategorised as bacteria, viruses and parasites, the three broad groups of these contaminants (WHO 2015b). The hierarchy of foodborne diseases incidence due to these biological food contaminants differs from region to region depending on the knowledge, attitudes and practices (KAP) and compliance of food handlers with provisions of the basic prerequisite programmes (PRPs) of the FSMS. According to Ucar *et al*. (2016), in the United States of America, *Salmonella* caused the highest incidence (15.19 per 100 000 people) followed by *Campylobacter* (13.82 per 100 000). *Vibrio* was amongst the least common causes with an incidence of 0.51 per 100 000, followed by *Yersinia* (0.36) and *Cyclospora* (0.03).

Diseases resulting from these microbiological contaminants range from endocarditis, bacterial pneumonia, tumours in the brain, liver and lungs, cancer, bile duct inflammation,

jaundice, cramps, epilepsy, constipation, blurred vision, muscle weakness, dyspnoea, paralysis, brain damage, liver disease/cancer, heart attack, abdominal pains, blood poisoning, depression, meningitis, bloody diarrhoea, chronic fatigue, renal failure, irritant bowel, muscle pains through to arthritis (WHO 2015b; Ucar *et al*. 2016). Some of the biological food contaminants such as *Salmonella*, *Hepatitis A, V. Cholerae and E. coli* cause diseases that may lead to brain damage, heart attack, renal failure, abdominal cramps, fever, vomiting and nausea (WHO 2015b; Ucar *et al*. 2016). Further to that, *Hepatitis A* causes liver cancer, chronic fatigue and abdominal pains, while *V. cholereae* cause cholera which can cause a fatal diarrhea which can kill in as little as six hours (WHO 2015b).

Giardia, through unpasteurised milk, contaminated vegetables and water, can cause cramps, growth and cognitive impairment in children, while *T. solium* from undercooked, infected pork can lead to epilepsy; while *Echinoccocus* from dog faeces, through unhygienic conditions, can cause tumours in the liver, lungs and brain (WHO 2015b). Chinese fluke is found in undercooked fish and can cause bile duct inflammation and jaundice (WHO 2015b). *T. gondii* from cat faeces is a hygiene and undercooking issue which can cause arthritis, abdominal pains, diarrhoea and vomiting (WHO 2015b). *Listeria* can be found in ready-to-eat foods, processed meats, raw or undercooked meat, and can cause blood poisoning and meningitis (WHO 2015b), while *Brucella*, found in unpasteurised milk, can cause depression, chronic fatigue, muscle pain, arthritis and fever (WHO 2015b). *Leptospira* bacteria that is spread by animal urine, particularly among rodents, cause the disease Leptospirosis, which in extreme cases leads to potentially fatal infections of the kidney, liver, brain, lungs or heart (CDC n.d.).

2.2.1.1 Chemical contaminants

Chemical contaminants can be in the form of natural toxins, metals, environmental pollutants, chemicals used for treating animals, improperly used chemicals, pesticides, cleaning chemicals and improperly used food additives **(**WHO 2006). Although the common chemical contaminants in the chemical category of food contaminants are aflatoxin and cyanide (WHO 2015b), other types of chemicals are introduced into the food by containers and utensils that leach hazardous chemicals such as copper, lead and cadmium, resulting in food contamination (Rane 2011).

These chemical contaminants cause different diseases and condition in humans. According to Liu and Wu (2010), aflatoxins from poor storage of grain can cause deadly liver cancer (liver cirrhosis) and stunted growth as well as delayed development in children. Copper can cause headaches, stomach aches and dizziness with long term effects of high uptake leading to a decline in intelligence of young adolescents, as well as liver and kidney damage (Rane 2011).

2.2.1.2 Physical contaminants

A physical contaminant can be anything that is originally not part of the food and can be visibly seen by the naked eye. Some physical contaminants create issues with aesthetics and quality, while others pose hazardous concerns. The University of Nebraska-Lincoln describes hazardous food contaminants as "any extraneous object or foreign matter in a food item which may cause illness or injury to a person consuming the product" (UNL Food 2017). It is however noted that the spread of the problem due to physical contaminants is unknown because most incidents are said to go unreported.

According to the University of Nebraska-Lincoln, the most common physical contaminant of food is glass that may result in cuts, the sources of which include bottles, jars, light fixtures and utensils. Additionally, cuts, infection and choking can originate from wood, stones from fields, pellets, boxes and buildings. The same consequences, plus trauma from broken teeth, can also result from careless employee practices with reference to jewellery and personal belongings. Pest body parts and filth may also cause illness and increase trauma for the consumer (UNL Food 2017).

2.3 FOOD CONTAMINATION AND BASIC PREREQUISITE PROGRAMMES (PRP) OF FOOD SAFETY MANAGEMENT SYSTEMS (FSMS)

The majority of food contamination occurs during the preparation, handling and distribution stages, with hands being the most implicated transfer mechanisms of microorganisms (WHO 2006; Ucar *et al*. 2016). However, the contamination process is supported by various means that are generally associated with unhygienic conditions and practices. These conditions and practices include the undercooking of food, unhygienic behaviour, unsafe raw materials, leaching chemicals, poor temperature controls, contaminated water, food handlers' hands, utensils and equipment, and can all be summarised as vehicles of food contaminants (Rane 2011; Okareh & Erhahon 2015; Ucar *et al*. 2016). Knowledge, attitudes and practices (KAP) plus compliance with the basic prerequisite programmes of FSMS play a crucial role in determining whether food contamination is going to occur or not. Thus several studies have concluded that the food contamination process is largely linked to the food handlers' knowledge, attitude and practice (KAP) and compliance with the basic PRPs of the FSMS (NDSC 2004; WHO 2006; Okareh & Erhahon 2015).

2.3.1 Knowledge about the basic PRPs of the FSMS

In food safety management systems, relevant knowledge is critical in influencing appropriate attitudes and practices by providing the foundation for the development and preservation of preventive strategies and initiatives for food safety (FAO/WHO 2002a; WHO 2006; FAO 2012). Thus food handlers trained on effective food safety practices have increased the probability of producing safe food, providing long-term benefits to public health and business at large (Smith quoted in Kahindi 2016). According to Hedberg *et al*. (2006), the presence of Certified Kitchen Managers reduced the risk of the outbreak of foodborne illnesses in restaurants. Food handlers' knowledge is essential in distinguishing between being clean and being safe primarily because observing that something looks clean, does not mean that it is safe. For instance, according to WHO (2006), about 10 000 000 bacteria are required to make 1ml (one millilitre) of water appear unclean, yet in some cases it takes only 15-20 bacteria to cause illness. Hence knowledge on the transfer process of contaminants in foodborne disease is critical. For instance, knowing that hands can transfer microorganisms which contaminate food is important and may lead to using measures that break the transportation route of microorganisms from hands to food (WHO 2006). Hedberg *et al*. (2006) found that the presence of Certified Kitchen Managers was associated with the absence of bacteria from bare hands coming in contact with food in restaurants. Thus knowledge helps to modify practices. According to a study conducted by Garayoa *et al*. (2014) in Spain, some food handlers were not aware that they were directly responsible for ensuring food safety. This shows that these food handlers need training in order to learn that they are the first line of food defence.

2.3.2 Attitude towards the basic PRPs of the FSMS

Although having relevant knowledge is important in safe food production, it is the right attitude that makes things happen. A study conducted by Garayoa *et al*. (2014) found that although food handlers had an idea of the importance of separating raw food from cooked, they still mixed the containers. This is a clear demonstration that attitude can present barriers between knowledge and practice. Therefore the attitude of disregarding hygiene measures on the part of the food handler may enable pathogens from raw food to come into contact with cooked food and in some cases to survive and multiply into sufficient numbers to cause illness in consumers (Rane 2011). Bacteria such as Salmonella are found in human mouths, hands and nose secretions and can be transmitted to food through contact with these secretions if the food handler is not careful (Ucar *et al*. 2016).

Issues to do with attitude can also be organisation or management based; for example, prepared foods may not be kept in appropriate storage and temperature conditions because of the absence of, or simple disregard of, procedures (Rane 2011). Additionally, food can be contaminated by bacteria, such as Shigella, where an infected person is allowed to continue preparing food because management does not reinforce the removal of such persons from handling food (Ucar *et al*. 2016). Also bacteria such as S. aureus can be passed onto food if someone with a skin, nose or throat infection, or with inflammatory wounds, is allowed to continue working as a food handler (Ucar *et al*. 2016). Food handlers who are infected with viruses such as Hepatitis A and Norovirus may pass the viruses onto the consumer via the food, if they are allowed to continue handling the food (WHO 2006). Bacteria such as S. aureus cannot be eliminated by cooking, therefore transference must be prevented by the use of personnel protective clothing such as aprons and gloves in order to reduce skin to skin

contact and physical contact with food (Ucar *et al*. 2016)**.** Management should therefore provide and enforce the use of such personnel protective clothing.

2.3.3 Practices of the basic PRPs of the FSMS

Food handlers' practice may introduce hazards into the food through cross contamination when they store raw and cooked foods together (Rane 2011). Garayoa *et al.* (2014) reports that in a study conducted in Spain some food handlers self-reported that they had mixed containers loaded with raw materials and those with cooked food. This could introduce hazards through cross contamination between the raw material and prepared food (Rane 2011). WHO (2006) advises that raw materials should be separated from other foods in order to reduce the risk of cross contamination. For the same reason, they further advise that equipment and utensils used for handling raw foods and prepared foods should be separated, and that food should be kept in separate containers to avoid contact between cooked and raw food (WHO 2006). Ucar *et al*. (2016) claims that the practice of poor handling of food such as those related to inadequate preparation and improper cooking of food, insufficient processing, poor hygiene and the re-use of leftovers are responsible for causing 14% of foodborne diseases. This is consistent with WHO's (2006) assertion that proper cooking of food kills almost all microorganisms; thus foods, especially meat, poultry, eggs and seafood need to be cooked or reheated thoroughly to ensure that the core achieves at least 70°C for it to be safe. They advise that microwave ovens are effective technology for heating food quickly, however care must be taken because if not done properly, it can cook different portions of food to different temperatures, thereby exposing the consumer to undercooked/reheated food (WHO 2006).

In another scenario that demonstrates the impact of poor practice in food safety, a Norovirus outbreak investigation reported by Hedberg *et al*. (2006), notes that contributing factors identified during outbreak investigations showed that 65% of the outbreaks was largely due to food being handled by an infected person or a carrier. Furthermore, 35% of the outbreaks was attributed to bare hand handling/contact with food (Hedberg *et al*. 2006). This is consistent with the claim by Kahindi (2016) that studies have shown that food safety in Zimbabwe is compromised and that food contamination was largely due to lack of KAP and disregard of the basic PRPs of the SFMS as well as government legislation.

2.3.4 Compliance with the basic PRPs of the FSMS

Compliance is about adherence to legislative provisions (ISO 2005). Zimbabwean legislation requires that at least one handwash basin with hot and cold water is provided in food handling premises (SI5 2015); this will ensure regular hand washing. SI41 (1994) requires that all food handlers undergo periodic food handler's medical examination screening and certification of fitness (SI41 1994). It further says that "no person shall employ and no person shall undertake employment as a food handler unless he has been certified … free from Typhoid, enteric fever or any other infectious disease" (SI41 1994). It follows that employees should undergo medical examination prior to employment in food contact operations (Stier 2012). This provision is to safeguard or ensure that only healthy individuals handle food and thus prevent the transfer of pathogens from the handler to the food. The management of food processing areas should ensure that any worker who is sick or has open wounds is not allowed in the food handling environment; and to prevent possible contamination of food, such persons should avoid food contact surfaces and/or packaging materials (Stier 2012; SI41 1994). However this is only possible if the managers are properly trained themselves, as is elaborated in the study that involved kitchen managers demonstrating that establishments

with Certified Kitchen Managers had no outbreak of diseases related to hand-food contact (Hedberg *et al*. 2006).

The legislative requirements further elaborate that workers should wear hairnets which contain and cover all hair including beards/moustaches and ears. It is also a requirement that a food establishment has its own adequate number of toilet facilities which are clean, stocked with hand washing soap and toilet paper and must be functional (Stier 2012; ISO/TS 2009; SI5 2015). Summarily, basic PRPs are designed to operationalise compliance with legal requirements to prevent contamination and other food safety hazards.

Personnel Hygiene and Facilities, Storage, Water Quality and Raw Materials, Waste Management, Cleaning and Sanitisation, Pest Control, Training on Food and Personnel Hygiene to Improve Knowledge, Attitudes and Practices are some of the basic PRPs applicable in food handling premises in Zimbabwe. The food safety management standard requires organisations to select these PRPs utilising appropriate information including local legislation, recognised guidelines, principles and codes of practice as well as standards (ISO 2005). Essentially this means that the PRPs, local legislation, guidelines, principles and codes of standards complement each other as building blocks of the food safety system.

2.3.5 Personnel Hygiene and Facilities and the basic PRPs of the FSMS

This basic PRP is meant to address issues related to personnel hygiene and facilities, based on the understanding that hygiene of personnel plays a critical role in food safety. Studies have shown that poor personnel hygiene, especially accompanied by unhygienic practices and conditions, contribute significantly to foodborne disease outbreaks (De Donder *et al*. quoted in Lockis *et al*. 2011). Concurring with other studies Clayton *et al*. (2002) asserts that human

handling errors in food processing have been attributed to most foodborne diseases. This is so because poor personnel hygiene may lead to the transfer of bacteria such as staphylococcus, Salmonella and Shigella into food via unhygienic food handlers and handling conditions (Rane 2011). Studies conducted on school food vendors in Nigeria (Okareh & Erhahon 2015) and in grocery and dairy shops in Egypt revealed that food handlers' hands were contaminated with pathogens of public health concern (Fawzi, Gomaa & Bark 2009; Okareh & Erhahon 2015). These micro-organisms can be transferred by food handlers to food, thereby contaminating it. In this regard facilities are required to have adequate, clean, functioning hygiene-enabling facilities with adequate hand-washing facilities, hand-washing instructions and training on personnel hygiene (Stier 2012; ISO/TS 2009). It follows that good personnel hygiene and sanitary conditions in the food processing area form the essential components of any preventive programme of food safety (Clayton *et al*. 2002; Todd *et al*. 2007; ISO/TS 2009).

2.3.6 Food Storage and the basic PRPs of the FSMS

Poor storage of food attracts or harbours pests that feed on the stored foods, destroying the food and contaminating both raw and prepared foods with pathogens of various diseases in the process. It is therefore necessary to store food in a manner that allows for the inspection and cleaning of the storage areas to prevent pest proliferation (ISO/TS 2009; Lockis, 2011). Moulds can grow on improperly stored grain, producing Aflatoxin, a toxin that can cause one of the most deadly forms of liver cancers (WHO 2015b). Holding or storage temperature is known to fuel food poisoning if cooked food is stored between 5 and 60°C, especially if it is stored in that temperature range for more than two hours. Thus food prepared outside the home is more prone to causing foodborne infections, because they may be prepared in bulk and stored in the danger temperature zones for more than two hours.

According to a claim by Ucar *et al*. (2016) "improper heating of food such as undercooking, re-heating and waiting in the heat or improper cooling of the food account for 44% of the foodborne illnesses". Similarly, Rane (2011) concurs with Ucar *et al*. (2016) that storage and reheating at poor temperatures, leads to the likelihood of pathogens such as C. perfringens and B. cereus producing heat stable toxins that further leads to foodborne illnesses. Bacteria such as S. aureus requires an optimum temperature of 37˚C, and it lives in the human body especially nostrils. This bacteria spreads through human to human contact, it is also transmitted to food by the food handler (Ucar *et al*. 2016). Thus as in the case of C. perfringens and Salmonella, S aureus can also be prevented by the proper cooling and storage of food at appropriate temperatures, outside of the danger temperature zone and following proper sanitation and hygiene practices including pest management (Ucar *et al*. 2016). The optimum temperature for Shigella ranges from 10 to 48˚C, but 37˚C is the most preferred while Campylobacter prefers temperatures up to 45˚C, proliferating most at room temperature (Ucar *et al*. 2016). Campylobacter is highly infectious to the extent that less than 100 bacterial cells are enough to cause infection, depending on age and condition of the host; it is the bacteria responsible for gastroenteritis (Ucar *et al*. 2016). Although at 70˚C most microorganisms die in 30 seconds, C. perfringens spores can resist heat at 100˚C for up to one hour and can grow rapidly in food not adequately refrigerated and stored after cooking (Ucar *et al*. 2016). Thus it is estimated that left in their optimum temperature, one bacterium can become 2 in 15 minutes, thereby being able to grow to over a billion bacterial cells in 6 hours (WHO 2006).

As such, the national legislative provision through SI5 (2015), calls for provision of adequate storage facilities to be provided for the protection of foods from contaminants. Further to that,

storing raw and prepared food stuffs in the same refrigeration facility is discouraged because that may also cause cross contamination (WHO 2006).

2.3.7 Water quality and raw materials and the basic PRPs of the FSMS

2.3.7.1 Water quality

Water is usually used in most food preparation processes; it is also used for cleaning utensils, surfaces and hands of food handlers, and therefore its quality and quantity is a major determinant of the safety of the food product. Thus if the water is contaminated it can itself affect the food product by being a source of several disease pathogens (Woodall quoted in Lockis *et al*. 2011). Unsafe water can transmit Enteropathogens such as E. coli, Salmonella spp, Campylobacter spp, faecal streptococci, V. cholera, and many others (Rane 2011). In view of the risks posed by unsafe water, it is recommended that water for use in food production should meet WHO guidelines for drinking water (CAC/RCP 1999; WHO 2006). Thus food establishments are required to use clean water or to treat it to be safe, select fresh and wholesome foods, and not to use food beyond expiry dates (WHO 2006). According to SI5 (2015), water supply by the council or a water supply approved by the Director of Health Services is the only water recommended to be provided within the premises (SI5 2015). The risk posed by contaminated water in food safety is increased when it is used for drinking, the washing of food, incorporated in the food as an ingredient and used for washing equipment, hands and utensils (Rane 2011). Bacteria such as Salmonella can live in water for several weeks, up to several years in soil and a few days in faeces; and can also survive in cool environments, but is killed by heat (Ucar *et al*. 2016).

Contamination of water by coliforms and faecal coliforms is totally unacceptable as this is evidence that the bacteria is of faecal origin, confirming that numerous other microbiological contaminants are present. This further reinforces the fact that water quality and quantity play a critical role in food safety, yet little attention is paid to this aspect. Results of studies done in regions of Asia, Africa and South America raised a major concern due to the unavailability of potable water for various activities at many sites (Rane 2011). Furthermore, studies conducted on the bacterial quality of water used in some food outlets revealed contamination with coliforms and faecal coliforms; for instance in Trinidad and Tobago, 57.3% of water used by street food vendors was contaminated by coliforms (Rane 2011).

2.3.7.2 Other raw materials

Besides water, other raw materials are also important in the food safety matrix because they themselves can be contaminated and introduce biological, chemical and physical hazards into the food (Rane 2011). For example, contaminated vegetables and spices can pass spore forming bacteria such as Bacilli and clostridium, and pathogens such as L. monocytogenes, Shigella, Salmonella and many more onto the food (Rane 2011). Raw meat, poultry and vegetables are commonly contaminated with large numbers of pathogenic bacteria such as B. cereus, C. perfringens, C. jejuni, E. coli, E. monocytogenes, Salmonella and S. aureus (Rane 2011). While spices are known to harbour large numbers of microorganisms such as Bacili, anaerobic, sporeformers, enterococci, members of Enterobacteraceae, yeasts and moulds (Rane 2011). The situation is made worse by some vendors who in order to keep prices of their food low, buy cheap or adulterated ingredients containing unpermitted chemical additives from unauthorised suppliers (Rane 2011).

2.3.8 Waste management and the basic PRPs of the FSMS

Poorly managed waste attracts and provide harbourage for pests such as rodents, flies and other insects that infest the food in production areas, feeding, destroying and contaminating the food products in the process. It is therefore a requirement under the prerequisite programmes that waste must not be allowed to accumulate in the food handling area or storage environment in order to prevent food and water contamination (CAC/RCP 1999). Accordingly (SI5 2015) requires provision of approved sanitary accommodation (SI5, 2015), because improper waste disposal leads to transmission of enteric pathogens such as Salmonella, Shigella, and E. coli via vectors (Rane 2011).

2.3.9 Cleaning and sanitisation and the basic PRPs of the FSMS

Poor cleaning of surfaces does not remove microorganisms that contaminate the food, it is therefore important to clean effectively, sanitising surfaces and equipment. It is recommended that hot and cold water, as well as drying facilities, be provided in order to improve cleaning (CAC/RCP 1999; ISO/TS 2009). Effective cleaning of work surfaces, equipment and utensils is important to remove microorganisms that could contaminate, and subsequently multiply in, prepared foods reaching unacceptable levels that may cause illness to the consumer. Poor quality food contact material, coupled with improper cleaning practices, may lead to toxin formation, pathogen growth or recontamination (Rane 2011; CAC/RCP 1999). This is so because microorganisms grow by multiplication and they need food, water, time and warmth as optimum conditions. It is estimated that under ideal conditions, one bacteria can become 2 in 15 minutes, which could equal over a billion in 6 hours (WHO 2006). Thus the design, construction and maintenance of equipment and utensils is also critical in food safety, because poor maintenance of them may lead to the inability to

clean and sanitise surfaces effectively; this can result in the accumulation of food residues facilitating microbial growth leading to contamination (WHO 2006; Rane 2011; ISO/TS 2009). If a food handler is infected with a virus and continues to handle food, some viruses, such as hepatitis A and Norovirus, may be passed onto the food contact surfaces and subsequently onto the food (WHO 2006; Hedberg *et al*. 2006). Thus it is important to keep everything clean by washing hands, washing and sanitising all surfaces and equipment used for food preparation.

2.3.10 Pest control and the basic PRPs of the FSMS

Pests are a major threat to food suitability: apart from destroying food they also contaminate it with either pathogens, their body parts or excrements, as well as when their body makes contact with food and surfaces. Many insect species attack grain, and the moisture that can accumulate from their activities provides ideal conditions for the fungi, which can cause cancers in humans (WHO 2015b). Thus pests play a significant role in the transmission of foodborne contaminants in the premises through contamination of equipment, surfaces, food or water.

Pests such as rodents and cockroaches live in sewer lines feeding, walking on faecal matter and other contaminants and then carry the same to food and food preparation surfaces, utensils and water (WHO 2006). More so, rodents are known as vectors for multiple diseases such as leptospirosis that is spread through rodent urine. The control of pests therefore, is critical in the prevention and control of major foodborne diseases. Pest management strategies that integrate hygiene and good housekeeping are effective against several vectors if implemented on a regular basis to prevent or eradicate pest infestation (CAC/RCP 1999; ISO/TS 2009). In that regard, stacking should be done in such a way that materials are raised

off the floor, with a gap left between the walls and stored products, to allow for inspection and cleaning against pests and other adverse conditions to stored goods (ISO/TS 2009). However, the process of controlling pests with pesticides may result in the chemical poisoning of the food products; for that reason, it is also recommended that establishments use registered pest control contractors to ensure effectiveness and chemical safety (ISO/TS 2009). In view of this, WHO (2006) advocates for the protection of kitchen areas and food from pests, insects and other animals in order to limit the use of chemical pesticides. All in all, the degree of pest infestation on any premises summarises or provides a snapshot of the standard of hygiene.

2.4 TRAINING AND THE BASIC PRPS OF THE FSMS

Smith (quoted in Kahindi 2016) claims that, in Zimbabwe, the food safety management practices are poor within the food industry and that this has caused food contamination leading to illness; the claim further alleges that studies indicate that this is due to a lack of KAP and PRPs and disregard of government legislation. Although this may be a claim, it is an uncontested fact that food handlers with proper knowledge on food safety practices have increased the probability of producing safe food thus providing long-term benefits to public health (Hedberg *et al*. 2006). According to Smith (quoted in Kahindi 2016), food handlers training on safety practices has become one of the strategies to increase safe food production and offers long term benefits to food producers, manufacturers and the public. Thus training food handlers with regards to hygiene is critical as a means of improving food handlers' practices with regards to food safety because KAP plays a critical role in the food contamination matrix. For instance, it is estimated that up to 20% of foodborne disease outbreaks are due to contamination by the food handler (Okareh & Erhahon 2015; Clayton *et al*. 2002). Keeping food clean, separating raw and cooked food, cooking food thoroughly,

keeping food at safe temperatures, using safe water and raw materials are the five keys to safe foods that are linked to the KAP of the food handler (WHO 2006). Food handlers training on food and personnel hygiene to increase knowledge, improve attitudes and practices on preventing food contamination is a fundamental component of safe food production (NDSC 2004). A review of the effectiveness of food handlers training on knowledge and hygienic food handling in the United States revealed a significant improvement after training (Riben *et al*. 1998).

It is also imperative that management in the food sector are trained in their responsibility with regards to food hygiene principles and practices in order for them to be competent in the identification and management of potential risks (CAC/RCP 1999; FAO/WHO 2002b). Studies reported by Hedberg *et al*. (2006) assert that Certified Kitchen Managers were associated with the absence of bacteria as far as bare hand contact with food as a contributing factor to foodborne disease outbreak is concerned. Thus the presence of Certified Kitchen Manager reduces the risk of an outbreak of foodborne diseases in restaurants and other food handling establishments. In a clear demonstration of the negative impact of a lack of appropriate knowledge, Garayoa *et al*. (2014) reports in a study conducted in Spain, that some of the food handler respondents were not aware that they were directly responsible for ensuring food safety. Therefore they need to be trained to know that, as food handlers, they, themselves, are the first line of food defence. This is the primary reason for WHO advocating for food handlers training, producing the 10 Golden Rules for food safety in the early 1990s and then further simplifying them into the Five Keys to Safe Food poster in 2001. The Five Keys to Safe Food demonstrate that most foodborne diseases are preventable by keeping the food clean, separating raw and cooked foods, cooking food thoroughly, keeping food at safe temperatures, using safe water and raw materials. Thus most transmission of food

contaminants is related to hygiene, cooking and raw materials which is a result of poor KAP and lack of compliance with the PRPs of the FSMS which have been designed to address these issues.

2.5 FOOD CONTROL SYSTEM IN ZIMBABWE

In 1996 the Government of Zimbabwe adopted a policy of ensuring food and nutrition safety as a basic right for citizens (FAO/WHO 2002b). In the same policy, the government commits itself to providing safe and wholesome food to all citizens. It further dedicates itself to ensuring that food conform to the international standards of food quality and safety through national public health legislation (FAO/WHO 2005b). The policy is supportive of a number of existing legislative frameworks such as the Food and Foods Standard Act, Public Health Act, Dairy Act, Animal Health Act and other various existing and new supportive statutory instruments including SI41 of 1994 (Public Health Food Handlers Medical Examination), SI265 of 2002 (Food Labelling) and others. All these legislative frameworks operationalise the international food standards and are in place to support the commitment to food safety. Thus the food regulatory system in Zimbabwe consists of laws, bye laws and regulations under different ministries, Local Authorities and communities (FAO/WHO 2005e). These functions are answerable to the Food Safety Advisory Board **(**FSAB**)** that advises the Ministry of Health and Child Care (MoHCC) on food safety (FAO/WHO 2005e). Accordingly, the overall responsibility of food safety lies with the MoHCC while FSAB is responsible for advising MoHCC on policy issues, setting food standards and food legislation (FAO/WHO 2005b).

FSAB derives its advisory mandate from the Food and Foods Standards Act (FAO/WHO 2005b). The major players in the monitoring/surveillance, inspection/sampling programme

are Health, Agriculture, Industry and Trade, Local Government and Standards Association of Zimbabwe (SAZ) (FAO/WHO 2005b). The Ministry of Health and Child Care through Environmental Health Officers (EHO) assumes the overall regulatory authority/agency (which includes inspections, sampling, responding to any food safety challenges and outbreaks checking on adherence to legislation). This involves monitoring for compliance with food legislation of food at retail outlets and abattoirs, confiscating/destroying unsafe food as required by legislation (FAO/WHO 2005b).

Thus various pieces of national legislation support the basic PRPs of food safety management systems. For instance, SI41 (SI41) of 1994 supports personnel hygiene by prohibiting the employment of anyone as a food handler if he or she has not been medically cleared from infectious diseases. Additionally, the Public Health Act 15:09, in some sections talks of pest control and the prohibition of selling unwholesome, diseased or contaminated articles of food. It also talks about EHOs' appointments as food inspectors under the Act to perform various duties such as inspection of premises and articles of food, empowering them to take appropriate action (prosecution, closure, destruction) to protect public health. The Act further supports the PRP on raw materials by requiring subjection to further treatment of any water drawn from any public water supply system of any local authority before that water can be used in the process or manufacture of food.

The role of EHOs is therefore critical in compliance monitoring, because in the absence of compliance enforcement even the best food safety regulations and standards become ineffective (Mwamakamba *et al*. 2012; FOA 2008). Further, the Ministry of Agriculture through its Agricultural Research and Extension (AREX department) deal with crop safety while the Veterinary department deals with the safety of animal and animal products. Each

regulatory agent provides compliance interventions relevant to their functions (FAO/WHO 2005a).

It is reported that the FSAB is seen as a weak organisation, its members work on a part time basis and are only paid a sitting allowance; it has no operating budget and meets only three times a year. It is further reported that it is difficult for the FSAB to form a quorum since there is no incentive (FAO/WHO 2002b). The weakness of the FSAB is seen in the lack of policy implementation, for instance, according to FAO/WHO (2005b), there was no agenda for food safety training and there was no compulsory requirement for industries to adopt HACCP in Zimbabwe. However, this was so in spite of Zimbabwe being a member of Codex Alimentarius Comission and other organisations that set international food standards to which Zimbabwe should have been complying (FAO/WHO 2002b).

2.6 SUMMARY

Food contamination can be prevented by improving the KAP of food handlers and compliance with the prerequisite programmes of the FSMS. However it is generally recognised that there are gaps in food legislation and inadequate linkages between strategies to ensure food safety in Zimbabwe (FAO/WHO 2005a). The following chapter presents the methodologies applied to come up with the sample, sampling methods and data collection for the study.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter provides the aim and objectives of the study. It also provides the methodology which includes the study design, study setting and study population, the sampling strategy, inclusion and exclusion criteria, data collection methods and tools, data management and analysis, ethical considerations and study limitations.

3.2 STUDY AIM AND OBJECTIVES

3.2.1 Study aim

The study was aimed at determining the knowledge, attitudes, practices and compliance of food service workers with the basic prerequisite programmes (PRPs) of food safety management systems in boarding schools and restaurants in Masvingo Province, Zimbabwe.

3.2.2 Study objectives

1) To determine the socio-demographic characteristics of food service workers in boarding schools and restaurants in Masvingo Province, Zimbabwe.
2) To determine the knowledge regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools in Masvingo Province, Zimbabwe.
3) To determine the attitudes regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools in Masvingo Province, Zimbabwe.
4) To determine the practices regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools in Masvingo Province, Zimbabwe.

5) To determine the compliance of food service managers with the basic prerequisite programmes (PRPs) of food safety management systems in restaurants and boarding schools in Masvingo Province, Zimbabwe.

3.3 STUDY DESIGN

A cross-sectional study design was applied to determine the knowledge, attitudes and practices and compliance regarding the basic prerequisite programmes of the food safety management systems of food service workers in Masvingo Province. This study design enabled description of the state and distribution of the variables in food safety in Masvingo Province (Webb & Bain 2016) Cross-sectional study design is applicable for investigating exposures that are fixed characteristics such as knowledge, attitudes and practices and compliance (Bonita, Beaglehole & Kjellstrom 2006).

3.3.1 Study setting and study population

Masvingo Province is one of 10 provinces in Zimbabwe. It is situated in the south-eastern part of the country where it borders Mozambique to the south-east and South Africa to the south. There are 8 districts comprising of 1 urban and 7 rural districts. The province has a total population of 1 486 604 (Zimstats 2012) and has two towns, Masvingo City being the capital of the province. In this study, Masvingo city was regarded as a district, as it has its own health department, while Chiredzi town was regarded as part of Chiredzi rural district.

Twenty four public boarding schools are distributed all over the province although the majority of them are in Gutu district (8), while Chiredzi district and Masvingo city have the least number of boarding schools (1 each). Ninety-nine restaurants in the province are mainly

concentrated in Masvingo city where 48 of them are found. At district level, Chiredzi has the highest number of restaurants (13), while Mwenezi has the least (2).

3.3.2 Sample size calculation

The total study population consisted of 123 units: 24 boarding schools and 99 restaurants in Masvingo Province. The desired confidence level was set at 95%, the confidence limit at 5% and the design effect at 1.0. Using Epi Info 7.0, the sample was calculated to be 85 units (68 restaurants and 17 boarding schools). This was based on the assumption that 50% of this population would have the knowledge, positive attitudes and practices as well as comply with the basic prerequisite programmes of the food safety management systems.

3.3.3 Sampling strategy

A multi-stage cluster stratified sampling approach was used. The following figure, **Figure 3.1** provides a flow diagram of the sampling strategy that was used.

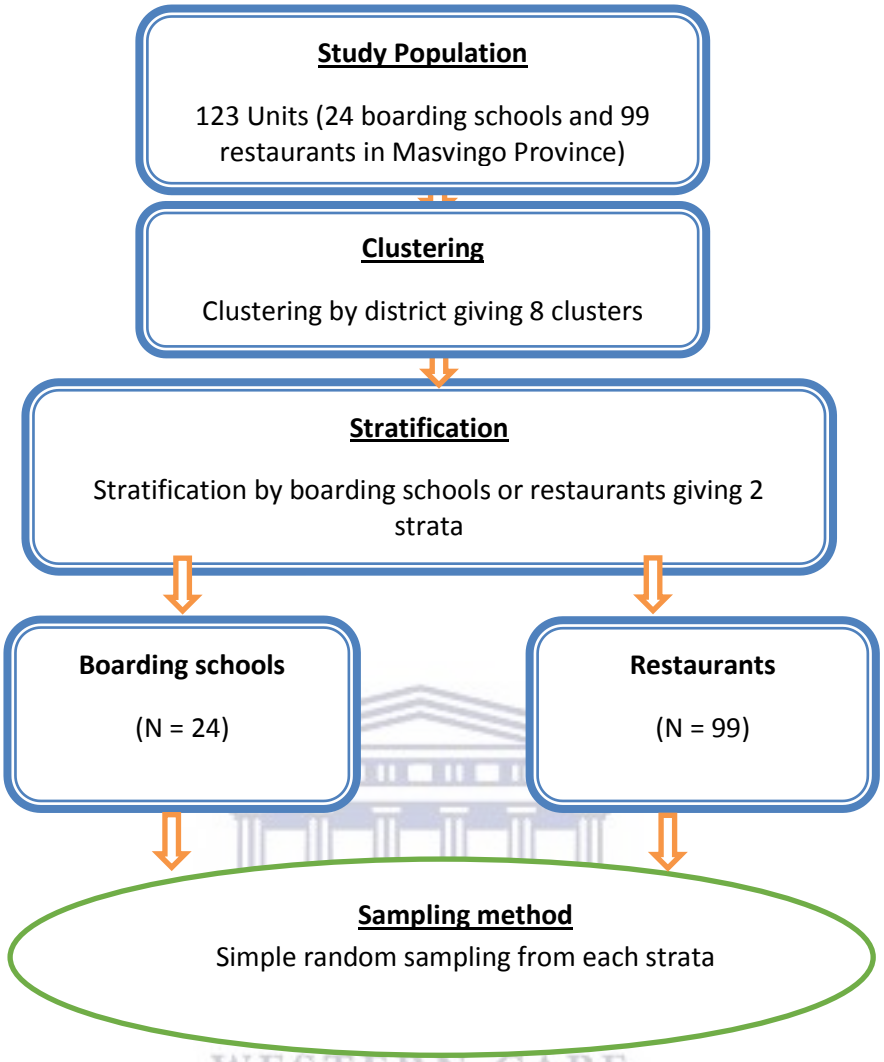

Figure 3.1: Multistage Sampling Flow Diagram

Multistage sampling was used in identifying the potential participating units as shown in **Figure 3.1** above. **The first stage** was dividing the province into clusters of which there were 8 (7 rural and 1 urban districts). **The second stage** was stratification by boarding schools and restaurants in each cluster. The stratification was necessary because of the differences between the characteristics of boarding schools and restaurants and also as the units were not proportionally distributed across the clusters. **The third stage** was drawing proportional

samples from each stratum using simple random sampling to identify the actual study units (17 boarding schools and 68 restaurants). The calculation of the proportions was based on the percentage contribution of a particular stratum in a cluster to the total study population. For example, Gutu district had 8 boarding schools in a province with 24, therefore it contributed 33%. As such 33% (6) of the 17 sample size of boarding schools was allocated to Gutu district (proportional allocation). The principle was applied to all strata in all clusters. Therefore boarding schools were drawn as follows: Gutu, 6 schools; Masvingo Rural, 3 schools; Masvingo Urban, 1 school; Mwenezi, 2 schools; Chiredzi, 1 school; Zaka, 1 school; Bikita, 2 schools and Chivi, 1 school. And the restaurants were: Gutu, 7 restaurants; Masvingo Urban, 33 restaurants; Masvingo Rural, 11 restaurants; Mwenezi, 1 restaurant; Chiredzi, 9 restaurants; Zaka, 2 restaurants; Bikita, 3 restaurants and Chivi, 2 restaurants.

In each stratum in a cluster, the names of the boarding schools or restaurants were written on a piece of paper, put in a container which was shaken; one piece of paper was then picked; the name on that piece of paper represented a study unit. The process was repeated until the desired proportion/number of study units of that stratum (boarding schools/ restaurants) in a particular cluster was achieved. The same approach was also applied in selecting the food service workers: 34 in the schools and 132 in restaurants. Purposive sampling was applied for 57 managers/supervisors because there are normally only a few at a single premises and they possess special information. In cases where the target worker respondent could not be found, the data collectors would choose another respondent from the same establishment.

3.3.4 Inclusion and exclusion criteria

1) The school had to be a public boarding school preparing and serving food to school children, not private boarding schools.
2) The restaurant had to be registered in Masvingo Province with a current licence and operating.
3) The food service worker had to be either one who worked as a food handler or as a manager or supervisor.

Those that did not meet the above criteria were excluded from the study.

3.4 DATA COLLECTION

3.4.1 Data collection methods and tools

A questionnaire (Appendix 6) and a structured observation checklist (Appendix 7) were used to collect the data on the knowledge, attitudes and practices and compliance regarding basic prerequisite programmes of the food safety management systems by food service workers in boarding schools and restaurants in Masvingo. These data collection tools were adopted and modified from Lockis *et al*. (2011) where they were used in a study on PRPs at schools.

These tools were fully developed and pilot tested in order to determine applicability in the field and ensure their validity and reliability. The testing was also to determine the time required to complete them.

Data was collected by the student Environmental Health Practitioners (EHPs) on field attachment to different stations in Masvingo Province; however if there were no students, a qualified EHP would collect. These data collectors were trained on 26 January 2017 in order

to standardise the application of the data collection tools and procedures so as to minimise errors related to data collection and collation. The training covered the study rationale, objectives, confidentiality, ethical issues and an overview of the benefit to general public health. The actual completion of the data collection tools was also covered.

3.4.1.1 The questionnaire (Appendix 6)

The questionnaire consisted of 26 questions divided into three sections. The section on socio-demographic status had questions on age, gender, education level, occupation, professional qualification and experience. The section on knowledge and attitudes consisted of questions on safe food preparation, food contamination, separation of raw and prepared food as well as pests. This section provided data regarding the participants' knowledge of food contamination, the contaminants and how to prevent them. The last section was on practices regarding the separation of raw and prepared foods, temperature control, hand washing, cleaning and raw materials. The possible answers to questions were provided as either Yes or No, or in some cases it was open-ended and the data collector would tick the appropriate response or write it as given. The questionnaire was completed with the food service managers and the food workers/handlers through face-to-face interviews.

3.4.1.2 The structured observation checklist (Appendix 7)

The structured observation checklist had 56 prompts and was divided into ten sections collecting data on basic PRPs, personnel hygiene and facilities, construction, waste management, documentation, water supply, storage, equipment, pest management, training and food preparation. The checklist was used for observation of the basic predetermined indicators in terms of basic PRP provision/availability. The food service worker's attitude and practices regarding waste management, putting on uniforms and protecting food were

observed. Thus the data collector observed compliance with the listed basic PRPs where the possible answers were listed as Yes or No and would tick a Yes if the PRP was complied with or No, where it would not have been complied with.

3.5 VALIDITY AND RELIABILITY

'Validity' is an expression of the degree to which a measurement measures what it purports to measure (Bonita *et al*. 2006). In this study it was addressed by including only registered restaurants and boarding schools in the sample, as these are expected to comply with the basic PRPs of the FSMS, since trading licenses are only issued to businesses which comply with basic PRPs. The accuracy of data collection tools were pilot tested in a province that had a similar study population that is on one food manager and one employee, at a boarding school and a restaurant in a district apart from Masvingo Province. Minor adjustments were made on construction of some of the questions that were found to be rather vague.

'Reliability' is the degree to which results obtained by a measurement procedure can be repeated, producing consistent results (Schoenbach & Rosamond 2000). In this study reliability was addressed through the study design which includes a large approximate sample size with p-value set at 95% confidence level, thus the findings would not be by chance. Both the questionnaire and the structured observation checklist were piloted and the data collectors, the EHPs, were trained in order to standardise the interviews for the questionnaire and the observation using the structured observation checklist. A structured observation checklist was preferred because it was inexpensive and provides opportunity for high objectivity as the researcher is able to observe issues on the ground. Although participants may display unnatural behaviour due to the presence of the researcher (Van den Broeck *et al*. 2013), in this study most of the observations were systems that were fixed and could not be

influenced by researcher presence, and it was not a requirement to ask people about their views or feelings (Robson 2011).

Systemic error or bias was addressed by random sampling of respondents to ensure representativeness, thus every unit in the province had equal opportunity for being included in the study. Although closed-ended questions have advantages in cross sectional studies because they gather specific information efficiently, they have their shortcomings as they limit the range of participant responses, thus possibly introducing invalidity or measurement bias from the data collection tools or methods. Bias was further reduced by training and standardising the data collectors, EHPs, in applying the questionnaires and the structured observation checklist. Data collectors had access to the researcher through cell phones to discuss sticking points. Face and content validity were addressed through discussion at a training session for EHPs and piloting the tools. Threat to internal validity (the extent to which the study results are 'true' in the studied population) was also dealt with by not announcing the survey prior to visiting the study sites.

3.6 DATA MANAGEMENT AND ANALYSIS

Information on questionnaires and structured observation checklists was double entered in Excel and imported into CDC Epi Info version 7.0 and SPSS for analysis. Data cleaning was done by comparing duplicate entries. Where there were variations, verification was done by checking the source of data sheets.

Demographic data was analysed using descriptive statistics. Categorical data was analysed using Pearson's Chi-square test where cell values were above 5 and Fisher's exact test was

used where cell values were less than 5 to establish differences in KAP and compliance with the basic PRPs of the FSMS. Statistical significance was set at $p \leq 0.05$.

3.7 ETHICS

Ethical approval was granted by the Ethics Committee of the University of the Western Cape in November 2016 (Appendix 1). In Zimbabwe, permission to conduct the study was granted by the Provincial Medical Director's office to gain access to restaurants under their jurisdiction. In boarding schools, permission was granted by the National Permanent Secretary for Education through recommendations from Masvingo Provincial Director of Education in the Ministry of Education (Appendix 2). The Medical Research Council of Zimbabwe also granted permission to conduct the study (Appendix 3). A participant information document (Appendix 4), explaining the rationale for the study, together with a written informed consent form (Appendix 5) were presented to the respondents in either Shona, the local language, or English, the predominant languages in the study area.

The autonomy and respect for the dignity of participants was adhered to through explaining to them that participation was not compulsory, the information they provided would remain confidential and that their identity would remain anonymous. This included going through the information sheet with the participants and requiring them to sign a voluntary consent form if they were agreeable to participating. With regards to the principle of nonmaleficence or the principle of no harm to research participants, it was explained that the process of data collection would not be harmful to them, everything possible would be done to protect them by maintaining confidentiality and protecting each participant's identity by using code names. The principle of justice, which deals with fair treatment, was addressed by simple random sampling in selection of the participants to ensure that all had equal opportunities of being selected. Furthermore, the principle of beneficence was explained to the participants in that

there would be no direct benefit to individual participants who took part in the study, but that the findings may assist the food sector in producing safer food, thereby benefiting the wider public health.

3.8 LIMITATIONS

The majority of questions used in this study were closed-ended. Although these had the advantage of gathering specific information efficiently, they limited the range of participant responses, and thus might have introduced measurement bias from the data collection tools or methods. Another limitation is that this study cannot be generalised throughout Zimbabwe because it was conducted in only one province out of the nine provinces of Zimbabwe.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

This chapter provides the findings of the current study which aimed at determining the KAP and compliance of food service workers with the basic PRPs of the FSMS in boarding schools and restaurants in Masvingo Province.

Specific objectives were:

1) To determine the socio-demographic characteristics of food service workers in restaurants and boarding schools in Masvingo Province, Zimbabwe.
2) To determine the knowledge regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools in Masvingo Province, Zimbabwe.
3) To determine the attitudes regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools in Masvingo Province, Zimbabwe.
4) To determine the practices regarding the basic prerequisite programmes (PRPs) of food safety management systems of food service workers in restaurants and boarding schools in Masvingo Province, Zimbabwe.
5) To determine the compliance of food service managers with the basic prerequisite programmes (PRPs) of food safety management systems in restaurants and boarding schools in Masvingo Province, Zimbabwe.

4.2 DEMOGRAPHIC DATA OF PARTICIPANTS

4.2.1 Number of participants by gender

The following table 4.2 shows the distribution of participants by gender and by district.

Table 4.1: Number of participants by gender and district (n-139)

District	Participant Gender		Total
	Male	Female	
Chiredzi Urban	9.7% (7)	7.5% (5)	8.6% (12)
Chiredzi Rural	4.2% (3)	7.5% (5)	5.8% (8)
Gutu	15.3% (11)	17.12% (12)	16.5% (23)
Masvingo Urban	30.6% (22)	47.8% (32)	38.8% (54)
Masvingo Rural	16.7% (12)	9.0% (6)	12.9% (18)
Mwenezi	4.2% (3)	4.5% (3)	4.3% (6)
Zaka	5.6% (4)	3.0% (2)	4.3% (6)
Chivi	5.6% (4)	0.0% (0)	2.9% (4)
Bikita	8.3% (6)	3.0% (2)	5.8% (8)
Totals	51.8% (72)	48.2% (67)	100% (139)

In table 4.1, one hundred and thirty nine (139) respondents participated in this study. The proportion of men (51.8%, n=72) was slightly higher than that of women (48.2%, n=67). The majority (38.8%, n=54) of the participants were from Masvingo urban. Chivi had the least 2.9% (4) number of participants. Masvingo urban constituted the majority (30.6%, n=22) of the overall male participants.

4.2.2 Number of restaurants and boarding schools by districts

The following table 4.2 shows the number of restaurants and boarding schools in each district.

Table 4.2: Number of restaurants and boarding schools by district (n=70)

		District									Total
		Chiredzi urban	Chiredzi Rural	Gutu	Masvingo Urban	Masvingo rural	Mwenezi	Zaka	Chivi	Bikita	
Type of premises	**Restaurant**	10.7% (6)	5.4% (3)	12.5% (7)	48.2% (27)	8.9% (5)	1.8% (1)	3.6% (2)	1.8% (1)	7.1% (4)	100% (56)
	Boarding school	0.0% (0)	7.1% (1)	35.7% (5)	0.0% (0)	28.6% (4)	14.3% (2)	7.1% (1)	7.1% (1)	0.0% (0)	100% (14)

The above table 4.2 shows that a total of 56 restaurants and 14 boarding schools were inspected to assess their compliance with the basic PRPs of the FSMS. The highest number of restaurants that were inspected were from Masvingo urban. Mwenezi and Chivi districts had the lowest number of premises that were sampled. The highest number of schools (35.7%, n=5) that were inspected were from Gutu district. No school premises were inspected in Chiredzi urban and Bikita.

4.2.3 Stratification of participants by age

The stratification of the study sample by age is shown in **Figure 4.1**.

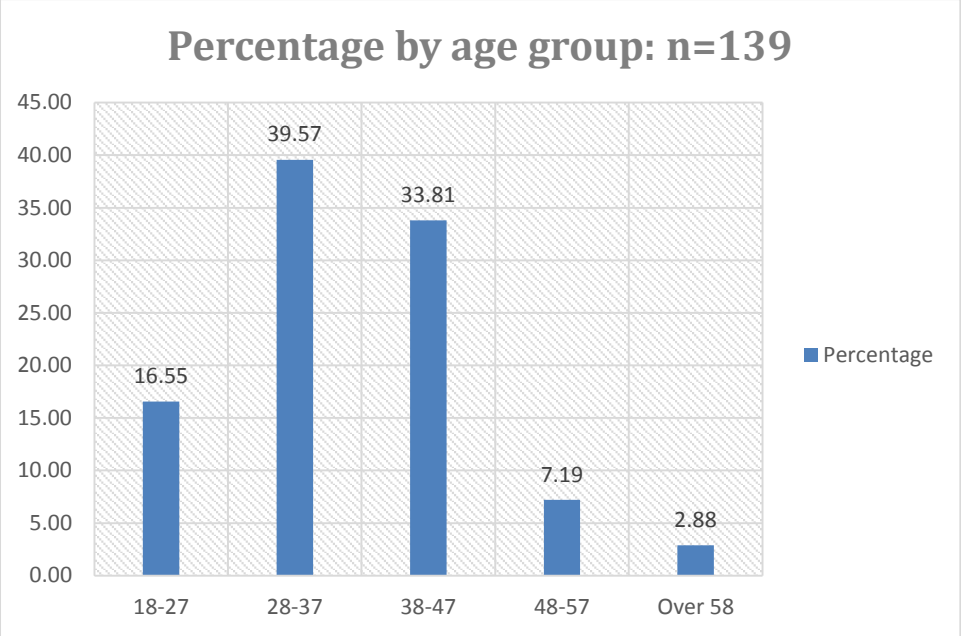

Figure 4.1: Study Population Stratified by Age

Stratifying by age, fig 1 shows that the majority (39.57%, n=55) of the participants were found in the 28-37 years age group. The 38-47 years age group constituted the second largest (33.81%, n=47) group of the participants. The 58+ years age group made up the smallest (2.88%, n=4) group of the participants.

4.2.4 Type of occupation by level of education

Table 4.3 shows the distribution of occupation by level of education.

Table 4.3: Type of Occupation by Level of Education

		Occupation						
		Cook	Waiter	Manger	Totals	χ^2	df	P-value
Educational level	Never been to school	100% (1)	0.00%(0)	0.00%(0)	100%(1)	29.03	6	0.01*
	Grade 1 to 7	80.00%(4)	20.00%(1)	0.00%(0)	100%(7)			
	Form 1 to 4	55.96% (61)	11.01% (12)	33.02% (36)	100%(109)			
	Form to 6	8.33%(2)	4.16%(1)	87.5%(21)	100%(24)			
	Total				100%(139)			

* Statistically significant if p=<0.05

The level of education influenced the type of job for an individual (χ^2=29.03; df=6; p<0.0001). The majority (87.5%; n=24) of those who attained education between form 5 and form 6 level (metric level) and 33.02% (36) of those who attained form form 1 to 4 education level were managers. Conversely none of those who had attained grade and below education level were managers/ supervisors. Only 8.33% (2) of those who had form 5 to 6 education level were cooks.

4.3 KNOWLEDGE OF THE BASIC PRPs OF FSMS

In the current study participant knowledge on basic PRPs was assessed under four broad concepts, namely knowledge of the five keys, food contamination, hand washing circumstances and cross contamination. These were assessed against personnel demographic variables that can influence knowledge. These personnel demographic variables were gender, type of occupation, education level, professional training, working experience, district and type of working environment that can influence knowledge.

4.3.1 Knowledge of the five keys, food contamination and hand washing by district

The following table 4.4 shows proportions of participant knowledge of the five keys, food contamination and hand washing by district.

Table 4.4: Knowledge of the five keys, food contamination and hand washing by district

		District									Totals	χ^2	df	P-value
		Chiredzi Urban	Chiredzi Rural	Gutu	Masvingo Urban	Masvingo Rural	Mwenezi	Zaka	Chivi	Bikita				
No. of keys mentioned out of the five keys to safer food	0	8.3%(1)	50.0%(4)	34.8%(8)	37.0%(20)	33.3%(6)	0.0%(0)	100.0%(6)	25.0%(1)	37.5%(3)	35.3% (49)	81.63	40	<0.01*
	1	66.7%(8)	12.5%(1)	21.7%(5)	33.3%(18)	27.8%(5)	0.0%(0)	0.0%(0)	25.0%(1)	12.5%(1)	28.1% (39)			
	2	16.7%(2)	0.0%(0)	21.7%(5)	25.9%(14)	27.8%(5)	50.0%(3)	0.0%(0)	50.0%(2)	25.0%(2)	23.7%(33)			
	3	0.0%(0)	12.5%(1)	17.4%(4)	1.9%(1)	5.6%(1)	0.0%(0)	0.0%(0)	0.0%(0)	25.0%(2)	6.5%(9)			
	4	8.3%(1)	25.0%(2)	4.3%(1)	1.9%(1)	5.6%(1)	33.3%(2)	0.0%(0)	0.0%(0)	0.0%(0)	5.6%(8)			
	5	0.0%(0)	0.0%(0)	0.0%(0)	0.0%(0)	0.0%(0)	16.7%(1)	0.0%(0)	0.0%(0)	0.0%(0)	0.7%(1)			
Totals		100%(12)	100%(8)	100%(23)	100%(54)	100%(18)	100%(6)	100%(6)	100%(4)	100%(8)	100%(139)			
No. of sources of food contamination in storage mentioned	0	25.0%(3)	62.5%(5)	56.5%(13)	43.4%(23)	50.0%(9)	0.0%(0)	0.0%(0)	75.0%(3)	37.5%(3)	42.8%(59)	84.4	32	<0.01*
	1	75.0%(9)	37.5%(3)	21.7%(5)	34.0%(18)	33.3%(6)	16.7%(1)	100.0%(6)	25.0%(1)	50.0%(4)	38.4%(53)			
	2	0.0%(0)	0.0%(0)	21.7%(5)	17.0%(9)	16.7%(3)	50.0%(3)	0.0%(0)	0.0%(0)	0.0%(0)	14.4%(20)			
	3	0.0%(0)	0.0%(0)	0.0%(0)	5.7%(3)	0.0%(0)	0.0%(0)	0.0%(0)	0.0%(0)	12.5%(1)	2.9%(4)			
	4	0.0%(0)	0.0%(0)	0.0%(0)	0.0%(0)	0.0%(0)	33.3%(2)	0.0%(0)	0.0%(0)	0.0%(0)	1.4%(2)			
Totals		100%(12)	100%(8)	100%(23)	100%(54)	100%(18)	100%(6)	100%(6)	100%(4)	100%(8)	100%(139)			

No. of any four circumstances mentioned requiring hand washing	0	0.0%(0)	62.5%(5)	39.1%(9)	24.1%(13)	33.3%(6)	33.3%(2)	66.7%(4)	25.0%(1)	62.5%(5)	31.9%(44)	71.48	32	<0.01*
	1	0.0%(0)	0.0%(0)	0.0(0)	1.9%(1)	0.0%(0)	0.0%(0)	33.3%(2)	0.0%(0)	12.51(1)	2.9%(4)			
	2	25.0%(3)	0.0%(0)	4.3%(1)	7.4%(4)	0.0%(0)	0.0%(0)	0.0(0)	0.0%(0)	0.0%(0)	5.8%(8)			
	3	50.0%(6)	0.0%(0)	17.4%(4)	35.2%(19)	5.6%(1)	33.3%(2)	0.0%(0)	0.0%(0)	0.0%(0)	23.2%(32)			
	4	25.0%(3)	37.5%(3)	39.1%(9)	31.5%(17)	61.1%(11)	33.3%(2)	0.0%(0)	75.0%(3)	25.0%(2)	36.2%(50)			
Totals		100%(12)	100%(8)	100%(23)	100%(54)	100%(18)	100%(6)	100%(6)	100%(4)	100%(8)	100%(139)			

* Statistically significant if p=<0.05

In table 4.4 above, the knowledge on the five keys to safer food, sources of food contamination in storage and any four circumstances requiring hand washing varied significantly (p<0.01) among districts. Zaka had the highest (100%) number of people who could not mention a single key to safer food. Only one person from Mwenezi district managed to mention the five keys to safer food.

At least 50% of participants from Chiredzi rural, Gutu, Masvingo rural and Chivi district could not mention a single source of contamination of stored food. Only 33.3% (2) participanrs from Mwenezi managed to mention four sources of food contamination for stored food, while the rest from other districts couldn't. Chiredzi and Bikita district had the highest (>62%) number of people who could not mention a single circumstance requiring hand washing. Masvingo rural and Chivi districts had a high level of knowledge on circumstances requiring hand washing.

4.3.2 Knowledge of cross contamination by district

The following table 4.5 shows participant knowledge on food contamination by district.

Table 4.5: Knowledge of cross contamination by district

	District												
	Chiredzi Urban	**Chiredzi Rural**	**Gutu**	**Masvingo Urban**	**Masvingo Rural**	**Mwenezi**	**Zaka**	**Chivi**	**Bikita**	**Totals**	**χ^2**	**df**	**P-value**
Yes, necessary to wash fruits and vegetable for salads	83.3% (10)	12.5% (1)	27.3% (6)	48.1% (26)	77.8% (14)	0.0% (0)	66.7% (4)	50.0% (2)	50.0% (4)	48.20% (67)	26.58	8	<0.01*
Yes, necessary to separate raw and cooked foods	100.0% (12)	50.0% (4)	100.0% (23)	75.9% (41)	94.4% (17)	83.3% (5)	100.0% (6)	100.0% (4)	87.5% (7)	85.61% (119)	21.10	8	0.01*
Yes, unsafe to leave cooked food between 5 and 65°C for more than 2 hours	58.3% (7)	75.0% (6)	47.8% (11)	88.7% (47)	72.2% (13)	50.0% (3)	100.0% (6)	75.0% (3)	87.5% (7)	74.10% (103)	20.65	8	0.01*
Yes, pests contaminate food	100.0% (12)	75.0% (6)	100.0% (23)	94.4% (51)	100.0% (18)	100.0% (6)	100.0% (6)	100.0% (4)	87.5% (7)	91.37%(127)	12.89	8	0.12
Yes, cannot see safety of water by merely looking at it	58.3% (7)	25.0% (2)	17.4% (4)	36.5% (19)	33.3 (6)%	0.0% (0)	33.3% (2)	0.0% (0)	25.0% (2)	30.22%(42)	11.81	8	0.16

* Statistically significant if p=<0.05

In table 4.5 above the knowledge on whether it was necessary to wash fruits and vegetables for salads, necessary to separate raw and cooked foods and unsafe to leave cooked food between 5 and 65˚C varied significantly (p=0.01). More than 50% of the participants from five districts conceded that it was necessary to wash fruits and vegetables for salads. Knowledge on whether it was necessary to separate raw and cooked foods and unsafe to leave cooked food between 5 and 65˚C, was generally high in most districts.

4.3.3 Knowledge of the five keys, food contamination and hand washing by type of premises

The following table 4.6 shows participant knowledge by type of premises.

Table 4.6: Knowledge of the five keys, food contamination and hand washing by type of premises

		Type of premises			χ^2	df	P-value
		Restaurants	Schools	Totals			
No. of keys mentioned out of the five keys to safer food	0	38.4%(43)	22.2%(6)	35.25%(49)	7.57	5	0.18
	1	28.6%(32)	25.9%(7)	28.06%(39)			
	2	22.3%(25)	29.6%(8)	23.74%(33)			
	3	5.4%(6)	11.1%(3)	6.47%(9)			
	4	5.4%(6)	7.4%(2)	5.76%(8)			
	5	0.0%(0)	3.7%(1)	0.72%(1)			
Totals		100%(112)	100%(27)	100%(139)			
No. of sources of food contamination in storage mentioned	0	40.5%(45)	51.9%(14)	37.41%(52)	11.20	4	0.02*
	1	41.4%(46)	25.9%(7)	35.97%(50)			
	2	14.4%(16)	14.8%(4)	11.51%(16)			
	3	3.6%(4)	0.0%(0)	4.32%(6)			
	4	0.0%(0)	7.4%(2)	5.76%(8)			
Totals		100%(112)	100%(27)	100%(139)			
No. of any four circumstances mentioned requiring hand washing	0	33.0%(37)	29.6%(8)	32.37%(45)	14.30	4	0.01*
	1	2.7%(3)	3.7%(1)	2.88%(4)			
	2	7.1%(8)	0.0%(0)	5.76%(8)			
	3	27.7%(31)	3.7%(1)	32.02%(32)			
	4	29.5%(33)	63.0%(17)	35.97%(50)			
Totals		100%(112)	100%(27)	100%(139)			

* Statistically significant if p=<0.05

Table 4.6 shows that knowledge on sources of food contamination and four circumstances to wash hands varied significantly between restaurants and schools (p=<0.02), with schools scoring better than restaurants. However, knowledge did not vary regarding number of keys to safer food.

4.3.4 Knowledge of cross contamination by type of premises

The following table 4.7 shows participant knowledge of cross contamination.

Table 4.7: Knowledge of cross contamination by type of premises

	Type of premises			χ^2	df	P-value
	Restaurants	Schools	Totals			
Yes, necessary to wash fruits and vegetable for salads	52.3%(58)	33.3%(9)	48.20%(67)	3.11	1	0.07
Yes, necessary to separate raw and cooked foods	84.8%(95)	88.9%(24)	85.61%(119)	0.29	1	0.59
Yes, unsafe to leave cooked food between 5 and 65˚C for more than 2 hours	79.3%(88)	55.6%(15)	74.10%(103)	6.46	1	0.01*
Yes, pests contaminate food	94.6(106)	100.0%(27)	95.68%(133)	1.51	1	0.21
Yes, cannot see safety of water by merely looking at it	32.7%(36)	22.2%(6)	30.21%(42)	1.13	1	0.289

* Statistically significant if p=<0.05

Table 4.7 shows that knowledge on whether it was necessary to wash fruits and vegetables for salads and that one cannot see the safety of water was better in restaurants than schools but there was no significant difference between the two types of premises. Although there was no significant difference in knowledge between restaurants and schools, regarding need to separate cooked and raw foods and that pest contaminate food in emereged that those in schools had better knowledge. The knowledge on whether it swas unsafe to leave cooked food between 5 and 65˚C varied significantly (p=<0.01) between restaurants and schools, it was high (79.3%; n=8) in restaurants with 55.6% (n=8)in schools.

4.3.5 Knowledge of the five keys, food contamination and hand washing by age

The following table 4.8 summarises participant knowledge on five keys, food contamination and hand washing by age category.

Table 4.8: Knowledge of the five keys, food contamination and hand washing by age

		Age category						χ^2	df	P-value
		18-27	**28-37**	**38-47**	**48-57**	**over 58**	Totals			
No. of keys mentioned out of the five keys to safer food	0	43.5%(10)	36.4%(20)	29.8%(14)	50.0%(5)	0.0%(0)	35.25%(49)	32.18	20	0.04*
	1	26.1%(6)	29.1%(16)	31.9%(15)	10.0%(1)	25.0%(1)	28.06%(39)			
	2	17.4%(4)	25.5%(14)	27.7%(13)	20.0%(2)	0.0%(0)	23.74%(33)			
	3	0.0%(0)	1.8%(1)	8.5%(4)	20.0%(2)	50.0%(2)	6.47%(9)			
	4	13.0%(3)	5.5%(3)	2.1%(1)	0.0%(0)	25.0%(1)	5.76%980			
	5	0.0%(0)	1.8%(1)	0.0%(0)	0.0%(0)	0.0%(0)	0.72%(1)			
Totals		23	55	47	10	4	100%(139)			
No. of sources of food contamination in storage mentioned	0	21.7%(5)	49.1%(27)	37.0%(17)	70.0%(7)	75.0%(3)	42.45%(59)	19.78	16	0.23
	1	56.5%(13)	32.7%(18)	43.5%(20)	20.0%(2)	0.0%(0)	38.13%(53)			
	2	17.4%(4)	9.1%95)	19.6%(9)	10.0%(1)	25.0%(1)	14.39%(20)			
	3	4.3%(1)	5.5%(3)	0.0%(0)	0.0%(0)	0.0%(0)	3.60%(5)			
	4	0.0%(0)	3.6%(2)	0.0%(0)	0.0%(0)	0.0%(0)	1.44%(2)			
Totals		23	55	47	10	4	100%(139)			
No. of any four circumstances mentioned requiring hand washing	0	40.9%(9)	34.5%(19)	19.1%(9)	70.0%(7)	0.0%(0)	31.65%(44)	29.96	16	0.02*
	1	13.6%(3)	1.8%(1)	0.0%(0)	0.0%(0)	0.0%(90)	2.88%(4)			
	2	4.5%(1)	5.5%(3)	6.4%(3)	0.0%(0)	25.0%(1)	5.76%(8)			
	3	22.7%(5)	21.8%(12)	25.5%(12)	10.0%(1)	50.0%(2)	23.02%(32)			
	4	18.2%(4)	36.4%(20)	48.9%(23)	20.0%(2)	25.0%(1)	36.69%(51)			
Totals		23	55	47	10	4	100%9139)			

* Statistically significant if p=<0.05

The above table 4.8 shows that age significantly influenced knowledge on the need to wash hands (p=0.02) and the five keys to safer food (p=0.04) among different age categories. However, knowledge on the five keys was low across all age categories. The 48 to 57 years age category had the highest proportion (50%; n=5) who could not mention any one of the five keys to safer food. There was no difference in knowledge regarding sources of food contamination in storage.

4.3.6 Knowledge of cross contamination by age

Table 4.9 summarises participant knowledge on contamination across age categories.

Table 4.9: Knowledge of cross contamination by age

	Age category								
	18-27	**28-37**	**38-47**	**48-57**	**over 58**	**Totals**	**χ^2**	**df**	**P-value**
Yes, necessary to wash fruits and vegetables for salads	56.5%(13)	41.8%(23)	57.4%(27)	22.2%(2)	50.0%(2)	48.20%(67)	5.57	4	0.23
Yes, necessary to separate raw and cooked foods	82.6%(19)	78.2%(43)	93.6%(44)	90.0%(9)	100.0%(4)	85.61%(119)	5.90	4	0.21
Yes, unsafe to leave cooked food between 5 and 65˚C for more than 2 hours	87.0%(20)	72.2%(39)	76.6%(36)	60.0%(6)	50.0%(2)	66.91%(93)	4.52	4	0.34
Yes, pests contaminate food	87.0%(20)	96.4%(53)	97.9%(45)	100.0%(10)	100.0%(4)	94.96%(132)	5.47	4	0.24
Yes, cannot see safety of water by merely looking at it	50.0%(11)	29.6%(16)	23.4%(11)	20.0%(2)	50.0%(2)	30.22%(42)	6.30	4	0.18

* Statistically significant if p=<0.05

In table 4.9 above age did not influence knowledge on cross contamination, where it was low, moderate or high, it was the same across all age categories.

4.3.7 Knowledge of the five keys, food contamination and hand washing by gender

Table 4.10 shows participant knowledge by gender.

Table 4.10: Knowledge of the five keys, food contamination and hand washing by gender

		Gender			χ^2	df	P-value
		Males	Females	Totals			
No. of keys mentioned out of the five keys to safer food	0	36.1%(26)	34.3%(23)	35.25%(49)	3.9	5	0.56
	1	27.8%(20)	28.4%(19)	28.06%(39)			
	2	26.4%(19)	20.9%(14)	23.74%933)			
	3	6.9%(5)	6.0%(4)	6.47%(9)			
	4	2.8%(2)	9.0%(6)	5.76%(8)			
	5	0.0%(0)	1.5%(1)	0.72%91)			
Totals		72	67	100%(139)			
No. of sources of food contamination in storage mentioned	0	38.9%(28)	47.0%(31)	42.45%(59)	1.86	4	0.76
	1	38.9%(28)	37.9%(25)	38.13%(53)			
	2	16.7%(12)	13.6%(9)	15.11%(21)			
	3	4.2%(3)	1.5%(1)	2.88%(40			
	4	1.4%(1)	1.5%(1)	1.44%(2)			
Totals		72	67	100%(139)			
No. of any four circumstances mentioned requiring hand washing	0	31.9%(23)	32.8%(22)	32.37%(45)	4.25	4	0.37
	1	4.2%(3)	1.5%(1)	2.88%(4)			
	2	2.8%(2)	9.0%(6)	5.76%(8)			
	3	20.8%(15)	25.4%(17)	23.02%(32)			
	4	40.3%(29)	31.3%(21)	35.97%(50)			
Totals		72	67	100%(139)			

* Statistically significant if p=<0.05

Table 4.10 above shows that knowledge on the five keys to safer food, sources of food contamination in storage and any four circumstances requiring washing hands was generally low and did not vary significantly by gender although males were more knowledgeable than females on circumstances requiring one to wash hands.

4.3.8 Knowledge of cross contamination by gender

Table 4.11 shows participant knowledge of cross contamination by gender.

Table 4.11: Knowledge of cross contamination by gender

	Gender			χ^2	df	P-value
	Males	**Females**	Totals			
Yes, necessary to wash fruits and vegetables for salads	51.4%(37)	45.5%(30)	48.20%(67)	0.48	1	0.48
Yes, necessary to separate raw and cooked foods	88.9%(64)	82.1%(55)	85.61%(119)	1.30	1	0.25
Yes, unsafe to leave cooked food between 5 and 65˚C for more than 2 hours	76.4%(55)	72.7%(4)	74.82%(104)	0.24	1	0.62
Yes, pests contaminate food	95.8%(69)	95.5%(64)	95.68%(133)	0.01	1	0.92
Yes, cannot see safety of water by merely looking at it	29.6%(21)	31.8%(21)	30.22%(42)	0.08	1	0.77

* Statistically significant if p=<0.05

Table 4.11 shows that gender did not influence responses (p=>0.05) on whether it was necessary to wash fruits and vegetables for salads, necessary to separate raw and cooked foods, unsafe to leave cooked food between 5 and 65˚C, that pests contaminate food and whether one can see whether water was safe by merely looking at it. Although not significant, males were generally more knowledgeable regarding cross contamination than females.

4.3.9 Knowledge of the five keys, food contamination and hand washing by education

The following table 4.12 summarises participant knowledge of the five keys, food contamination and hand washing by education.

Table 4.12: Knowledge of the five keys, food contamination and hand washing by education

		Education level					χ^2	df	P-value
		Never been to school	Up to grade 7	Form 1 to Form 4	Form 5 to Form 6	Totals			
No. of keys mentioned out of the five keys to safer food	0	100.0% (1)	20.0% (1)	33.9% (37)	41.7% (10)	35.25%(49)	5.08	15	1.00
	1	0.0% (0)	40.00% (2)	27.5% (30)	29.2% (7)	28.06%(39)			
	2	0.0% (0)	40.0% (2)	24.8%(27)	16.7% (4)	23.74%(33)			
	3	0.0% (0)	0.0% (0)	6.40% (7)	8.30% (2)	6.47%(9)			
	4	0.0%(0)	0.0%(0)	6.40%(7)	4.20%(1)	5.76%(8)			
	5	0.0%(0)	0.0%(0)	9%(1)	0.0%(0)	0.72%(1)			
Totals		1	5	109	24	100%(139)			
No. of sources of food contamination in storage mentioned	0	100.00%(1)	60.00%(3)	41.70%(45)	41.70%(10)	42.45%(59)	4.77	12	0.96
	1	0.0%(0)	40.0%(2)	38.9%(42)	37.5%(9)	38.13%(53)			
	2	0.0%(0)	0.00%(0)	13.90%(15)	20.80%(5)	15.11%(21)			
	3	0.0%(0)	0.0%(0)	3.7%(4)	0.0%(0)	2.88%(4)			
	4	0.0%(0)	0.0%(0)	1.9%(2)	0.0%(0)	1.44%(2)			
Totals		1	5	109	24	100%(139)			
No. of any four circumstances mentioned requiring hand washing	0	0.0%(0)	40.0%(2)	33.0%(36)	29.2%(7)	32.37%(45)	5.07	12	0.95
	1	0.0%(0)	0.0%(0)	3.7%(4)	0.0%(0)	2.88%(4)			
	2	0.0%(0)	0.0%(0)	6.4%(7)	4.2%(1)	5.76%(8)			
	3	0.0%(0)	40.00%(2)	21.10%(23)	29.20%(7)	23.02%(32)			
	4	100.0%(1)	20.0%(1)	35.8%(39)	37.5%(9)	35.97%(50)			
Totals		1	5	109	24	100%(139)			

* Statistically significant if p=<0.05

Table 4.12 above academic qualification did not influence knowledge on the five keys to safer food, sources of food contamination in storage and circumstances requiring hand washing (p=>0.05). However, those who had attained education level between form 1 and 4 had better knowledge than the others although it did not make significant difference.

4.3.10 Knowledge of cross contamination by education

The following table 4.13 shows participant knowledge of cross contamination by education.

Table 4.13: Knowledge of cross contamination by education

	Education level					χ^2	df	P-value
	Never been to school	Up to grade 7	Form 1 to Form 4	Form 5 to Form 6	Totals			
Yes, necessary to wash fruits and vegetable for salads	0.0%(0)	40.0%(2)	50.0%(54)	45.8%(11)	48.20%(67)	1.25	3	0.74
Yes, necessary to separate raw and cooked foods	0.0%(0)	100.0%(5)	84.4%(92)	91.7%(22)	85.61%(119)	7.63	3	0.05*
Yes, unsafe to leave cooked food between 5 and 65˚C for more than 2 hours	100.0%(1)	60.0%(3)	75.0%(81)	75.0%(18)	74.10%(103)	0.92	3	0.82
Yes, pests contaminate food	100.0%(1)	100.0%(5)	94.5%(103)	100.0%(24)	95.68%(133)	1.73	3	0.63
Yes, cannot see safety of water by merely looking at it	0.0%(0)	40.0%(2)	30.6%(33)	30.4%(7)	30.22%(42)	0.65	3	0.88

* Statistically significant if p=<0.05

Table 4.13 shows that academic level did not influence knowledge on whether it was necessary to wash fruits and vegetables for salads, unsafe to leave cooked food between 5ºC and 65˚C, that pests contaminate food and whether it was possible to see whether water was safe by merely looking at it. However academic knowledge had significant influence on whether it was necessary to separate raw and cooked food (X^2 =7.63; df 3; p=0.05). Knowledge level was generally high in most of the questions.

4.3.11 Knowledge of the five keys, food contamination and hand washing by professional qualifications

The following table 4.14 shows participant knowledge of the five keys, food contamination and hand washing by professional qualifications.

Table 4.14: Knowledge of the five keys, food contamination and hand washing by professional/technical qualifications

			Professional/technical qualifications					χ^2	df	P-value
		Nothing	Certificate	Diploma	Degree	More than a degree	Totals			
No. of keys mentioned out of the five keys to safer food	0	38.6%(17)	29.2%(19)	28.6%(4)	45.5%(5)	80.0%(4)	35.25%(49)	31.13	20	0.10
	1	27.3%(12)	32.3%(21)	14.3%(2)	36.4%(4)	0.0%(0)	28.06%(39)			
	2	22.7%(10)	29.2%(19)	28.6%(4)	0.0%(0)	0.0%(0)	23.74%(33)			
	3	2.3%(1)	4.6%(3)	21.4%(3)	9.1%(1)	20.0%(1)	6.47%(9)			
	4	9.1%(4)	4.6%(3)	0.0%(0)	9.1%(1)	0.0%(0)	5.76%(8)			
	5	0.0%(0)	0.0%(0)	7.1%(1)	0.0%(0)	0.0%(0)	0.72%(1)			
Totals		44	65	14	11	5	100%(139)			
No. of sources of food contamination in storage mentioned	0	40.9%(18)	40.6%(26)	35.7%(5)	63.6%(7)	60.0%(3)	42.45%(59)	16.47	16	0.40
	1	45.5%(20)	39.1%(25)	28.6%(4)	18.2%(2)	40.0%(2)	38.85%(54)			
	2	11.4%(5)	17.2%(11)	14.3%(2)	18.2%(2)	0.0%(0)	14.39%(20)			
	3	2.3%(1)	3.2%(2)	14.3%(2)	0.0%(0)	0.0%(0)	2.88%(4)			
	4	0.0%(0)	1.6%(1)	7.1%(1)	0.0%(0)	0.0%(0)	1.44%(2)			
Totals		44	65	14	11	5	100%(139)			
No. of any four circumstances mentioned requiring hand washing	0	34.1%(15)	26.2%(17)	35.7%(5)	54.5%(6)	40.0%(2)	32.37%(45)	25.15	16	0.11
	1	9.1%(4)	0.0%(0)	0.0%(0)	0.0%(0)	0.0%(0)	2.88%(4)			
	2	6.8%(3)	6.2%(4)	7.1%(1)	0.0%(0)	0.0%(0)	5.76%(8)			
	3	13.6%(6)	36.9%(24)	7.1%(1)	9.1%(1)	0.0%(0)	23.02%(32)			
	4	36.4%(16)	30.8%(20)	50.0%(7)	36.4%(4)	60.0%(3)	35.97(50)%			
Totals		44	65	14	11	5	100%(139)			

* Statistically significant if p=<0.05

In table 4.14 professional qualification did not influence knowledge on the five keys to safer food, sources of contamination in stored food and any four circumstances requiring hand washing. However the level of knowledge was generally lower in most of the questions.

4.3.12 Knowledge of cross contamination by professional qualifications

The following table 4.15 shows participant knowledge of cross contamination by professional qualifications.

Table 4.15: Knowledge of cross contamination by professional/technical qualifications

		Professional/technical qualifications							
	Nothing	**Certificate**	**Diploma**	**Degree**	**More than a degree**	**Totals**	**χ^2**	**df**	**P-value**
Yes, necessary to wash fruits and vegetables for salads	56.8%(25)	50.0%(32)	35.7%(5)	45.5%(5)	0.0%(0)	48.20%(67)	6.94	4	0.14
Yes, necessary to separate raw and cooked foods	84.1%(37)	83.1%(54)	85.7%(12)	100.0%(11)	100.0%(5)	85.61%(119)	3.11	4	0.54
Yes, unsafe to leave cooked food between 5 and 65˚C for more than 2 hours	70.5%(31)	75.4%(49)	92.3%(12)	72.7%(8)	60.0%(3)	74.10%(103)	3.16	4	0.53
Yes, pests contaminate food	93.2%(41)	95.4%(62)	100.0%(14)	100.0%(11)	100.0%(5)	95.68%(133)	2.03	4	0.73
Yes, cannot see safety of water by merely looking at it	40.9%(18)	31.7%(20)	21.4%(3)	9.1%(1)	0.0%(0)	30.22%(42)	7.39	4	0.16

* Statistically significant if p=<0.05

Table 4.15 shows that professional qualifications did not influence knowledge on whether it was necessary to wash vegetables for salads, necessary to separate raw and cooked food, unsafe to leave cooked food between 5 and 65˚C, that pests contaminate food and whether it is possible to see safety of water by merely looking at it. The knowledge level was generally high in all questions except for whether it was necessary to wash fruits and vegetables for salads and whether it was possible to see safety of water by merely looking at it**.**

4.3.13 Knowledge of the five keys, food contamination and hand washing by occupation

The following table 4.16 shows participant knowledge of the five keys, food contamination and hand washing by occupation.

Table 4.16: Knowledge of the five keys, food contamination and hand washing by occupation

		Occupation				χ^2	df	P-value
		Cook	**Waiter**	**Supervisor/ Manager**	Totals			
No. of keys mentioned out of the five keys to safer food	0	33.8%(23)	35.7%(5)	36.8%(21)	35.25%(49)	6.75	10	0.75
	1	26.5%(18)	42.9%(6)	26.3%(15)	28.06%(39)			
	2	26.5%(18)	14.3%(2)	22.8%(13)	23.74%(33)			
	3	4.4%(3)	0.0%(0)	10.5%(6)	6.47%(9)			
	4	7.4%(5)	7.1%(1)	3.5%(2)	5.76%(8)			
	5	1.5%(1)	0.0%(0)	0.0%(0)	0.72%(1)			
Totals		68	14	57	100%(139)			
No. of sources of food contamination in storage mentioned	0	45.6%(31)	42.9%(6)	39.3%(22)	42.45%(59)	4.43	8	0.82
	1	33.8%(23)	42.9%(6)	42.9%(24)	38.13%(53)			
	2	13.2%(9)	14.3%(2)	16.1%(9)	14.39%(20)			
	3	4.4%(3)	0.0%(0)	1.8%(1)	2.88%(4)			
	4	2.9%(2)	0.0%(0)	1.8%(1)	2.16%(3)			
Totals		68	14	57	100%(139)			
No. of any four circumstances mentioned requiring hand washing	0	30.9%(21)	28.6%(4)	35.1%(20)	32.37%(45)	12.08	8	0.15
	1	5.9%(4)	0.0%(0)	0.0%(0)	2.88%(4)			
	2	22.9%(2)	14.3%(2)	7.0%(4)	5.76%(8)			
	3	22.1%(15)	42.9%(6)	19.3%(11)	23.02%(32)			
	4	38.2%(26)	14.3%(2)	38.6%(22)	35.97%(50)			
Totals		68	14	57	100%(139)			

* Statistically significant if p=<0.05

In table 4.16 the knowledge level was generally low in all occupations and there was no significant difference in knowledge among various occupations. It was however interesting that cooks or waiters knew better than supervisors and managers.

4.3.14 Knowledge of cross contamination by occupation

The following table 4.17 shows participant knowledge of cross contamination by occupation.

Table 4.17: Knowledge of cross contamination by occupation

	Occupation						
	Cook	**Waiter**	**Supervisor/ Manager**	**Totals**	χ^2	**df**	**P-value**
Yes, necessary to wash fruits and vegetables for salads	50.0%(34)	53.8%(7)	45.6%(26)	48.20 %(67)	0.40	2	0.82
Yes, necessary to separate raw and cooked foods	77.9%(53)	100.0%(14)	91.2%(52)	85.61 %(119)	7.06	2	0.03*
Yes, unsafe to leave cooked food between 5 and 65˚C for more than 2 hours	72.1%(49)	64.3%(9)	80.4%(45)	74.10 %(103)	1.10	2	0.37
Yes, pests contaminate food	91.2%(62)	100.0%(14)	100.0%(57)	95.68 %(133)	6.55	2	0.04*
Yes, cannot see safety of water by merely looking at it	37.3%(25)	42.9%(6)	19.6%(11)	30.22 %(42)	5.57	2	0.06

* Statistically significant if p=<0.05

In table 4.17 knowledge on whether it was necessary to separate raw and cooked food and that pests contaminate food varied significantly by type of occupation (p=<0.04). While whether it was necessary to wash and disinfect fruits and vegetables for salads, unsafe to keep cooked food between 5ºC and 65˚C and whether one could see the safety of water by merely looking at it, did not vary significantly by type of occupation (p>0.05). The knowledge was generally high in most questions**.**

4.3.15 Knowledge of the five keys, food contamination and hand washing by working experience

The following table 4.18 shows participant knowledge of the five keys, food contamination and hand washing by working experience.

Table 4.18: Knowledge of the five keys, food contamination and hand washing by working experience

		Working experience						χ^2	df	P-value
		Less than 5 years	6 to 10 years	11 to15 years	16 to 20 years	More than 20 years	Totals			
No. of keys mentioned out of the five keys to safer food	0	33.8%(27)	37.1%(13)	47.4%(9)	0.0%(0)	0.0%(0)	35.25%(49)	19.22	20	0.51
	1	30.0%(24)	28.6%(10)	10.5%(2)	0.0%(0)	66.7%(2)	27.33%(38)			
	2	26.3%(21)	14.3%(5)	26.3%(5)	50.0%(1)	33.3%(1)	23.74%(33)			
	3	3.8%(3)	8.6%(3)	15.8%(3)	50.0%(1)	0.0%(0)	7.19%(10)			
	4	6.3%(5)	8.6%(3)	0.0%(0)	0.0%(0)	0.0%(0)	5.76%(8)			
	5	0.0%(0)	2.9%(1)	0.0%(0)	0.0%(0)	0.0%(0)	0.72%(1)			
Totals		80	35	19	2	3	100.%(139)			
No. of sources of food contamination in storage mentioned	0	40.0%(32)	38.2%(13)	68.4%(13)	50.0%(1)	0.0%(0)	42.45%(59)	27.18	16	0.04*
	1	42.5%(34)	38.2%(13)	21.07%(4)	0.0%(0)	66.7%(2)	38.13%(53)			
	2	15.00%(12)	17.6%(6)	10.5%(2)	50.0%(1)	0.0%(0)	15.11%9(21)			
	3	2.5%(2)	2.85%(1)	5.3%(1)	0.0%(0)	33.3%(1)	3.6%(5)			
	4	0.0%(0)	5.9%(2)	0.0%(0)	0.0%(0)	0.0%(0)	1.44%(2)			
Totals		80	35	19	2	3	100%(139)			
No. of any four circumstances mentioned requiring hand washing	0	32.5%(26)	28.6%(10)	42.1%(8)	50.0%(1)	0.0%(0)	32.37%(45)	17.55	20	0.62
	1	3.8%(3)	2.9%(1)	0.0%(0)	0.0%(0)	0.0%(0)	2.88%(4)			
	2	7.5%(6)	2.9%(1)	5.3%(1)	0.0%(0)	0.0%(0)	5.75%(8)			
	3	20.0%(16)	28.6%(10)	15.8%(3)	50.0%(1)	100.0%(3)	23.74%(33)			
	4	36.3%(29)	37.1%(13)	36.8%(7)	0.0%(0)	0.0%(0)	35.25%(49)			
Totals		80	35	19	2	3	100%(139)			

* Statistically significant if p=<0.05

In table 4.18 above knowledge was generally lower across all experience categories and was not influenced by working experience except on the source of food contamination in storage where the knowledge varied with working experience (X^2=27.18; df=20; p=0.04)

4.3.16 Knowledge of cross contamination by professional by working experience

The following table 4.19 shows participant knowledge of cross contamination by professional by working experience.

Table 4.19: Knowledge of cross contamination by professional by working experience

	Working experience						χ^2	df	P-value
	Less than 5 years	6 to 10 years	11 to15 years	16 to 20 years	More than 20 years	Totals			
Yes, necessary to wash fruits and vegetables for salads	54.4% (43)	42.9% (15)	36.8% (7)	0.0% (0)	66.7% (2)	48.20% (67)	3.92	4	0.42
Yes, necessary to separate raw and cooked foods	81.3% (65)	94.3% (33)	89.5% (17)	100.0% (1)	66.7% (2)	84.89%(118)	4.63	4	0.34
Yes, unsafe to leave cooked food between 5 and 65˚C for more than 2 hours	75.0% (60)	70.6% (24)	84.2% (16)	0.0% (0)	100.0% (3)	74.10%(103)	5.24	4	0.26
Yes, pests contaminate food	93.8% (75)	97.1% (34)	100.0% (19)	100.0% (1)	100.0% (3)	94.96%(132)	1.93	4	0.75
Yes, cannot see safety of water by merely looking at it	36.7% (29)	20.6% (7)	31.6% (6)	0.0% (0)	0.0% (0)	30.22%(42)	5.20	5	0.39

* Statistically significant if p=<0.05

In table 4.19 experience did not have a significant (p>0.05) impact on knowledge whether washing fruits and vegetables in disinfectants was necessary when making salads, necessary to separate raw and cooked foods, unsafe to leave cooked food between 5^{o}C and 65°C, that pests contaminate food and whether it was possible to see safety of water by merely looking at it. However, knowledge level in most of the questions was generally high.

4.4 ATTITUDE

In this study, participant attitude on basic PRPs was assessed under the following three prerequisites: personnel hygiene, cleaning & sanitation and pest management, in districts and in premises.

4.4.1 Attitude towards personnel hygiene, cleaning and sanitation plus pest management by districts

Table 4.20 on the following page shows participant attitude towards personnel hygiene, cleaning and sanitation plus pest management by district.

The number of eating places designated for staff members varied among districts (χ^2=22.41; df=8; p=0.00). The highest number of designated areas for eating were found in Chiredzi rural, Zaka and Chivi districts. Masvingo urban had the lowest number of areas designated for eating. Compliance with principle regarding the 'first in, first out' (FIFO) also significantly varied (χ^2=22.87; df=8; p=0.00) among districts. There was a 100% compliance with FIFO in Chiredzi urban, Chiredzi rural, Masvingo rural, Zaka and Chivi districts, while Mwenezi did not comply at all. Although this did not significantly vary (p>0.05) with the districts, most districts were free from pests, food was labelled with names, while fridge and freezers were clean.

Table 4.20: Attitude towards personnel hygiene, cleaning and sanitation plus pest management by district

	District										χ^2	df	P-value
	Chiredzi urban	Chiredzi Rural	Gutu	Masvingo Urban	Masvingo rural	Mwenezi	Zaka	Chivi	Bikita	Totals			
Yes, have designated place for eating	83.3% (5)	100.0% (4)	91.7% (11)	33.3% (9)	77.8% (7)	66.7% (2)	100.0% (3)	100.0% (2)	75.0% (3)	33.09%(46)	22.41	8	0.00*
Yes, facility free of pests	100.0% (6)	25.0% (1)	58.3% (7)	44.4% (12)	77.8% (70	0.0% (0)	66.7% (2)	50.0% (1)	75.0% (3)	73.38%(102)	14.05	8	0.08
Yes, fridge and freezer clean	100.0% (6)	75.0% (3)	91.7% (11)	63.0% (17)	88.9% (8)	66.7% (2)	100.0% (3)	100.0% (2)	75.0% (3)	39.57%(55)	9.01	8	0.34
Yes, FIFO followed	100.0% (6)	100.0% (4)	66.7% (8)	48.1% (13)	100.0% (9)	0.0% (0)	100.0% (3)	100.0% (2)	75.0% (3)	34.53%(48)	22.87	8	0.00*
Yes, food labelled by names	33.3% (2)	100.0% (4)	66.7% (8)	70.4% (19)	88.9% (8)	100.0% (3)	100.0% (3)	100.0% (2)	50.0% (2)	36.69%(51)	11.75	8	0.02*

* Statistically significant if p=<0.05

4.4.2 Attitude towards personnel hygiene, cleaning and sanitation plus pest management by type of premises

The following table 4.21 shows participant attitude towards personnel hygiene, cleaning and sanitation plus pest management by type of premises.

Table 4.21: Attitude towards personnel hygiene, cleaning and sanitation plus pest management by type of premises

	Type of premises			χ^2	df	P-value
	Restaurant	Schools	Totals			
Yes, have designated place for eating	60.7% (34)	85.7% (12)	33.09%(46)	3.11	1	0.08
Yes, facility free of pests	55.4% (31)	57.1% (8)	28.06%(39)	0.01	1	0.90
Yes, fridge and freezer clean	75.0% (42)	92.9% (13)	39.57%(55)	0.07	1	0.80
Yes, FIFO followed	67.9% (38)	71.4% (10)	34.53%(48)	0.29	1	0.59
Yes, food labelled by names	71.4% (40)	78.6% (11)	36.69%(51)	2.12	1	0.15

* Statistically significant if p=<0.05

When stratified by type of premises, table 21 shows that **t**here was no significant difference (p>0.01) between restaurants and boarding schools in terms of eating places designated for staff members, number of places free of pests, the cleanliness of fridges and freezers, compliance to FIFO nor in the labeling of names of food.

4.5 PRACTICE

In this study, participant practice on basic PRPs was assessed under the following four prerequisites: personnel hygiene, waste management, temperature control and pest management by district.

4.5.1 Practice of personnel hygiene, waste management, temperature control, raw materials and pest management by district.

Table 4.22 on the following page shows participant practice regarding personnel hygiene, waste management, temperature control, raw materials and pest management by district.

There was a significant difference regarding eating places designated for staff members across districts. The rest of the districts scored >66.7%, while Masvingo urban had the lowest scoring 33.3% (9) (χ^2=22.4; df=8; p=0.01). Although waste removal was not satisfactory, Mwenezi distrtict scored 0% (0) (χ^2=15.546; df=8; p=0.00). FIFO was practised in >48.1% of the districts, however in Mwenezi it was not being practised, where they scored 0% (0) (χ^2=22.9; df=8; p=0.000). More than 81.5% in four of the districts were using suitable food handling equipment while less than 33.3% of the remaining districts used suitable equipment (χ^2=33.632; df=8; p=0.01). Regarding workers taking a bath before coming to work, all districts scored 100% except Zaka (66.7%) and interestingly Masvingo urban (48.1%) (χ^2=27.8; df=8; P=0.01).

Although there was no significant difference in response from various occupational categories on the safe temperature for storing cooked food, 62.7% (42) of cooks, 64.3% (9) of waiters and 52.8% (28) of supervisors/managers indicated that they store cooked food in 5 to 65°C temperature zone. Source of beef/mutton varied significantly (χ^2=126.46; df=16; p=0.00). Most (55.6% (5)) of the districts obtained meat from either an abattoir/butchery. Mwenezi procured 66% of its meat from the community and was the only district to do so. Inspection of beef meat and pork meat varied from different districts.

Designated eating places, compliance to FIFO, availability of suitable handling equipment and bathing of workers significantly varied among districts (p<0.05). However, other responses did not vary among the districts as shown below.

Table 4.22: Practice of personnel hygiene, waste management, temperature control, raw materials and pest management by district

	District												
	Chiredzi urban	Chiredzi Rural	Gutu	Masvingo Urban	Masvingo rural	Mwenezi	Zaka	Chivi	Bikita	Totals	χ^2	df	P-value
Yes, designated place for eating	83.3% (5)	100.0% (4)	91.7% (11)	33.3% (9)	77.8% (7)	66.7% (2)	100.0% (3)	100.0% (2)	75.0% (3)	33.09%(46)	22.40	8	0.01*
Yes, hand washing disinfectant	83.3% (5)	100.0% (4)	91.7% (11)	48.1% (13)	66.7% (6)	66.7% (2)	33.3% (1)	100.0 % (2)	100.0% (4)	34.53%(48)	15.10	8	0.10
Yes, soap and antiseptic present	66.7% (4)	25.0% (1)	66.7% (8)	44.4% (12)	33.3% (3)	33.3%(1)	0.0% (0)	100.0% (2)	100.0% (4)	25.18%(35)	13.70	8	0.10
Yes, boxes and containers removed	100.0% (6)	75.0% (3)	91.7% (11)	63.0% (17)	88.9% (8)	0.0% (0)	66.7% (2)	50.0% (1)	75.0% (3)	36.69%(51)	15.55	8	0.01*
Yes, FIFO followed	100.0% (6)	100.0% (4)	66.7% (8)	48.1% (13)	100.0% (9)	0.0% (0)	100.0% (30	100.0% (2)	75.0% (3)	34.53%(48)	22.90	8	0.01*
Yes, food labelled by names	33.3% (2)	100.0% (4)	66.7% (8)	70.4% (19)	88.9% (8)	100.0% (3)	100.0% (3)	100.0% (2)	50.0% (2)	36.69%(51)	11.80	8	0.20
Yes, fridge and freezer clean	100.0% (6)	75.0% (3)	91.7% (11)	63.0% (17)	88.9% (8)	66.7% (2)	100.0% (3)	100.0% (2)	75.0% (3)	39.57%(55)	9.01	8	0.30
Yes, suitable food handling equipment used	16.7% (1)	0.0% (0)	91.7% (11)	81.5% (22)	33.3% (3)	0.0% (0)	33.3% (1)	100.0% (2)	100.0% (4)	31.65%(44)	33.63	8	0.01*
Yes, food prepared in small batches	100.0% (6)	75.0% (3)	83.3% (10)	88.9% (24)	66.7% (6)	33.3% (1)	100.0% (3)	50.0% (1)	100.0% (4)	41.73%(58)	11.99	8	0.20
Yes, workers bath before coming to work	100.0% (6)	100.0% (4)	91.7% (11)	48.1% (13)	100.0% (9)	100.0% (3)	66.7% (2)	100.0% (2)	100.0% (4)	38.85%(54)	27.80	8	0.01*
Yes, facility free of pests	100.0% (6)	25.0% (1)	58.3% (7)	44.4% (12)	77.8% (7)	0.0% (0)	66.7% (20	50.0% (1)	75.0% (3)	41.01%(57)	14.00	8	0.20
Yes, beef inspected	100.0% (12)	100.0% (8)	100.0% (22)	100.0% (54)	100.0% (17)	100.0% (6)	100.0% (6)	100.0% (4)	100.0% (8)	98.56%(137)	34.96	8	0.01*
Yes, pork inspected	58.3% (7)	0.0% (0)	56.5% (13)	31.4% (16)	16.7% (3)	0.0% (0)	0.0% (0)	0.0% (0)	75.0% (6)	32.37%(45)	44.27	16	0.01*

* Statistically significant if p=<0.05

4.5.2 Practice of personnel hygiene, waste management, temperature control, raw materials and pest management by type of premises.

The following table 4.23 shows participant practice regarding personnel hygiene, waste management, temperature control, raw materails and pest management by type of premises.

Table 4.23: Practice of personnel hygiene, waste management, temperature control, raw materails and pest management by type of premises

	Type of premises		Total	χ^2	df	P–value
	Restaurant	Schools				
Yes, designated place for eating	60.7% (34)	85.7% (12)	65.7% (46)	3.11	1	0.08
Yes, hand washing disinfectant	64.3% (36)	85.7% (12)	68.6% (48)	2.39	1	0.12
Yes, soap and antiseptic present	50.0% (28)	50.0% (7)	50.0% (35)	0.01	1	1.00
Yes, boxes and containers removed	73.2% (41)	71.4% (10)	72.9% (51)	18.00	1	0.89
Yes, FIFO followed	67.9% (38)	71.4% (10)	68.6% (48)	0.07	1	0.80
Yes, food labelled by names	71.4% (40)	78.6% (11)	72.9% (51)	0.29	1	0.59
Yes, fridge and freezer clean	75.0% (42)	92.9% (13)	78.6% (55)	2.12	1	0.15
Yes, suitable food handling equipment used	67.9% (38)	42.9% (6)	62.9% (44)	2.10	1	0.08
Yes, food prepared in small batches	91.1% (51)	50.0% (7)	82.9% (58)	13.30	1	0.01*
Yes, workers bath	73.2% (41)	92.9% (13)	77.1% (54)	2.45	1	0.12
Yes, facility free of pests	55.4% (31)	57.1% (8)	55.7% (39)	0.01	1	0.90
Yes, beef inspected	92.7% (102)	85.2% (23)	91.2% (125)	1.54	1	0.21
Yes, pork inspected	36.7% (40)	19.2% (50	33.3% (45)	6.10	2	0.05*

* Statistically significant if p=<0.05

Table 4.23 shows that there was no significant difference in practice regarding these PRPs, however a significant difference was noticed in preparing food in smaller batches: 91.1% (51) in restaurants and 50% (7) in schools (χ^2=13.30; df=1; p=0.01).

4.6 COMPLIANCE

In this study participant compliance with basic PRPs was assessed under the following eight prerequisites: personnel hygiene, waste management, temperature control, cleaning and sanitation, pest management, raw material, facilities and construction, training and storage in districts and in types of premises.

4.6.1 Compliance with personnel hygiene, facilities and construction by district

Table 4.24 on the following page shows the percentage of compliance with personnel hygiene, facilities and construction by district.

The stocking of sinks with soap, disposable towels and warm water significantly varied (χ^2 =18.10; df=8; p=0.02). No facility was stocked in Chiredzi rural, while all facilities in Mwenezi, Chivi and Bikita were stocked. Similarly, adequacy of toilets for clients varied significantly (χ^2=20.60; df=8; p=0.01) among districts. Toilet adequacy was above 83% in Gutu, Masvingo rural, Mwenezi, Zaka and Bikita. Cleanliness of uniforms significantly varied (χ^2=17.50; df=8; p=0.01). Sixty six point sixty seven percent (6) of district staff had complete clean uniforms and shoes. Chiredzi rural, Masvingo urban and rural districts had less than 74% compliance. Availability of food handlers' health records also varied significantly (χ^2 =17.70; df=8; p=0.03). Chiredzi urban, Gutu, Masvingo rural and Chivi had at least 77% of their food handlers' health records available. Employee toilets were clean and operational and significantly varied among different districts (χ^2=22.70; df=8; p=0.04). All toilets in Chiredzi urban, Gutu, Masvingo rural, Zaka, Chivi and Bikita were clean and operational. More than 50% of toilets from Chiredzi rural and Mwenezi were not clean and operational.

Table 4.24: Percent compliant with personnel hygiene, facilities and construction by district

	District												
	Chiredzi urban	Chiredzi Rural	Gutu	Masvingo Urban	Masvingo rural	Mwenezi	Zaka	Chivi	Bikita	Totals	χ^2	df	P-value
Yes, clean uniforms and shoes	100.0% (6)	25.0% (1)	100.0% (12)	74.1% (20)	66.7% (6)	100.0% (3)	100.0% (3)	100.0% (2)	100.0% (4)	41.01%(57)	17.50	8	0.01*
Yes, hairnets worn properly	100.0% (6)	25.0% (1)	91.7% (11)	96.3% (26)	88.9% (8)	100.0% (3)	66.7% (2)	100.0% (2)	100.0% (4)	45.32%(63)	23.50	8	0.01*
Yes, finger nails short and clean	100.0% (6)	100.0% (4)	75.0% (9)	77.8% (21)	88.9% (8)	66.7% (2)	100.0% (3)	50.0% (1)	100.0% (4)	41.73%(58)	6.83	8	0.60
Yes, jewellery controlled	83.3% (5)	75.0% (3)	75.0% (9)	59.3% (16)	88.9% (8)	0.0% (0)	66.7% (2)	50.0% (1)	100.0% (4)	34.53%(48)	12.40	8	0.10
Yes, procedure for hand washing	16.7% (1)	75.0% (3)	83.3% (10)	37.0% (10)	33.3% (3)	33.3% (1)	66.7% (2)	0.0% (0)	75.0% (3)	24.46%(34)	15.30	8	0.10
Yes, hand sink stocked	50.0% (3)	0.0% (0)	75.0% (9)	37.0% (10)	44.4% (4)	100.0% (3)	66.7% (2)	100.0% (2)	100.0% (4)	26.62%(37)	18.10	8	0.20
Yes, hand wash reminder	16.7% (1)	0.0% (0)	25.0% (3)	18.5% (5)	11.1% (1)	33.3% (1)	0.0% (0)	0.0% (0)	50.0% (2)	9.35%(13)	5.77	8	0.71
Yes, adequate toilets for clients	50.0% (3)	50.0% (2)	83.3% (10)	37.0% (10)	88.9% (8)	100.0% (3)	100.0% (30	100.0% (2)	100.0% (4)	51.80%(72)	20.60	8	0.01*
Yes, toilet paper present	33.3% (2)	25.0% (1)	83.3% (10)	51.9% (14)	77.8% (7)	66.7% (2)	33.3% (1)	50.0% (1)	100.0% (4)	30.22%(42)	12.20	8	0.10
Yes, food handlers health records	100.0% (6)	50.0% (2)	83.3% (10)	33.3% (9)	77.8% (7)	66.7% (2)	66.7% (2)	100.0% (2)	50.0% (2)	30.22%(42)	17.70	8	0.03*
Yes employee toilets clean and operable	100.0% (6)	50.0% (2)	100.0% (12)	55.6% (15)	100.0% (9)	33.3% (1)	100.0% (3)	100.0% (2)	100.0% (4)	38.85%(54)	22.70	8	0.04*
Yes, light fitted with protection	50.0% (3)	0.0% (0)	58.3% (7)	44.4% (12)	33.3% (3)	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (2)	19.42%(27)	10.56	8	0.23

* Statistically significant if p=<0.05

4.6.2 Compliance with personnel hygiene, facilities and construction by type of premises

The following table 4.25 shows the percentage of compliance with personnel hygiene, facilities and construction by type of premises.

Table 4.25: Percent compliant with personnel hygiene, facilities and construction by type of premises

	Type of premises			χ^2	df	P-value
	Restaurants	Schools	Totals			
Yes, clean uniforms and shoes	76.8% (43)	100.0% (14)	41.01%(57)	3.99	1	0.46
Yes, hairnets worn properly	91.1% (51)	85.7% (12)	45.32%(63)	0.36	1	0.55
Yes, finger nails short and clean	80.4% (45)	92.9% (13)	41.73%(58)	1.23	1	0.27
Yes, jewellery controlled	69.6% (39)	64.3% (9)	34.53%(48)	0.15	1	0.70
Yes, procedure for hand washing	46.4% (26)	50.0% (7)	23.74%(33)	0.06	1	0.81
Yes, hand sink stocked	48.2% (27)	71.4% (10)	26.62%(37)	2.42	1	0.12
Yes, hand wash reminder	17.9% (10)	21.4% (3)	9.35%(13)	0.09	1	0.76
Yes, adequate toilets for clients	76.8% (43)	78.6% (11)	38.85%(54)	0.20	1	0.89
Yes, toilet paper present	57.1% (32)	92.9% (13)	32.37%(45)	6.22	1	0.01*
Yes, food handlers health records	57.1% (32)	71.4% (10)	30.22%(42)	0.95	1	0.33
Yes employee toilets clean and operable	57.1% (32)	71.4% (10)	30.22%(42)	0.95	1	0.33
Yes, light fitted with protection	37.5% (21)	42.9% (6)	19.42%(27)	0.53	1	0.46

* Statistically significant if p=<0.05

In table 4.25, toilet paper adequacy varied significantly (χ^2=6.22; df=1; p=0.01) between restaurants and schools. More schools (92.9%, n=13) had toilet paper in the toilet than restaurants (57.1%, n=32). There was generally high compliance with the wearing of clean uniforms and shoes, proper wearing of hairnets, cutting of finger nails and employee cleanliness; stocking of hand sinks was moderate with employee toilets clean and operational. There was low compliance with the presence of a hand washing reminder or poster in both premises. There was no significant difference) on the number of toilets for clients between the restaurants and schools. There were more toilets with paper in schools than in restaurants (X^2=6.22: df=1: p=0.01).

4.6.3 Compliance with pest control by district

The table 4.26 on the following page shows the percentage of compliance with pest control in districts.

Table 4.26: Percent compliant with pest control by district

	District										χ^2	df	P-value
	Chiredzi urban	**Chiredzi Rural**	**Gutu**	**Masvingo Urban**	**Masvingo rural**	**Mwenezi**	**Zaka**	**Chivi**	**Bikita**	**Totals**			
Yes, windows and doors screens	16.7% (1)	0.0% (0)	33.3% (4)	29.6% (8)	22.2% (2)	0.0% (0)	0.0% (0)	0.0% (0)	25.00% (1)	11.51%(16)	5.15	8	0.71
Yes, pest programme by registered practitioner	16.7% (1)	0.0% (0)	25.0% (3)	11.1% (3)	33.3% (3)	33.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	7.91%(11)	6.45	8	0.60
Yes, pest controller licensed	16.7% (1)	0.0% (0)	66.7% (8)	33.3% (9)	11.1% (1)	0.0% (0)	0.0% (0)	50.0% (1)	50.0% (2)	15.83%(22)	14.81	8	0.10
Yes, potential for pesticide contamination	50.0% (3)	25.0% (1)	41.7% (5)	37.0% (10)	44.4% (4)	33.3% (1)	66.7% (2)	50.0% (1)	75.0% (3)	21.58%(30)	3.57	8	0.91
Yes, pesticides material safety data sheets	0.0% (0)	25.0% (1)	66.7% (8)	29.6% (8)	22.2% (2)	0.0% (0)	66.7% (2)	50.0% (1)	25.0% (1)	16.55%(23)	13.30	8	0.11

* Statistically significant if p=<0.05

Table 4.26 shows that compliance with pest control did not vary among the districts (p>0.05). Nonetheless compliance was generally low.

However, Gutu district was better than the rest although that was not statistically significant.

4.6.4 Compliance with pest control by type of premises

The following table 4.27 shows the percentage of compliance with pest control by type of premises.

Table 4.27: Percent compliant with pest control by type of premises

	Type of premises			χ^2	df	P-value
	Restaurants	**Schools**	Totals			
Yes, windows and door screens	25.0% (14)	14.3% (2)	11.51 %(16)	0.73	1	0.39
Yes, pest programme by registered practitioner	10.7% (6)	35.7% (5)	7.91 %(11)	5.29	1	0.12
Yes, pest controller licensed	28.6% (16)	42.9% (6)	15.83 %(22)	1.06	1	0.30
Yes, potential for pesticide contamination	42.9% (24)	42.9% (6)	21.58 %(30)	0.01	1	1.00
Yes, pesticides material safety data sheets	26.8% (15)	57.1% (8)	16.55 %(23)	4.68	1	0.03*

* Statistically significant if p=<0.05

In table 4.27, compliance with PRP was generally low across both types of premises, and districts too. However there was no significant (p>0.05) difference between restaurants and schools, with the exception of the pesticides material safety data sheet (MSDS) which is significantly higher (χ^2=4.68; df=1; p=0.03) in schools (57.1%; n=8) compared to 26.8% (n=15) in restaurants.

4.6.5 Compliance with water safety and waste management by district

The following table 4.28 shows compliance with requirements of water safety and waste management in districts.

Table 4.28: Percent compliant with water safety and waste management by district

	District										χ^2	df	P-value
	Chiredzi urban	**Chiredzi Rural**	**Gutu**	**Masvingo Urban**	**Masvingo rural**	**Mwenezi**	**Zaka**	**Chivi**	**Bikita**	**Totals**			
Yes, facility test water	0.0% (0)	25.0% (1)	33.3% (4)	18.5% (5)	44.4% (4)	33.3% (1)	0.0% (0)	50.0% (1)	0.0% (0)	11.51%(16)	8.30	8	0.41
Yes, water tank covered	50.0% (3)	100.0% (4)	91.7% (11)	66.7% (18)	88.9% (8)	100.0% (3)	100.0% (3)	100.0% (2)	100.0% (4)	40.29%(56)	11.81	8	0.22
Yes, facility has drinkable water	100.0% (6)	100.0% (4)	91.7% (11)	81.5% (22)	100.0% (9)	100.0% (3)	100.0% (3)	100.0% (2)	100.0% (4)	46.04%(64)	6.32	8	0.61
Yes, waste collectors plugs	66.7% (4)	25.0% (1)	41.7% (5)	48.1% (13)	33.3% (3)	33.3% (1)	0.0% (0)	100.0% (2)	0.0% (0)	20.86%(29)	10.60	8	0.21
Yes, kitchen garbage can covered	100.0% (6)	100.0% (4)	83.3% (10)	48.1% (13)	77.8% (70	33.3% (1)	100.0% (3)	50.0% (1)	75.0% (3)	79.86%(111)	14.88	8	0.10

* Statistically significant if p=<0.05

Table 4.28 shows that there was no significant difference (p>0.05) in compliance with water safety among districts. Compliance was generally low with water facility tests and waste collection plugs, while water tank coverage, availability of drinkable water facility and coverage of kitchen garbage cane was generally high.

4.6.6 Compliance with water safety and waste management by type of premises

The following table 4.29 shows compliance with requirements of water safety and waste management by type of premises.

Table 4.29: Percent compliant with water safety and waste management by type of premises

	Type of premises			χ^2	df	P-value
	Restaurants	**Schools**	Totals			
Yes, facility test water	12.5% (7)	64.3% (9)	11.51%(16)	17.03	1	0.01*
Yes, water tank covered	75.0% (42)	100.0% (14)	40.29%(56)	4.38	1	0.03*
Yes, facility has drinkable water	89.3% (50)	100.0% (14)	46.04%(64)	1.64	1	0.20
Yes, waste collectors plugs	39.3% (22)	50.0% (7)	20.86%(29)	0.53	1	0.47
Yes, kitchen garbage can covered	64.3% (36)	85.7% (12)	34.53%(48)	2.38	1	0.12

* Statistically significant if p=<0.05

In table 4.29 a significantly higher number of schools (64.3%; n=9) than restaurants (12.5%, n=7) tested their water. While there was a marginal difference (χ^2=4.38; df=1; p=0.03) in the number of restaurants (75.0%, n=42) that covered their water tanks compared to schools (100%, n=14).

4.6.7 Compliance with training by district

Table 4.30 on the following page shows compliance with training in districts.

Staff training varied significantly ($\chi^{2=}$17.70; df=8; p=0.02). There were no training in 44.44% (4) of the districts. Three of the districts had 44% training coverage. Evidence in the past 12 months of food handlers' training records, food hygiene manuals and hygiene poster practice did not vary with districts, these were generally low.

Table 4.30: Percent compliant with training by district

	District										χ^2	df	P-value
	Chiredzi urban	**Chiredzi Rural**	**Gutu**	**Masvingo Urban**	**Masvingo rural**	**Mwenezi**	**Zaka**	**Chivi**	**Bikita**	**Totals**			
Yes, worker training records present	0.0% (0)	0.0% (0)	58.3% (7)	11.1% (3)	44.4% (4)	0.0% (0)	33.3% (1)	0.0% (0)	25.0% (1)	11.51(16)	17.70	8	0.02*
Yes, staff training evidence in the past 12 months	0.0% (0)	0.0% (0)	41.7% (5)	7.4% (2)	11.1% (1)	33.3% (1)	33.3% (1)	0.0% (0)	25.0% (1)	7.91(11)	11.60	8	0.20
Yes, food handler training records	50.0% (3)	0.0% (0)	58.3% (7)	14.8% (40	33.3% (3)	33.3% (1)	33.3% (1)	0.0% (0)	0.0% (0)	39.57(55)	13.60	8	0.11
Yes, manual for food hygiene present	16.7% (1)	0.0% (0)	41.7% (5)	25.9% (7)	33.3% (3)	0.0% (0)	33.3% (1)	0.0% (0)	25.0% (1)	12.95(18)	5.34	8	0.71
Yes, hygiene practice posters	16.7% (1)	0.0% (0)	8.3% (1)	22.2% (6)	11.1% (1)	33.3% (1)	0.0% (0)	0.0% (0)	75.0% (3)	9.35(13)	12.31	8	0.10
Yes, free from pest	100.0% (6)	25.0% (1)	58.3% (7)	44.4% (12)	77.8% (7)	0.0% (0)	66.7% (2)	50.0% (1)	75.0% (3)	28.06(39)	14.00	8	0.10

* Statistically significant if p=<0.05

4.6.8 Compliance with training by type of premises

The following table 4.31 shows compliance with training by type of premises.

Table 4.31: Percent compliant with training by type of premises

	Type of premises			χ^2	df	P-value
	Restaurants	**Schools**	Totals			
Yes, worker training records present	16.1% (9)	50.0% (7)	11.51%)16)	7.31	1	0.01*
Yes, staff training evidence in the past 12 months	12.5% (7)	28.6% (4)	7.91%)11)	2.18	1	0.14
Yes, food handler training records	25.0% (14)	35.7% (5)	13.67%)19)	0.65	1	0.42
Yes, manual for food hygiene present	25.0% (14)	28.6% (4)	12.95%)18)	0.08	1	0.78
Yes, hygiene practice posters	17.9% (10)	21.4%	7.22%)10.03)	0.09	1	0.76
Yes, free from pest	55.4% (31)	57.1% (8)	28.06%)39)	0.01	1	0.90

* Statistically significant if p=<0.05

Table 4.31 shows that the availability of workers' training records varied significantly (χ^2=7.31; df=1; p=0.01) with premises. Eighty three point nine percent (47) of restaurants had no workers' training records, while 50% (7) of boarding schools had the records. Compliance with other requirements was generally low.

4.6.9 Compliance with storage by district

Table 4.32 on the following page shows compliance with storage requirements in various districts.

The safe storage of ingredients, storage of food above the floor, protection of food from contamination and storing of chemicals away from food differed significantly ($p=0.01$) across districts. At least 75% of ingredients were properly stored in seven districts with the exception of Mwenezi where none of the ingredients were stored properly. There was no significant difference ($p>0.05$) in registering the temperature of cooling and heating, availability of washable and rust resistance shelves, presence of bulging or leaking canned goods, storage of food in original containers or a food grade container, whether the equipment and tools was resistant to corrosion and on the risk of cross contamination between raw and prepared food.

Table 4.32: Percent compliant with storage by district

	District										χ^2	df	P-value
	Chiredzi urban	**Chiredzi Rural**	**Gutu**	**Masvingo Urban**	**Masvingo rural**	**Mwenezi**	**Zaka**	**Chivi**	**Bikita**	**Totals**			
Yes, temperature control monitoring	33.3% (2)	0.0% (0)	50.0% (6)	33.3% (9)	11.1% (1)	0.0% (0)	33.3% (1)	0.0% (0)	50.0% (2)	15.11%(21)	8.62	8	0.40
Yes, rust resistant shelves	100.0% (6)	100.0% (4)	66.7% (8)	66.7% (18)	66.7% (6)	100.0% (3)	66.7% (2)	100.0% (2)	75.0% (3)	37.41%(52)	6.73	8	0.61
Yes, ingredients properly stored	100.0% (6)	100.0% (4)	91.7% (11)	59.3% (16)	100.0% (9)	0.0% (0)	100.0% (3)	100.0% (2)	75.0% (3)	38.85%(54)	23.61	8	0*01
Yes, no bulging or leaking packed goods	83.3% (5)	100.0% (4)	33.3% (4)	51.9% (14)	77.8% (7)	66.7% (20	66.7% (2)	100.0% (2)	100.0% (4)	44.60%(62)	13.80	8	0.11
Yes, food stored 6 inches above floor	100.0% (6)	25.0% (1)	91.7% (11)	44.4% (12)	66.7% (6)	0.0% (0)	66.7% (2)	100.0% (2)	100.0% (4)	31.65%(44)	22.92	8	0.01*
Yes, food protected from contamination	100.0% (6)	100.0% (4)	91.7% (11)	85.2% (23)	100.0% (9)	33.3% (1)	100.0% (3)	50.0% (1)	100.0% (4)	44.60%(62)	15.81	8	0.01*
Yes, chemicals labelled and stored from food	100.0% (6)	25.0% (10	83.3% (10)	63.0% (17)	77.8% (7)	0.0% (0)	66.7% (2)	100.0% (2)	75.0% (3)	41.01%(57)	15.80	8	0.01*
Yes, food grade food containers	100.0% (6)	100.0% (4)	91.7% (11)	77.8% (21)	77.8% (7)	66.7% (2)	100.0% (3)	50.0% (1)	100.0% (4)	42.45%(59)	7.29	8	0.50
Yes, equipment/tools corrosion resistant	100.0% (6)	100.0% (4)	75.0% (9)	63.0% (17)	100.0% (9)	66.7% (2)	66.7% (2)	100.0% (2)	100.0% (4)	39.57%(55)	11.31	8	0.10
Yes, risk of cross contamination	16.7% (1)	0.0% (0)	33.3% (4)	48.1% (13)	11.1% (1)	66.7% (2)	33.3% (1)	0.0% (0)	0.0% (0)	15.83%(22)	12.20	8	0.10

* Statistically significant if p=<0.05

4.6.10 Compliance with storage by type of premises

The following table 4.33 shows compliance with storage requirements by type of premises

Table 4.33: Percent compliant with storage by type of premises

	Type of premises			χ^2	df	P-value
	Restaurants	**Schools**	Totals			
Yes, temperature control monitoring	62.5% (39)	64.3% (9)	34.53%(48)	0.15	1	0.70
Yes, rust resistant shelves	32.1% (18)	21.4% (3)	15.11%(21)	0.61	1	0.43
Yes, ingredients properly stored	69.6% (39)	92.9% (13)	37.41%(52)	3.16	1	0.08
Yes, no bulging or leaking packed goods	75.0% (42)	85.7% (12)	38.85%(54)	0.73	1	0.39
Yes, food stored 6 inches above floor	62.5% (35)	64.3% (9)	31.65%(44)	0.01	1	0.90
Yes, food protected from contamination	62.5% (35)	64.3% (9)	31.65%(44)	0.02	1	0.90
Yes, chemicals labelled and stored from food	89.3% (50)	85.7% (12)	44.60%(62)	0.14	1	0.71
Yes, food grade food containers	67.9% (38)	71.4% (10)	34.53%(48)	0.07	1	0.80
Yes, equipment/tools corrosion resistant	82.1% (46)	92.9% (13)	42.45%(59)	0.97	1	0.32
Yes, risk of cross contamination	76.8% (43)	85.7% (12)	39.57%(55)	0.53	1	0.47

* Statistically significant if p=<0.05

In table 4.33, there was no difference in storage compliance between restaurants and schools (p>0.05). Close to two thirds of products in both premises had expiry dates, product tags, had no bulging or leaking canned foods, food was stored at least six inches above the floor and chemicals were clearly labelled and stored away from food and food related supplies.

4.6.11 Compliance with cleaning and sanitation by district

Table 4.34 on the following page summarises compliance with cleaning and sanitation requirements in districts.

Availability of schedules for cleaning and sanitising processes varied significantly (χ^2=21.93; df=8; p=<0.01) from 0-91.7%. Mwenezi had no schedule, while Chiredzi rural had the highest score (100%; n=4). Similarly schedules for cleaning food surfaces varied significantly among districts (χ^2=18.78; df=8; p=0.02). Chivi had no regular cleaning schedule for food surfaces. Masvingo urban had 29.9% (7) with Bikita recording a 100% (4) compliance. There was no significant difference in hygiene after work, sanitisation of drawers and rakes or utensils and surfaces among various districts (p>0.05). Almost all districts were in concurrence (100%) that keeping kitchen surfaces clean reduced the risk of illness with the exception of Masvingo urban which had a proportion of 94.1%.

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Table 4.34: Percent compliant with cleaning and sanitation by district

	District										χ^2	df	P-value
	Chiredzi urban	**Chiredzi Rural**	**Gutu**	**Masvingo Urban**	**Masvingo rural**	**Mwenezi**	**Zaka**	**Chivi**	**Bikita**	**Totals**			
Yes, scheduled cleaning/sanitising	33.3% (2)	100.0% (4)	91.7% (11)	29.6% (8)	55.6% (5)	0.0% (0)	33.3% (1)	50.0% (1)	75.0% (3)	25.18 %(35)	21.91	8	0.01*
Yes, hygienisation procedure after work	33.3% (2)	75.0% (3)	83.3% (10)	37.0% (10)	55.6% (5)	33.3% (1)	66.7% (2)	50.0% (1)	100.0% (4)	27.34 %(38)	13.20	8	0.10
Yes, record of storeroom cleaning/sanitisation	16.7% (1)	0.0% (0)	58.3% (7)	18.5% (5)	33.3% (3)	0.0% (0)	0.0% (0)	0.0% (0)	25.0%	30.94 %(43)	12.51	8	0.10
Yes, regular cleaning schedule for food surfaces	33.3% (2)	50.0% (2)	83.3% (10)	25.9% (7)	44.4% (4)	33.3% (1)	66.7% (2)	0.0% (0)	100.0% (4)	23.02 %(32)	18.73	8	0.02*
Yes, drawers and rakes clean and sanitised	100.0% (6)	75.0% (3)	66.7% (8)	51.9% (14)	66.7% (6)	33.3% (1)	66.7% (2)	50.0% (1)	100.0% (4)	32.37 %(45)	9.06	8	0.30
Yes, food equipment, utensils and surfaces sanitised	100.0% (6)	100.0% (4)	83.3% (10)	85.0%(23)	88.8%(8)	66.7% (2)	75.0% (3)	100% (2)	100% (4)	44.60 %(62)	4.51	8	0.81

* Statistically significant if p=<0.05

4.6.12 Compliance with cleaning and sanitation by type of premises

The following table 4.35 summarises compliance with cleaning and sanitation by type of premises.

Table 4.35: Percent compliant with cleaning and sanitation by type of premises

	Type of premises			χ^2	df	P-value
	Restaurants	**Schools**	Totals			
Yes, scheduled cleaning/sanitising	42.9% (24)	78.6% (11)	25.18%(35)	5.71	1	0.02*
Yes, hygienisation procedure after work	48.2% (27)	78.6% (11)	27.34%(38)	4.16	1	0.04*
Yes, record of storeroom cleaning/sanitisation	21.4% (12)	35.7% (5)	12.23%(17)	1.24	1	0.27
Yes, regular cleaning schedule for food surfaces	39.3% (22)	71.4% (10)	23.02%(32)	4.66	1	0.03*
Yes, drawers and rakes clean and sanitised	60.7% (34)	78.6% (11)	32.37%(45)	1.57	1	0.21
Yes, food equipment, utensils and surfaces sanitised	89.3% (50)	85.7% (12)	44.60%(62)	0.14	1	0.70

* Statistically significant if p=<0.05

Table 4.35 shows that cleaning and saninitising processes varied significantly (χ^2=5.71; df=1; p=0.02) between restaurants and schools. 78.6% (11) schools and 42.9% (24) restaurants had cleaning and sanitising procedures. Hygiene practices after work time also differed significantly (χ^2=4.16; df=1; p=0.04) between restaurants and schools, where schools had 78.6% (n=11) compared to restaurants 48.2% (n=27). Similarly, regular cleaning schedules for food surfaces was significantly higher ($\chi^{2=}$4.66; df=1; p=0.03) in schools 71.4% (n=10) than in restaurants 39.3% (n=22). The type of premises did not influence compliance in other parameters.

4.7 SUMMARY

The food safety knowledge of respondents was moderate despite their high literacy levels. Males knowledgeable than females regarding cross contamination and the five keys to safer food. The particpants in the age category 18 to 27 years were more knowledgeable about cross contamination while those in 38 to 47 years age group had more knowledge on five keys to safer food. Attitudes and practices varied within the scope of the study between districts or by type of premises. Compliance also varied from district to district and between type of premises. However the majority of non-compliance was observed in restaurants than in boarding schools.

CHAPTER 5

DISCUSSION

5.1 INTRODUCTION

In this chapter the results of the current study are discussed in the context of other scientific research on this topic. The results of this study are based on the knowledge, attitudes and practice, and compliance regarding basic PRPs of the FSMS by the food service workers in Masvingo Province of Zimbabwe. Compliance with the FSMS has not been extensively described in the Zimbabwean context in the past. Studies conducted in other African countries revealed that food safety is compromised in Africa, and Zimbabwe was reported to be one of the most affected African countries (FAO/WHO 2002b). This is attributed to various factors that include knowledge, attitudes, practices and compliance with the basic PRPs of the FSMS by workers in the food sector.

5.2 FACTORS THAT INFLUENCED KNOWLEDGE REGARDING THE BASIC PRPs of the FSMS

In the current study it was found that various factors influenced the knowledge of the food handlers regarding the PRPs of the FSMS i.e. age, gender, education level, professional qualifications, occupation, experience, the district as well as the food service premises where the food handlers work.

5.2.1 Age

Several studies have described the impact of various variables on food safety in a variety of settings throughout the world (Akabanda, Hlortsi & Qwusu-Kwarteng 2017; Lee *et al.* 2017; Howes *et al*. quoted in Akabanda *et al*. 2017; Webb & Marancie quoted in Akabanda *et al*. 2017; Powell *et al*. quoted in Akabanda *et al*. 2017; Nyamari 2013; Clayton *et al*. 2002). Age is one of these variables. Older workers are reported to have better hygiene scores than their younger colleagues (Cakiroglu & Ucar quoted in Akabanda *et al*. 2017). In this study age did not influence respondents' knowledge on all questions except on hand washing (p=0.02)

where those in the 38 to 47 years age category were more knowledgeable on hand washing requirements.

5.2.2 Gender

In other studies more females worked as food handlers than males, and in some cases as much as 77% of them were females (Scares *et al*. 2012, Baluka *et al*. 2015 and Son *et al*. quoted in Akabanda *et al*. 2017). Contrary to those findings, this study found that there were slightly more male food handlers (51.8%) than females. However, gender did not influence the knowledge of the respondents. This could be due to fact that the level of academic and professional qualifications were almost the same between males and females.

5.2.3 Education

Educational achievement is generally expected to aid individuals in understanding (Lee *et al.* 2017). Ninety five point seven percent (133) of respondents had completed between form 1 and 6. The Zimbabwe literacy level is said to be at 91% (French 2015) However, academic achievement had no impact on knowledge of food safety. The majority of participants concurred that one could not tell whether water was safe by merely looking at it. Sixty eight percent (94) of the people were aware of basic hygiene, especially hand washing. The majority of participants across all educational levels found it unnecessary to wash fruits and vegetables before making salads but had high knowledge of food storage practices (temperature control). Those who had attended high school (forms 1-6) constituted the highest number of people who could not state at least one of the five keys to safer food. This is in contrast with Lee *et al*. (2017), who found that participants who had secondary education scored higher on food safety items related to personnel hygiene knowledge than others. Other studies concur with Lee *et al*. (2017), that the education level of food handlers

is generally perceived as one of the factors impacting on food safety and hygiene (Toh & Birchenough quoted in Lee *et al*. 2017). However, Webb and Marancie (quoted in Akabanda *et al*. 2017) argue that education level does not influence knowledge regarding food safety and hygiene. This suggests that irrespective of education level, there is still a need for training in food safety and hygiene related issues for food handlers to understand and practise food safety.

5.2.4 Professional qualification

The relevant knowledge of food safety can only be acquired through training as demonstrated in Spain where it was noted that the presence of Certified Kitchen Managers (CKM) in restaurants resulted in a reduction of the risks of foodborne disease outbreaks in such restaurants (Hedberg 2006). Thus food handlers trained in food safety are more likely to conform to safer food practices (Smith quoted in Kahindi 2016; Howes *et al*. quoted in Akabanda *et al*. 2017; Hedberg 2006). More studies have revealed that food handlers with refresher training demonstrated higher knowledge than those without.

In the current study it was found that professional qualification of participants was not related to food handling in any way, and did not influence responses. Respondents were ignorant of the five keys and possible sources of food contamination in storage. Further to that, half the participants across the professional divide did not find it necessary to wash vegetables and fruits in disinfectant before preparing salads. Similarly, a study by Akabanda *et al*. (2017) found that all the respondents reported that it was not necessary to wash vegetables and fruits in a disinfectant. However, in this study there was high knowledge on food storage practices that prevent illness, such as separating cooked and raw foods, leaving cooked food outside the refrigerator for more than two hours and that pests can contaminate food. The majority of

those with certificate and undergraduate degrees could not state the safe temperature for storing food. Most participants concurred that it was not possible to tell, by merely looking, that water was safe. The reason may be that water and sanitation is an area focused on by EHPs when they conduct inspections. The findings are consistent with that of Webb and Marancie (quoted in Akabanda *et al*. 2017), that professional qualification has nothing to do with food safety knowledge. Other studies attribute this to different areas emphasised during training or to daily operations to which the respondents are normally exposed or expected to follow (Adesokan, Akinseye & Adesokan 2015; Campbell 2011).

5.2.5 Occupation

In food safety, relevant knowledge is critical in influencing appropriate attitudes and practices by providing the foundation for the development and preservation of preventive strategies and initiatives for food safety (FAO/WHO 2012; WHO 2006; Lee *et al*. 2017). Howes *et al*. and Powell *et al*. (both quoted in Akabanda *et al*. 2017) concur that training improves the food safety knowledge of food handlers. According to Hedberg *et al*. (2006) the presence of trained food handlers helped to reduce the incidents of bacteria from bare hand contact with food in restaurants (Hedberg 2006). This further reinforces the notion that knowledge helps to modify practices. A study by Garayoa *et al*. (2014) in Spain reported that food handlers were not aware that they were directly responsible for ensuring food safety.

In this study it was found that the knowledge of participants was significantly related to the job level of the participant. Of the cooks, 89.7% (n=61) and 85.7% (n=12) of waiters had accomplished form 1 to 4 while 63.2% of manager/supervisors had attained form 5-6. Knowledge level on whether separating raw and cooked food, as well as whether pests contaminate food, was significantly low in cooks compared to other groups. Even supervisors (39.3%), cooks (45.6%) and waiters (42.9%) did not know the source of food contamination.

This may be due to a lack of training since only 8% of participants had been trained in food safety. Worse still, supervisors/managers' (45%) knowledge on the need to disinfect fruits and vegetables before making salads, was lower than that of their subordinates (>50% in cooks and waiters).

Although knowledge regarding disinfecting fruits and vegetables for salads was poor in this study, it was however much better compared to 0% reported by Akabanda *et al*. (2017), on the same question. Moreover, in this study, cooks (29.9%) and waiters (28.6%) together had better knowledge than supervisors/managers (35.1%) on the circumstances that require one to wash hands. These findings are consistent with that of Webb and Marancie (quoted in Akabanda *et al*. 2017) that education level has nothing to do with food safety knowledge. The low knowledge demonstrated by management staff in these aspects is of concern because management should take leadership in food safety. This might be attributed to a lack of training specifically in food safety, since only 8% of the participants reported having been trained in food safety in the previous twelve months.

5.2.6 Experience

According to findings by Lee *et al*. (2017), work experience influenced food safety knowledge. Those with more working experience in the food industry had better knowledge of food safety. Contrary to this notion, in this study it was found that the knowledge of participants did not vary significantly due to experience. A high level of knowledge on the safe temperature for storing food, the role of pests on food contamination and the importance of separating raw and cooked food was shown across the experience divide. The majority (76.3%) of participants across this divide mentioned that it was not possible to tell whether water was safe by merely looking at it. Close to one third of the participants regardless of

experience did not know the circumstances when hands should be washed. This is a public health concern in that unclean hands harbour numerous types of disease causing microorganisms (FAO/WHO 2012). A study conducted by Todd *et al*. (2007) found that 50% of food handlers' hands were contaminated with salmonella. Thus knowing that hands can contaminate food is important and may lead to good hygiene practices (WHO 2006). One third of participants did not know when to wash their hands, although they concurred that cleaning surfaces reduced illness risk. This suggests that knowledge can be inconsistent. Similarly Campbell (2011), reports that respondents could not mention five keys to safer food, but could mention the principles of their application. In the current study, the knowledge of the respondents on the application of these principles was inconsistent. This could be influenced by day-to-day operations at their workplace as highlighted by Adesokan *et al*. (2015). The knowledge of the managers/supervisors in food safety may play a key role in this regard, as they are expected to guide subordinates in food safety operations.

5.2.7 District

Food safety knowledge significantly differed across the districts in the study area ($p<0.02$). This could be due to inspection frequency and supervision or training. The effect of the management/supervision style of the District Environmental Health Officers (DEHO) who head the district may not be ruled out and could include training and supervision frequencies from one district to the other. According to Nyamari (2013), the frequency of supervision improved compliance and in the absence of inspection, management would ignore food safety measures. In addition to this, proximity of premises to town affects food safety supervision. FAO/WHO (2002b) reports that food safety monitoring was more concentrated in urban areas than in rural or small towns.

There was a high level of knowledge across all the districts on food contamination. As expected, the knowledge level was higher in urban than in rural districts. Food safety measures are mostly reinforced in urban areas than rural. Knowledge on the safe temperature for storing cooked food varied significantly from one district to another. This could be related to the support given by the DEHO to EHPs. Furthermore it could be due to inadequate staffing of EHPs which results in poor coverage. More importantly, it could be to do with availability of electricity, since its coverage in Zimbabwe is still poor where temperature control usually requires electricity. Lockis *et al*. (2011) and Nyamari (2013) found that the lack of resources, such as electricity, compromises food safety practices.

Generally there was low knowledge on whether one could tell if water was safe by merely looking at it. The level of ignorance was high in rural areas such as Chivi (0%) and Mwenezi (0%), where all respondents gave incorrect responses on the question; this could be related to EHP coverage or supervision of food safety in rural areas. This concurs with other researchers who found that food safety was more supervised in urban areas than in rural (FAO/WHO 2002a).

The low knowledge regarding water safety among food handlers is of concern because water is one of the major vehicles of foodborne disease pathogens (WHO 2006; Rane 2011; Ucar *et al*. 2016; Woodall 2009 quoted in Lockis *et al*. 2011). For instance, according to WHO (2006), about 10 000 000 bacteria are required to make 1ml (one millilitre) of water appear unclean, yet in some cases it takes only 15-20 bacteria to cause illness. Thus food handlers' knowledge is important in distinguishing between being clean and being safe.

On whether it was necessary to wash fruits and vegetables with disinfectant before making salads, the knowledge on this question was very low in rural districts compared to urban

districts. For instance, there was no correct answer from the Mwenezi district and only 12.5% of participants from Chiredzi rural got it correct. This could be because less salad making is practised in rural areas than in urban, and that food safety measures are poor in rural areas compared to urban areas as reported by FAO/WHO (2002) . Responses on whether separating raw and cooked food prevented illness also varied significantly with districts. Chiredzi rural had the lowest level of knowledge compared to other districts. This could be due to insufficient resources, which are known to compromise food safety practices. It could also be due to a lack of training, or a combination of these two factors.

On whether it was unsafe to leave food in temperatures between 5 and 65˚C, the knowledge was significantly different with rural districts reporting low knowledge in general, for example, Gutu (47.8%), Mwenezi (50.06%) and Chiredzi urban (58.3%).

The five keys to safer food are summarised strategies developed by the World Health Organisation (WHO 2006). These are raw materials, separation of raw and cooked foods, keeping it clean, thorough cooking and temperature control (WHO 2006). The level of knowledge on these five keys to safer food varied significantly among the districts. The level of knowledge was higher in rural districts than in the urban**.** The level of knowledge on when to wash hands also varied significantly among the districts, though was not associated with the location of the study area**.** The variation in knowledge can also be attributed to a lack of training.

5.2.8 Type of premises

Knowledge on food contamination was lower in schools than in restaurants (p=0.02) because EHPs inspect restaurants more frequently than schools. For instance, I found that 65.2.% of restaurants had been inspected in the last three months compared to only 29.6% of schools. In spite of this, the general knowledge between schools and restaurants did not vary and was generally high on that it is necessary to store raw and cooked food separately to prevent illness and that keeping surfaces clean reduces illness risk. More than 31.9% (44) of the food handlers did not know the circumstances that required them to wash hands. Similarly Campbell (2011) found that participants could not mention the five keys to safer food, but could practise the principles of the five keys (Campbell 2011). This is also a reflection of a lack of training in food safety: close to 92% of the participants had not had any training during the previous twelve months in this study.

Pork meat is prone to infections that parasitise humans, sometimes with dire consequences, such as epilepsy in some cases (FAO/WHO 2012). Thus meat should be inspected to exclude that which is infected with parasite. The source of beef/mutton also varied significantly between the type of premises. Restaurants attained 94.6% of their meat from butcheries against 74.4% for the schools. It is worrying to note that about two thirds of the pork meat used in both premises, was not inspected.

Knowledge of the five keys to safer food and circumstances to wash hands significantly varied between restaurants and schools. Restaurants had the highest proportion (38.4%) of participants who could hardly name one single key of the five to safer food. Boarding schools had a higher proportion (63.0%) of participants who managed to mention four circumstances

to wash hands. Perhaps schools as institutions of learning adhere to better food safety practices than restaurants.

5.3 FACTORS THAT INFLUENCED ATTITUDE REGARDING THE BASIC PRPs of the FSMS

In the current study, it was found that some factors influenced the attitude of the food handlers regarding the PRPs of the FSMS, such as the district where the food handlers work, the environment and also the food service premises.

The effectiveness of the implementation of food safety systems is dependent on the attitude of managers, their subordinates and the hygiene culture of the organisation. This is hinged on the type and level of education on food safety of managers. The absence of these traits in food managers may lead to poor food safety standards (Nyamari 2013; FAO/WHO 2002b). Thus issues to do with the attitude of food handlers may be organisation based. Several studies reported that a lack of training in food safety, poor working conditions, malfunctioning or inadequate equipment, lack of water, insufficient supervision and motivation regarding an employee's compliance with the standards are the main barriers inhibiting food handlers from handling food in a safe manner in developing countries (Nyamari 2013; Clayton *et al*. 2002; Walker *et al*. and Cilce *et al*. both quoted in Nyamari 2013; Lockis *et al*. 2011).

5.3.1 District

The attitude of practising the principle of 'first in, first out' (FIFO) which demands that the first delivered goods be used first in order to avoid situations where goods expire in stock varied with districts. This was generally higher in rural than in urban districts, except for

Mwenezi. This may be because in rural areas commodities are slow selling and retailer shops may be far from wholesalers; thus retailers prefer to order in bulk hence selling of goods may need FIFO. While in urban areas, commodities sell faster and retailers are closer to wholesalers, hence there is no need to stock large amounts of goods that may expire on shelves.

Attitudes resulting from a lack of training and sufficient supervision cannot be ruled out. Several studies reported that lack of training and sufficient supervision compromise attitudes towards compliance with food safety (Nyamari 2013; Clayton *et al*. 2002; Walker *et al*. and Cilce *et al*. both quoted in Nyamari 2013; Lockis *et al*. 2011). Most (66.7%) district facilities were not free from pests although knowledge was high on that pests contaminate food. The tendency to ignore pest management issues could be due to unavailability of pest controllers since in Zimbabwe there is no board or training programmes specifically for the control of public health industrial pests. The non-availability of service providers may have a negative bearing on the attitude of the food operators in the study area.

5.3.2 Type of premises

In this study, a pest-free facility, with a clean fridge and freezer, adhering to FIFO and the labelling of food by name did not vary with type of premises. Premises in half of the districts had food labelled by name, and the influence of EHPs cannot be ruled out. Similarly, Adesokan *et al*. (2015) noted that what is practised in specific premises could be due to the nature of the training or the daily operations to which the workers might have been exposed.

There were many inconsistencies in attitude towards various components of food safety. For instance, the attitude towards personnel hygiene for preventing food contamination through

keeping finger nails short and jewellery control was quite positive and the majority of these practices were in schools. This was the case despite the fact that 92% of participants were not trained in food safety. This contradicts the notion that trained food handlers would exhibit positive attitudes (Lee *et al.* 2017; Howes *et al*. quoted in Akabanda *et al*. 2017). This can be attributed to a general desire for hygiene and/or to the type of hygiene they were exposed to.

Surprisingly, the study also noted that there was a poor attitude towards hand washing, as almost a third of respondents could not mention situations where hand washing could be required. This was more rampant in restaurants. The findings also contradicted that of other researchers who indicated that food handlers self-reported that although they knew they should provide safe food, they still engaged in unsafe food handling practices more frequently than they actually engaged in safe practices (Prianka *et al*. quoted in Nyamari 2013). Further to that (Clayton *et al*. 2002) reported that 63% of food handlers who exhibited knowledge in food safety did not demonstrate corresponding positive behaviour towards food safety and hygienic practices.

The level of knowledge on the circumstances when to wash hands does not tally with the high level of education of food handlers exhibited in this study. Other researchers also argue that the inconsistency between what is reported and practised could be due to a lack of supervision (Nyamari 2013). This might be due to training that focuses only on some components of food safety and hygiene, leaving out other components. Thus food safety issues need to be approached in an integrated manner to achieve meaningful effect. Akabanda *et al*. (2017) suggest that there is a need to combine employee motivation, continual education and training on the job for food handlers, with the aim of instilling good attitudes and subsequently practices.

The attitude towards cleaning was poor, as it was observed that regular cleaning of food surfaces was practised in only 45.7% (32) of the premises (restaurants, 39.3% and schools, 71.4%), thereby creating a high risk of food cross contamination through unclean surfaces (WHO, 2006). The attitude exhibited in this study contradicted the findings by Akabanda *et al*. (2017) who noted that the majority (98.6%) of participants agreed that food surfaces should be properly sanitised to prevent cross contamination of foods. The current study results might be related to a lack of supervision, since the majority of these food handlers reported that they were aware that unclean surfaces contaminate food. Several researchers have concurred that lack of supervision creates laxity among food handlers (Nyamari 2013; Clayton *et al*. 2002; Walker *et al*. and Cilce *et al*. both quoted in Nyamari 2013; Lockis *et al*. 2011). It may also be related to what is emphasised during inspections. EHP inspections include identification of food safety hazards and are also supervisory by nature.

Besides a lack of resources, the remaining attitude issues in this study were largely centred on a lack of training, although several authors differed in perceptions about this. Proponents of training have noted that those who had received training exhibited positive attitudes towards food safety, confirming the notion that there is a strong link between the training of food handlers and a positive attitude in maintaining safe food handling practices (Lee *et al.* 2017; Campbell 2011; Howes *et al*. quoted in Akabanda *et al*. 2017). Those who oppose training argue that there is no relationship between education level and a positive attitude to food safety (Webb & Marancie quoted in Akabanda *et al*. 2017; McIntosh *et al*. quoted in Nyamari 2013). A significantly high number of boarding schools (28.6%) when compared to restaurants (12.5%) had food handlers training. On the same note, training posters on hygiene practice were found in only 18.6% of restaurants and 21.4% of schools. This is much lower

when compared to Lockis *et al*. (2011) who found that 80% of the schools had posters concerning food hygiene. Such posters provide useful information on the five keys to safer food (WHO 2007).

5.4 FACTORS THAT INFLUENCED PRACTICES REGARDING THE BASIC PRPs of the FSMS

In the current study, it was found that factors such as type of occupation, district and premises influenced the attitude of the food handlers regarding the PRPs of the FSMS.

In food safety, good practices that promote safe food production or preparation are founded on numerous variables that range from training, supervision, resource allocation and compliance among others. These together create an environment that is supportive to a food safety management system, where food handlers practise acceptable food safety practices with basic PRPs of the FSMS.

5.4.1 Occupation

The culture of practising good food safety in an organisation is the jurisdiction of management. The level and type of managers' education on food safety is the bedrock of the success of the culture. The absence of knowledge of food safety principles and practices among food managers leads to a poor food safety culture in their organisations. It is the responsibility of management staff to guide subordinates in food safety operations (CAC/RCP 1999).

In this study, it emerged that there was no variation on practice by occupation on various food safety variables. For instance, almost equal proportions of cooks and waiters reported that they store cooked food at temperatures between 5ºC and 65˚C. This practice may be associated with a lack of resources, since electricity coverage in Zimbabwe is not adequate

particularly in rural areas. On the other hand, this practice may also be attributed to a lack of training. In this study, it was discovered that only 8% of all food handlers had a food safety training in the previous twelve months.

5.4.2 District

A lack of resources and skill are known as barriers to executing any activity in a safe manner. Several studies concur that in food safety, shortages of resources such as equipment, staff and time accompanied by a lack of training and supervision are among important barriers to safer food handling practices (Lockis *et al*. 2011; Nyamari 2013).

It has also emerged in the current study that most districts had inadequate equipment for handling food safely. This scenario was prevalent in both urban and rural districts. This is not surprising as all types of businesses in Zimbabwe are struggling due to the economic challenges prevailing in the country.

Preparing food in small batches is good practice, especially where temperature control facilities are not adequate, as is the situation in Zimbabwe. This helps to curtail recolonisation of food by microorganisms. It was found that less than 67% of participants from Masvingo rural, Masvingo urban and Chivi districts prepared food in smaller batches/quantities. More than 75% of the districts reported preparing food in smaller batches. In contrast, a study by Akabanda *et al*. (2017) noted that 83.8% of respondents from food handlers prepared food in advance (Akabanda *et al*. 2017). This practice is acceptable as long as the cooked food is stored timeously at appropriate temperatures to prevent bacterial growth.

Regarding the requirement that waste be removed from food areas to prevent food contamination and the proliferation of pests, pest infestation was generally moderate across the districts. However, Mwenezi district was the most infested district and this was linked to poor waste removal in that district. Mwenezi district was the only district where waste removal was not done.

5.4.3 Type of Premises

Positive practice regarding PRPs did not vary significantly between restaurants and schools. Restaurants significantly prepared smaller food dishes than schools. This is not surprising because schools need to prepare large amounts of food, and to achieve this the preparation has to be done in advance in order to feed the school children whose number is always greater than customers in restaurants. Unlike schools, restaurants can prepare food on customer's request.

5.5 FACTORS THAT INFLUENCED COMPLIANCE REGARDING THE BASIC PRPs of the FSMS

Compliance with the basic PRPs of the FSMS is one of the pillars that supports the production or preparation of safe food. Its effectiveness is seen through determining compliance status to PRPs of the FSMS. Although there are many PRPs of the FSFMS, there are some basic ones that must be complied with by all food handling facilities regardless of size and location (ISO/TS 2009). Thus compliance is measured through national statutory instruments or other standards (FAO/WHO 2005b).

In the current study it was found that factors such as knowledge, attitude, resources, legislation enforcement, district and type of premises influenced the compliance of the food handlers regarding the PRPs of the FSMS.

5.5.1 District

There was a significant difference in six of the eight knowledge variables ($p<0.01$), three out of five attitude variables (<0.02) and seven out of thirteen practice variables ($p<0.01$) across districts. In this study it emerged that compliance with pest control was generally low across all the districts and did not vary significantly between them. The study found that there was evidence of staff training on food hygiene in the past twelve months in only 8% of the participants in study area. Thus training was very poor in all districts with Chiredzi urban, Chiredzi rural and Chibi districts having not trained their food handlers at all in this time frame.

Legislation requires food handlers to undergo periodic medical examination where a certificate of fitness is issued and kept for production on demand by authorised personnel. In Zimbabwe the Public Health Food Handlers Medical Examination Order (SI41 1994) requires food handler employers to only employ a food handler with a valid medical certificate. In this study, we discovered that only 60% of food handlers had valid health certificates, and this did not vary among districts. Masvingo urban had the least (33.3%) compliance. This finding is contrary to the FAO/WHO (2002) assertion that food control measures are better enforced in urban setups than in rural areas. This could be due to a general disregard of legislation by the food handlers.

There was a significant difference in the availability of toilets for customers across the districts. Toilet availability was above 50% in all rural districts. However, it was only 37% in Masvingo urban. This is in sharp contrast to the notion that food safety is monitored more in urban areas than in rural areas. It is surprising to note that compliance is so low in Masvingo urban, when most respondents in Masvingo urban reported that their premises were inspected

in the previous one to three months. Toilet adequacy is a legal requirement to be complied with before a recommendation of licensing is made by EHPs.

All districts' respondents reported that their beef was bought from registered outlets and was inspected, however some individual respondents within districts reported that at times the meat is not inspected. Uninspected meat may be cheaper than inspected meat or it could be due to a lack of supervision by EHPs.

5.5.2 Premises

There was a significant difference ($p<0.02$) in three of the eight knowledge variables, and ($p=0.01$) in two of the twelve variables in practice across all premises. Pest control is one of the critical components of food safety. Compliance with pest control was low (15.7%) across all premises, however it was much lower (10.7%) in restaurants compared to (35.7) schools. In contrast, Lockis *et al*. (2011) found compliance was low (5%) in schools in Spain.

It is also a requirement in the FSMS to have a pest control programme managed by a person trained accordingly in order to reduce the risk of food contamination by pesticides and injuries to people and other non-targeted species (ISO/TS 2009). In the current study there was a significant difference ($p=0.03$) between the two types of premises in the availability of pesticide material safety data sheets (MSDS). However, schools had better (57.1%) coverage compared to restaurants (26.8%). Low coverage may be due to a lack of trained pest controllers and training on the part of food service operators. This is a cause for concern because pesticides are toxic and can kill or injure people or animals if not used properly. According to Ucar *et al*. (2016), pesticide handlers should comply with instructions governing the use of such chemicals.

Compliance with the requirement for food handlers to undergo periodic medical examination did not vary significantly between schools and restaurants. However, there was less compliance in restaurants (57.1%) compared to schools (71.4%) despite the fact that inspection frequencies by EHPs were higher in restaurants than in schools. This contradicts findings by Nyamari (2013) that compliance was better where frequency of inspection was also high. While Seaman (quoted in Lee *et al*. 2017) noted that continual training and management support are important elements in the transfer of knowledge into behaviour.

Compliance with personnel hygiene (uniform clean, shoes worn, finger nails short) significantly differed between schools and restaurants, however this was generally good in both premises. This could be related to the variations in their knowledge due to the type of training or day-to-day operations they might be exposed to. Training of staff, wash hand reminders and food handlers' medical records were low in both types of premises and this decline was more pronounced in restaurants.

A significantly high number of boarding schools (28.6%) compared to restaurants (12.5%) had food handlers training. On the same note, training posters on hygiene practice were found in only 18.6% of restaurants and 21.4% of schools. This is much lower when compared to Lockis *et al*. (2011) who found that 80% of the schools had posters concerning food hygiene. Posters provide useful information on the five keys to safer food (Lockis *et al*. 2011; WHO 2007).

Compliance with PRP cleaning and sanitation was generally higher in schools than in restaurants. These differences were significantly greater in scheduled cleaning/sanitising and

a regular cleaning schedule for food surfaces. Contrary to his findings, Lockis *et al*. (2011) found that there was 0% compliance in the schools they studied in Spain.

Cleaning is integral to safe food production removing potential growth media for pathogens. Regarding raw materials, it emerged that at times some premises used uninspected beef or pork. This was more common in schools than in restaurants. Perhaps it is because some schools have farms where they keep their own animals for meat. However, uninspected pork presents a major risk to public health, as some epilepsy is attributed to the consumption of infected pork (WHO 2015b).

Business premises owners are required to provide adequate toilet facilities at their establishments. This is a requirement of basic PRP personnel hygiene and facilities (ISO/TS 2009). Schools were more compliant with toilet requirements than restaurants. Similarly, Lockis *et al*.(2011) found that compliance with requirements for adequate toilets was high (90%) in schools in Spain. The inadequacy of toilet facilities at food handling facilities is a major violation of the legal requirements for such facilities.

5.5.3 Knowledge

One needs knowledge in order to comply with a requirement. In the study, knowledge on the five keys to safer food (cleanliness, temperature control, separation, raw materials and thorough cooking) was poor and varied significantly across districts (X^2; 81.63; df 40; $p<0.01$). Similar trends emerged on other knowledge variables in districts and restaurants. This can be attributed to a lack of training since only 8% of participants reported that they had been trained in the previous twelve months and there was a significant difference between districts ($p=0.02$).

Food handlers training is one of the most important strategies in food safety (NDSC 2004). Some studies have noted that trained food handlers practised positive behaviours that improve food safety (Lambiri *et al*. quoted in Akabnda *et al*. 2017; Conningham; Jenkins-Mclean *et al* and Lin & Sneed all quoted in Nyamari 2013). Other studies suggest that theoretical training is required to motivate food handlers to change their attitudes and practices in food handling. (Seaman quoted in Lockis *et al*. 2011). Some studies argue that training does not improve food safety practice and attitude. They further argue that knowledge does not always guarantee positive food safety behaviour and compliance (Nyamari 2013; Campbell 2011; Howes *et al*. and Powell both quoted in Akabanda *et al*. 2017; Lee et al, 2017; Akabanda *et al*. 2017) .

However, in Zimbabwe national strategy has not embraced training as one of the important strategies to improve food safety (FAO/WHO 2005a). Some studies in other countries also reported low coverage in training, for instance Nyamari (2013), noted that 22.7% of participants reported having attended a course on food handling and hygiene, and 50% was noted by Lockis *et al*. (2011). In contrast, Campbell (2011) reports that training coverage was 67% among food handlers in Johannesburg.

It is interesting to note that there was low compliance with food handling training in Zimbabwe despite the country being a member of CODEX, which is a board that sets and recommends food safety standards, and the country further committing itself to ensuring that its food services conform to international standards of food safety through national public health legislation (WHO 2012).

5.5.4 Attitude

Use of unsafe raw materials is against the principles of food safety governed by various standards and statutory instruments (PHA 15:09; F and FS Act; FSMS; WHO 2006). Smith (quoted in Kahindi 2016) claimed that in the context of Zimbabwe's food industry, unsafe food practices caused food contamination that led to illness. Studies indicated that the food contamination was due to a lack of KAP, and disregard of government legislation. Ushewokunze-Obatolu (2008) also noted that food products such as fresh meat was presented on the market without evidence of complying to the food control regulations thereby endangering consumers in Zimbabwe.

5.5.5 Enforcement of legislation

Non-compliance with legislative provisions was high despite EHPs having inspected 65.2% of restaurants and 29.6% of schools between the previous one to three months. EHPs inspect premises and educate on various food safety issues including the legislative requirements. The officers are empowered to enforce legislation, including closure of non-complying premises and even resorting to enforcement through the courts of law. So it is surprising to note the high level of non-compliance when EHPs are supposed to correct the situation. Virtually no or very little is being done regarding the enforcement of food handling regulations as mandated. Throughout the study area only Masvingo city health department has at times exercised these powers through the courts of law. Lack of legislation enforcement by EHPs may be due to the low status accorded to them as highlighted in FAO/WHO conference in 2002 that "food inspectors in Africa suffer from low professional recognition which is not consistent with their responsibilities, lack of logistical support to carry out the inspections and that national food inspection services are often located in the

capital or major cities with little control in smaller towns and rural areas". In Zimbabwe this may also be attributed to the nature of the training of EHPs versus their mandate. These officers are the custodians of food safety laws and are expected to implement these laws, yet they were not trained to do this (including court procedures). This may present a barrier to their being able to handle legal issues in food safety. Thus food service operators and other stakeholders in the food industry may take advantage of this and disregard compliance. One of the limitations of this study is that EHPs were not asked about the challenges they are facing in enforcing the law through courts of law.

Some studies have shown that non-compliance may be related to a lack of mechanisms for enforcing legislation. In Zimbabwe and in other African countries, this could be attributed to fragmentation of responsibilities as well as outdated laws (FAO/WHO 2002a). According to FAO/WHO (2002a) Zimbabwean laws are said to be out of date and overly prescriptive, while failing to adequately address the whole range of food safety concerns (FAO/WHO 2002a). This is consistent with the findings of Jordaan *et al*. (2004) quoted in Kahindi *et al.* (2016) who noted that the management practices of food safety systems was facing a challenging time in Zimbabwe and was not functioning well due to a working environment that was not supportive of food safety activities.

Political interference at a lower level and interference from other stakeholders cannot be ruled out as food safety laws in Zimbabwe are influenced by different government departments resulting in confusion with regards to implementation. FAO/WHO (2005c) described the food laws in Zimbabwe as uncoordinated, difficult to implement and outdated, and that duplication of functions due to a lack of clear guidelines on responsibilities and mandates of various stakeholders has been reported (FAO/WHO 2005c). In Zimbabwe it is

also said that there are very few EHPs in the field, leaving some areas unattended (NMCP 2017). This has influenced compliance with basic PRPs of the FSMS in Masvingo Province.

5.6 LIMITATIONS

The study attempted to describe the knowledge, attitude and practices, and compliance with basic PRPs of the FSMS using a quantitative approach.

1) One limitation occurred when not enough trainee EHP data collectors were found in the field because in some areas there were no student EHPs. This left practising EHPs to collect data in their areas of jurisdiction. This might have compromised the outcome as the area EHPs may have been interested parties.
2) Obtaining the inspection frequency schedule for restaurants and boarding schools as well as the scope of inspection could have added insight into the system even though it was not one of the objectives of the study.
3) Furthermore, obtaining information on the action taken on non-compliant restaurants and boarding schools could have put the results of this study into the context of the PRPs of the FSMS, providing some valuable insight.
4) An overview of the support or challenges faced by EHPs in executing their work could also have provided interesting insights.
5) Information regarding the content on which food handlers were trained was not obtained, so could not be evaluated.
6) The acquisition of surface swabbing and food samples for microbiological contamination could have added value to the study by putting some of the results regarding knowledge and practices into actual context.

5.7 SUGGESTIONS FOR FURTHER STUDIES

This study provides baseline information for further studies on KAP and compliance in schools and restaurants in Zimbabwe regarding food safety.

1) There is a need to further explore why there is high inspection coverage by EHPs and yet there is also high non-compliance with food safety standards by food handlers.
2) There may be a need to review the effectiveness of EHPs inspections.
3) There is a need to study how best the food safety system can be coordinated for effective compliance.
4) There may also be a need to conduct a study to determine the strengths and weaknesses of the licensing system of food service premises in Zimbabwe in view of improving its coordination.

5.8 RELEVANCE

This study provides baseline information on food safety in Masvingo Province from which a comprehensive national study can be done. It also provides an insight for the Ministry of Health and Child Care officials into the state of food safety in the study area, which may be used to inform policy with regards to reviewing the training curriculum for EHPs. Further to that, the results obtained may be used as a basis for engagement of stakeholders to review food safety policy implementation in Zimbabwe, including the responsibilities and power sharing in order to avoid duplication, overlaps and omissions.

5.9 SUMMARY

Compliance was generally poor and a general disregard of legislation was rampant This may be attributed to a number of factors such as knowledge, attitude, resources, legislation

enforcement, district and type of premises. Generally schools were more knowledgeable and compliant compared to restaurants.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter provides conclusions drawn from the current study with recommendations to be pursued in order to address gaps that were revealed by this study.

6.2 CONCLUSIONS

The food service workers in Masvingo Province had high literacy levels, as 95.7% of them had attained secondary school education. However their food safety knowledge was not commensurate with their educational levels because they had not been trained specifically on food safety issues. There was also a general disregard of food legislation among these workers.

The food saety knowledge did not vary across districts and between types of premises although it was better in schools than restaurants. Similarly the knowledge level between managers and cooks/ waiters was the same. However those who had worked for longer periods as food handlers had improved food safety knowledge. Low training coverage (8%) of particpants on food safety could have contributed to that.

The food service workers' attitudes towards various components of food safety varied also, this may be due to lack of training and supervision as management was equally not quite knowledgeable in food safety issues like their subordinates. On one hand the general practice regarding basic PRPs of FSMS was poor. The practice of pest control was low throughout but much lower in restaurants than schools. Some meat was not inspected thereby exposing school children and other customers to meat-borne parasites.

Management compliance with the basic PRPs of FSMS was poor across all districts and types of premises although compliance was generally better in schools than restaurants. Health inspections were more frequently done in restaurants than schools. Despite high inspection

frequency, premises that did not comply with provisions of legislation, such as requirements for food handlers' medical examination, provision of adequate sanitary facilities and safe water as well as a pest control programme, continued to operate. Surprisingly, although the law empowers food safety law enforcement agencies (EHPs) where necessary to take legal action through the courts of law against non-compliances, it appeared this was not being done in all districts except rarely in Masvingo urban.

The non-compliance was influenced by many factors such as lack of training on the part of food service management in the study area to understand their obligation in food safety. However, chief factor appeared to be ineffective enforcement of legislation on the part of EHPs which might have sustained the non-compliance partly because these carders are not trained in the practical enforcement of this law. To a larger extend, non compliance with food safety in Zimbabwe may be due to lack of clearly defined coordination of roles and responsibilities of stakeholders in the food safety system. Studies have reported lack of compliance with food laws as a common scenario in Africa and have attributed this to low status and lack of logistical support given to EHPs who are supposed to enforce the law. They further report that this is compounded by lack of mechanisms of enforcing legislation as responsibilities are fragmentation, uncoordinated and functions duplicated due to lack of guidelines on responsibilities and mandate of various stakeholders. On one hand the food laws are outdated, overly prescriptive and difficult to implement, yet not adequately addressing the whole range of food safety concerns such as training in the context of Zimbabwe. It was also noted that the political environment did not support the implementation of food safety policies.

6.3 RECOMMENDATIONS

1) There is a need to consider aligning legislation with the current food safety dimensions as prescribed in the CODEX.
2) There is a further need to review definitions of roles, responsibilities and powers amongst the stakeholders in food safety in order to remove confusion, overlaps and omissions.
3) The current syllabus for EHPs may need to be reviewed to include food safety legislation at all levels to enable them to tackle legal issues in the field. This will require an orientation course for practising EHPs.
4) EHPs may need to have periodic refreshers courses on their legal obligation to enforce food safety.
5) There is need to consider the development of clearly defined, minimum and easy-to-use health standards, in particular for food premises.
6) Training in food handling is critical, there is a need to consider a standardised training programme for food handlers and make it a prerequisite for the renewal or issuance of a trading licence.
7) Compliance is also critical in food safety. There is a need to explore why there is high inspection coverage by EHPs while there is also high non-compliance with food safety standards by food handlers.

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APPENDICES

Appendix 1: UWC Ethics Committee Approval

UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 2988/2948
F: +27 21 959 3170
E: research-ethics@uwc.ac.za
www.uwc.ac.za

06 December 2016

Mr F Zvenyika
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM/16/5/34

Project Title: The knowledge, attitudes and practices and compliance regarding the basic pre-requisite programs (PRPs) of food safety management systems of food service workers in boarding schools and restaurants in Masvingo Province, Zimbabwe.

Approval Period: 24 November 2016 – 24 November 2017

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER -130416-050

FROM HOPE TO ACTION THROUGH KNOWLEDGE

Appendix 2: Ministry of Primary and Secondary Education Approval

All communications should be addressed to
"The Secretary for Primary and Secondary Education
Telephone: 732006
Telegraphic address : "EDUCATION"
Fax: 794505

ZIMBABWE

Reference: C/426/3Masvingo
Ministry of Primary and Secondary Education
P.O Box CY 121
Causeway
HARARE

30 January 2017

Zvenyika Faustino
Environmental Health Department
Bag 802
Triangle

Re: **PERMISSION TO CARRY OUT RESEARCH IN MASVINGO PROVINCE: BIKITA, CHIREDZI, CHIVI, GUTU, MASVINGO, MWENEZI AND ZAKA DISTRICT: AT THE ATTACHED SCHOOLS**

Reference is made to your application to carry out research at the attached schools in Masvingo Province on the research title:

"THE KNOWLEDGE, ATTITUDES AND PRACTICES AND COMPLIANCE REGARDING THE BASIC PREREQUISITE PROGRAMS (PRPs) OF FOOD SAFETY MANAGEMENT SYSTEMS OF FOOD SERVICES WORKERS IN BOARDING SCHOOLS AND RESAURANTS IN MASVINGO PROVINCE "

Permission is hereby granted. However, you are required to liaise with the Provincial Education Director, Masvingo Province, who is responsible for the schools which you want to involve in your research. You should ensure that your research work does not disrupt the normal operations of the school. Where students are involved, parental consent is required.

You are also required to provide a copy of your final report to the Secretary for Primary and Secondary Education by 30 May 2017.

E. Chinyowa
Acting Director: Planning, Research and Statistics
For: **SECRETARY FOR PRIMARY AND SECONDARY EDUCATION**
cc: PED – Masvingo

Appendix 3: Medical Research Council of Zimbabwe Approval

Telephone: 791792/791193
Telefax: (263) - 4 - 790715
E-mail: mrcz@mrcz.org.zw
Website: http://www.mrcz.org.zw

Medical Research Council of Zimbabwe
Josiah Tongogara / Mazoe Street
P. O. Box CY 573
Causeway
Harare

APPROVAL LETTER

Ref: MRCZ/B/1221 **6 February, 2017**

Faustino Zvenyika
University of Western Cape
South Africa

RE: - The Knowledge, Attitudes and Practices and Compliance Regarding the Basic Prerequisite Programs (PRPs) of Food Safety Management Systems of Food Service Workers in Bearding Schools and Restaurants in Masvingo Province, Zimbabwe.

Thank you for the above titled proposal that you submitted to the Medical Research Council of Zimbabwe (MRCZ) for review. Please be advised that the Medical Research Council of Zimbabwe has **reviewed** and **approved** your application to conduct the above titled study. This is based on the following documents (among others) that were submitted to the MRCZ for review:

a) Research Protocol

- **APPROVAL NUMBER** **: MRCZ/B/1221**

This number should be used on all correspondence, consent forms and documents as appropriate.

- **TYPE OF REVIEW** **: EXPEDITED**
- **EFFECTIVE APPROVAL DATE** **: 6 February, 2017**
- **EXPIRATION DATE** **: 5 February, 2018**

After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Website should be submitted three months before the expiration date for continuing review.

- **SERIOUS ADVERSE EVENT REPORTING**: All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Website.
- **MODIFICATIONS**: Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Website is required before implementing any changes in the Protocol (including changes in the consent documents).
- **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Website.
- **QUESTIONS**: Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on mrcz@mrcz.org.zw
- **Other**
- Please be reminded to send in copies of your research results for our records as well as for Health Research Database.
- You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.

Yours Faithfully

.....

MRCZ SECRETARIAT
FOR CHAIRPERSON
MEDICAL RESEARCH COUNCIL OF ZIMBABWE

MEDICAL RESEARCH COUNCIL OF ZIMBABWE
2017 -02- 06
APPROVED
P.O. BOX CY 573 CAUSEWAY, HARARE

PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH

Appendix 4: Participant Information Sheet

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809 Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

INFORMATION SHEET

Project Title:

The knowledge, attitudes, and practices and compliance regarding the basic prerequisite programs (PRPs) of food safety management systems of food service workers in boarding schools and restaurants in Masvingo Province, Zimbabwe.

What this study is about

This is a research project being conducted by Faustino Zvenyika at the University of the Western Cape. We are inviting you to participate in this research project because you work in food service sector. The purpose of this research project is to understand the knowledge, attitudes, practices and compliance of food service employees of boarding schools and restaurants with the basic prerequisite programs (PRPs) of food safety management systems in Masvingo province. The findings may inform the policy makers on the state of KAP and compliance with the basic PRPs of the FSMS in food sector in Zimbabwe. This may also lead to initiation of programmes for improving food safety, which may include health promotion sessions with food sector operators and public awareness on food safety.

What you will be asked to do if I agree to participate

You will be asked to answer some questions with regards to producing safe food. The study will be conducted in your work area and it may take between 25 and 35 minutes of your time. The questions will include your knowledge, attitudes and practices in food handling. Observations will also be made in relation to provision/ compliance with the basic PRPS of FSMS. All the information gathered will be treated anonymously.

How your participation in this study will be kept confidential

I, Faustino Zvenyika undertake to protect your identity and the nature of your contribution. To ensure your anonymity, the data collected will be anonymous, that is will not contain information that may personally identify you. To ensure your confidentiality, only identification codes will be used on data forms. If we write a report or article about this research project, your identity will also be protected.

Possible risks of this research

We do not anticipate any risks to you although we cannot rule out that you may feel discomfort as we will be talking about your way of ensuring food safety in your establishment, however we will try by all means to minimise the risk

Benefits of this research

The benefits to you include your awareness of how you are doing with regards to food safety in your premises that may lead to your improving food safety thereby improving customer confidence in your products. On the other hand it may improve your compliance with regulatory requirements

The need for you to be in this research and option to stop participating at any time

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized.

If you have questions

*This research is being conducted by **Faustino Zvenyika** at the University of the Western Cape. If you have any questions about the research study itself, please contact Dr Ernesta Kunekke at: University of the Western Cape Private Bag X17 Bellville 7535 ekunekke@uwc.ac.za*

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Prof Helen Schneider

School of Public Health

Head of Department

University of the Western Cape

Private Bag X17

Bellville 7535

soph-comm@uwc.ac.za

Prof José Frantz

Dean of the Faculty of Community and Health Sciences

University of the Western Cape

Private Bag X17

Bellville 7535

chs-deansoffice@uwc.ac.za

This research has been approved by the University of the Western Cape's Senate Research Committee. (REFERENCE NUMBER: BM/16/5/34)

Appendix 5: Participant Consent Form

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809, Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

CONSENT FORM

Title of Research Project:

The knowledge, attitudes, and practices and compliance regarding the basic prerequisite programs (PRPs) of food safety management systems of food service workers in boarding schools and restaurants in Masvingo Province, Zimbabwe.

The study has been described to me in a language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

Participant's name……..

Participant's signature…….

Date……

Appendix 6: Questionnaire

UNIVERSITY OF THE WESTERN CAPE, Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809, Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

The knowledge, attitudes, and practices and compliance regarding the basic prerequisite programs (PRPs) of food safety management systems of food service workers in boarding schools and restaurants in Masvingo Province, Zimbabwe.

	TYPE OF PREMISES_____	
	QUESTIONNAIRE	
	SECTION 1 - GENERAL INFORMATION	
1	**What is your gender? (Observe)**	
	Male	
	Female	
2	**How old are you**	
3	**What is your marital status**	
	Single	
	Married	
	Widowed	
	Divorced	
	Separated	
4	**What is the highest level of education you attained**	
	Never been to school	
	Up to grade 7	
	Form 1 to Form 4	
	Form 5 to Form 6	
5	**What is the highest technical /professional training you undertook**	
	Certificate	
	Diploma	
	Degree	
	More than a degree	

6	**What is your occupation**				
	Cook				
	Waiter				
	Supervisor/ Manager				
7	**For how many years have you been working here in the same capacity**				
	Less than 5 years				
	6 to 10 years				
	11 to 15 years				
	16 to years				
	More than 20 years				
	SECTION 2 SIZE OF PREMISES				
8	**How many people are employed here including yourself?**				
	<Less than 5				
	5 to 9				
	10 to 15				
	More than 15				
9	**How many plates do you serve per day**				
	Less than 20				
	21 - 40				
	41 To 60				
	61 to 80				
	More than 80				
	SECTION 3: KNOWLEDGE AND ATTITUDE - REGULATIONS				
10	Can you please list any of the five keys to food safety				
11	What are the possible sources of food contamination in storage?				
12	Should fruits and vegetables be washed with disinfectants before preparing salads	Yes		No	
13	Does keeping raw and cooked foods separate help prevent	Yes		No	
	illness?				
14	Do you think that it is unsafe to leave cooked food out of the refrigerator for more than two hours?	Yes		No	
15	Do you think pests can contaminate foods?	Yes		No	
16	Do you know who the EHP/ Health Inspector is?	Yes		No	

17	When was your premises last inspected					
	SECTION 4: PRACTICES					
18	Where do you get your beef/mutton from?					
19	Is the meat inspected?	Yes		No		
20	Where do you get your pork from?					
21	Is the pork inspected?	Yes		No		
22	Do you think it Is necessary to store raw foods separately from cooked food?	Yes		No		
23	Which temperature range do you keep cooked foods at?					
	less than 5 degrees celcius					
	5 to 65 degrees celcius					
	Above 65 degrees celcius					
24	Can you determine safety of water by the way it looks?	Yes		No		
25	Mention 4 circumstances that require you to wash your hands					
26	Do you think keeping kitchen surface clean reduces the risk of illness?	Yes		No		
	Adopted and customised from Lockis, (2011)					

Appendix 7: Structured Observation Checklist

UNIVERSITY OF THE WESTERN CAPE, Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809, Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

The knowledge, attitudes, and practices and compliance regarding the basic prerequisite programs (PRPs) of food safety management systems of food service workers in boarding schools and restaurants in Masvingo Province, Zimbabwe.

	TYPE OF PREMISES_____				
	CHECKLIST				
	SECTION 1: PERSONNEL HYGIENE AND FACIILTIES				
1	Is there a risk of cross-contamination between raw and prepared foods?	Yes		No	
2	Has the place established a schedule for cleaning and sanitizing processing facilities?	Yes		No	
3	Is there a hygienization procedure after the worktime?	Yes		No	
4	Do the handlers wash and disinfect their hands and/or use disposable gloves during distribution of the prepared food?	Yes		No	
5	Do the workers take a bath before work?	Yes		No	
6	Do employees wear clean and proper uniforms including shoes?.	Yes		No	
7	Are hair nets or caps worn properly?	Yes		No	
8	Are fingernails short, unpolished, and clean (no artificial nails)?.	Yes		No	
9	Is jewellery limited to a plain ring, such as wedding band?	Yes		No	
10	Is there a procedure on proper hand washing?.	Yes		No	
11	Is there a designated place for eating, drinking, and chewing gum?,	Yes		No	
12	Are hand sinks stocked with soap, disposable towels, and warm water?	Yes		No	

13	Is there a handwashing reminder sign posted?.	Yes		No	
14	Are employee toilets operational and clean.	Yes		No	
	SECTION 2: CONSTRUCTION				
15	Do Does the facility have self-closing doors?	Yes		No	
16	Do facilities have adequate toilets for clients	Yes		No	
17	Do facilities have toilet paper,	Yes		No	
18	Do facilities have soap, and antiseptic lotion?	Yes		No	
19	Do the facilities have protection around the light fittings over food preparation areas?	Yes		No	
20	Are the doors and windows fitted with screens to avoid pest access?	Yes		No	
	SECTION 3: WASTE MANAGEMENT				
21	Do the facilities have waste collectors with plugs to avoid manual contact?	Yes		No	
22	Are kitchen garbage cans clean and kept covered.	Yes		No	
23	Are boxes, containers, and recyclables removed from site?	Yes		No	
	SECTION 4: DOCUMENTATION				
24	Does the facility keep records on how and when the stock room cleaned and sanitised?	Yes		No	
25	Does the facility maintain training records for food handlers	Yes		No	
26	Does the facility keep records of the food handlers' health?	Yes		No	
27	Does the facility have a manual of good hygiene practices?	Yes		No	
28	Does the facility have register of a pest program control?	Yes		No	
	SECTION 5: WATER SUPPLY				
29	Do the facility test water for safety	Yes		No	
30	Are the water tanks kept covered	Yes		No	
31	Do the facilities have drinkable water?	Yes		No	
	SECTION 6: STORAGE				
32	Does the product tag contain expiry date	Yes		No	
33	Does the facility monitor and register the temperatures of cooling and heating equipment?	Yes		No	
34	Does the facility contain washable and rust resistant shelves?	Yes		No	
35	Do the workers store properly the ingredients that were not used?	Yes		No	

36	Do the workers follow the guideline "first in, first out"?	Yes		No	
37	Are all food labelled with name	Yes		No	
38	Are there no buldging or leaking canned goods.	Yes		No	
39	Is food stored at least 6 inches above the floor or in walk-in cooling equipment?				
40	Are refrigerator and freezer units clean and neat.				
41	Is food protected from contamination?	Yes		No	
42	Are chemicals clearly labelled and stored away from food and food related supplies.	Yes		No	
43	Is there a regular cleaning schedule for all food surfaces?	Yes		No	
444	Is Food stored in original containers or a food grade container?	Yes		No	
	SECTION 7: EQUIPMENT, TOOLS AND UTENSILS				
45	Are drawers and racks clean and sanitized before use.	Yes		No	
46	Do the equipment and tools have resistance to corrosion?	Yes		No	
	SECTION 8: PEST MANAGEMENT				
47	Is there a regular schedule of pest control by a licensed pest control operator?	Yes		No	
48	Is there no potential of pesticide risk	Yes		No	
49	Is the pesticide MSDS in place	Yes		No	
50	Are the processing areas kept free of pest or vectors?	Yes		No	
	SECTION 9: EDUCATION AND TRAINING				
52	Do the facilities keep records of workers' training?	Yes		No	
53	Do the facilities keep explanatory posters regarding hygiene practices?	Yes		No	
54	Is there evidence of staff training during the past twelve months?	Yes		No	
	SECTION 10: FOOD PREPARATION				
55	Are food equipment, utensils, and food contact surfaces properly washed, rinsed, and sanitized before every use.	Yes		No	
56	Is food handled with suitable utensils, such as single-use gloves or tongs.	Yes		No	

57	Is Food prepared in small batches to limit the time it is in the temperature danger zone.	Yes		No	
	Adopted and customised from Lockis, (2011)				

Appendix 8: Research Assistants Training List (At a Provincial Health Workshop)

						Number	Signature of Participant
6	KECHE JESCA.V	F	MOHCC	DEHO	MWENEZI D.HOSP P.O BOX 27 NESHURO	22-21682 3V12	Keche
7	CHIVASA MILLTON	M	MOH CC	EHT	NYAJENA HOSP RENCOMINE	12-0947 [illegible]	[illegible]
8	KECHE BEATRICE	F	MOHCC	EHO	CHIVI DISTRICT [illegible] P.BAG 551 CHIVI	22-2182100-12	B.Keche
9	CHAZA ROSARIA	F	MOHCC	EHT	MASVINGO DHE Box 114	08-199 2003-04	R.Chaza
10	CHIRANDINA ONWARD	M	MoHCC	EHT	MASVINGO DHE Box 114 Masv	02-059139T22	[illegible]
11	MAWERE NORBERT	M	MoHCC	EHO	Zaka DHE Bag 105, Jerera	66-055773C66	[illegible]
12	Chikomo Ephison	M	MOHCC	DEHO	Zaka DHE	22-0518 [illegible]	[illegible]
13	Mufudza Tafadzwa	M	MoHCC	E.HO	Chireda Hosp	75-344013A75	[illegible]
14	NEGANJE NAKEI	F	MOHCC	EHT	Masvingo DHE BOX 114	63-1376878 P50	Neganje
15	MOYO THERESA A.D	F	MOHCC	DEHO	GUTU DHE BOX136 GUTU.	12-094 [illegible]	T.Moyo.

	Name of Participant	Sex (M/F)	Organization	Designation	Address	National ID Number	Signature of Participant
16	TAKARUWIRWA TINAFUKIDZE	M	MOHCC	DEHO	CHIVI DIST HOSP P BAG 551 CHIVI	08 553193D 83	
17	CHABATA ISRAEL	M	MOHCC	EHO	BIKITA DTTE BOX180, NYIKA	08-082782 G 80	
18	SIBANDA EDMORE T.	M	TRIANGLE	EHT	COLIN SAUNDERS HOSP P.BAG 802	29-230968Q67	
19	Solomon Mudzikeswube	M	PLAN	MPC	608 BAOBAB ROAD CHIREDZI	75-172882 75	
20	ZVENYIKA ITAI	M	MOHCC	H/O	NESHURO HOSP BOX 27 NESHURO	27-141480 H 27	
21	MAVUKA TAKAIDZA	M	MOHCC	EHT	NEHANDA RHC MWENEZI	67-122249 Q 12	
22	MBEDZI JOEL	M	MOHCC	SLT	DE BEERS RES BOX 197 CHIREDZI	[illegible]	
23	Nyadenga Edson	M	CTC	EHO	CTC BOX 128 CHIREDZI	29-047363G27	
24	CHIBAYA SUSAN	F	MOHCC	EHT	JERERA DHE BAG 105 JERERA	29-192641 F 77	
25	CHIGARIRO MERCY	F	MOH CC	EHT	Bikita R Hospital PBag 602 Nyika	63-0597525 S 32	
26	MARWA BIGBOY	M	MOHCC	EHT	MACHOKO BIKITA	27-0893 32 R 27	

27	MAHLANGANO TAPERA	M	MoHCC	A/DHSU	MWANEZI 1450 P.O. BOX 24 LASHURO	54-037786 M54	
28	MUSHANGUKI JACOB	M	MOHCC	HRA	NDANGA ZAKA	22-025366 F22	
29	MUKWATI CAINOS	M	MOHCC	A/HSA	MASVINGO PHE	22-0654154 83	
30	DZIWAVATORGA PUBLIC	M	MOHCC	EHT	CHIBWEDZIVA CLINIC BOX 142 CHIREDZI	85-111857 Z85	
31	JIMU ALEX	M	MOHCC	EHT	MUSHANDA ZAKA	04-0833-6A 22	
32	SIRIVOYI TAWEDZEGWA	M	MOHCC	EHT	Phalilela RHC CHIREDZI	12 076463 P12	
33	CHIRAMBIWA CRISPEN	M	MOHCC	ES	CHIREDZI GEN	12107306P12	
34	KATUNGA KURAWONE	M	MOHCC	EHT	DEURE 2 RHC P.BAG 1018 BIKITA	83-112495583	
35	MUGABIRI NOKHUTHULA	F	MOHCC	EHO	Neshuro Hosp BOX 22 Neshuro	67-103067067	
36	SIBANDA NORLEN	M	MOHCC	EHT	NESHURO HOSP BOX 27 NESHURO	54-052313 N-54	
37	VURUMBE DARLINGTON	M	MOHCC	EHT	P/A NESHURO MWENEZI	12-058701 H12	

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	Name of Participant	Sex (M/F)	Organisation	Designation	Address	National ID Number	Signature of Participant
43	CHARUMA BRIAN	M	MOHCC	EHT	CHIKWIRIRE RHC WARD 20 CHIREDZI	12-132954 S83	
44	SIMBA MASAWI	m	PSI/Z	MFC	PSI – HARARE	27-[illegible]	
45	MUTIKANI HONEST	M	DEHO	MOHCC	BOX 114 MASVINGO	27160968Q27	
46	MUUSHA FUNGWA	M	EHT	MOHCC	NESGOVANO RHC P. BAG 569 NYIKA	27-131742Y27	
47	KANDA NORMAN	M	Accountant	MoHCC	NESHURO HOSP BOX 27 NESHURO	[illegible]	
48	MAJAURA DAVID B	M	ZAKA RDC	CEO	BOX 500 JERERA	83-043521W83	
49	CHITETEMA BONIFACE	M	PMD	MOHCC	PMD BOX 147. MASVINGO	22-167259W22	
50							
51							
51							
53							
54							

	Name of Participant	Sex (M/F)	Organization	Designation	Address	National ID Number	Signature of Participant
38	Manyika Doubt	M	MOHCC	EHT	Pore Pore Clinic Chirezi	54-041621R54	[signature]
39	GOMBE JOSEPH	M	MOHCC	EHT	Jerera DHE P Bag 105 Jerera	22-206755822	[signature]
40	CHINASA TAFADZWA	M	MOH&CC	EHO	Cutsu DHE P.O. Box 136 Cutsu	63-1364536227	[signature]
41	TEVERA TANAKA	M	MOHCC	EHO	Cutsu Rural Hosp P.O. Box 136, Cutsu	12-114870 L12	[signature]
42	KWAVA MARTHA	F	MOHCC	EHT	Jerera DHE P Bag 105 Jerera	27-150728K27	[signature]

Name of Training Coordinator.. **Signature:**.. **Date**..

Name of Authorising Officer:.. **Signature:**.. **Date**..