

KNOWLEDGE, ATTITUDES AND PRACTICES ON FOOD SAFETY AMONG FOOD  
HANDLERS IN OPUWO DISTRICT, KUNENE REGION, NAMIBIA

THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF

MASTER OF SCIENCE APPLIED FIELD EPIDEMIOLOGY

OF THE UNIVERSITY OF NAMIBIA

BY

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APRIL 2019

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## **ABSTRACT**

Food safety is a key component of food security as food can only be considered to exist, if it is safe for human consumption. Food handlers play a massive role in food safety, it is for this purpose we conducted a study to determine knowledge, attitudes and practices of food safety among food handlers in Opuwo District. An analytical cross sectional study was conducted, using a multi-staged probability sampling method.

A total of 137 food handlers participated in the study from 24 kitchens in the district. The majority of participants 65% (89/137) were females and 57.7% (79/137) were from state kitchens. The level of knowledge on food safety was inadequate as there were only 36% (49/137) respondents with adequate knowledge, with an average score of 45% (13.5/30). The levels of knowledge were significantly associated with levels of education (P-value of 0.03). Respondents had good attitudes towards food safety, with only two (1.5%) respondents with a negative attitude. Most food handlers (91%, 125/137) were found to be practicing food safety. Food handlers from private kitchens were more likely to always wash their hands with soap before handling food (OR= 4.89, 95% CI = 1.58 – 15.16. All kitchens had portable water, but only 33% (8/24) of the kitchens had hot water. About 17% (4/24) of the kitchens were found with clean washing sinks while about 37.5% (9/24) kitchens did not have washing sinks and 71% (17/24) of the kitchens did not have a hand washing basin.

Food handlers in Opuwo District had limited knowledge on food safety, with positive attitudes towards food safety and good food safety practices. Poor hygiene levels of food preparation area was observed in most kitchens. One of the recommendations from this study is thus, in-service training of food handlers on food safety.

**Key words: Food safety, food handlers, Knowledge, Attitude and Practice**

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## List of Abbreviations

<b>AOR</b>	Adjusted Odd Ratio
<b>CAC</b>	Codex Alimentarius Commission
<b>CDC</b>	Centers for Disease Control and Prevention
<b>CI</b>	Confidence Interval
<b>COR</b>	Crude Odd Ratio
<b>EHPs</b>	Environmental Health Practitioners
<b>EHS</b>	Environmental Health Services
<b>FAO</b>	Food and Agriculture Organization
<b>FIFO</b>	First In First Out
<b>KAP</b>	Knowledge, Attitude and Practice
<b>MoHSS</b>	Ministry of Health and Social Services
<b>NAMFELTP</b>	Namibia Field Epidemiology and Laboratory Training Programme
<b>OR</b>	Odd Ratio
<b>PPE/C</b>	Personal Protective Equipment/Clothing
<b>UNAM</b>	University of Namibia
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organisation
<b>WHO</b>	World Health Organisation

## **Acknowledgements**

Firstly, I would like to thank God the Almighty for guiding me throughout my childhood up to now; and for giving me His divine wisdom and knowledge throughout the course of this study.

Secondly, I wish to extend my deepest gratitude to my supervisor, Dr. Taimi Amakali-Nauseb and my co-supervisor, Dr. Ester Mulenga for their sustained guidance, critical review and patience throughout the process and execution of this research. Thank you so much. May God bless you to continue with this selfless nature.

Thirdly, I would like to acknowledge Dr. Kofi Nyarko, the Resident Advisor for the Namibia Field Epidemiology and Laboratory Training Programme (NAMFELTP); thank you for your support and for your words of encouragement.

I am thankful to the administrators of the University of Namibia, for allowing me to study through this institution. My sincere gratitude also goes to the Namibian Ministry of Education, Art and Culture, for allowing me to conduct this research at the schools in Opuwo District.

My sincere gratitude goes to the Epidemiology department of the Ministry of Health and Social Services (MoHSS) for their continuous support during my studies. My fellow residents and the entire NAMFELTP for your support and encouragement. Appreciations to the entire regional and district staff members of the Kunene Health Directorate, particularly the Regional Director Mr. Thomas Shapumba, my mentor Ms. Ertha Haludilu, Mrs. Ndilimeke Mutikisha, the Environmental Health and Health Information department for their support and hospitality during my field placement.

I would like to thank all the respondents for their cooperation; working with you has been a wonderful and an enriching experience.

Last, but certainly not least, I would like to thank my family and friends for being understanding and caring during my study period.

May God the Almighty bless all of you abundantly!

## **Dedications**

First of all, I would like to dedicate this thesis to my mother, Loide Tangi Shiwana, for she is my greatest supporter. Mom, you taught me to be strong, to never give up, and most importantly, to value education. Secondly, I would like to dedicate this project to my uncle, Oscar Shiwana for challenging me to continue with my studies. To my younger siblings, Sion Hakwenye, Benjamin Hakwenye and Hilia Hakwenye: let this be your motivation to study further.

## **Declaration**

I, Helena Lamanguluka Hakwenye, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

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**Name of Student**

**Signature**

**Date**

# **Chapter 1: Introduction**

## **1.1 Background of the study**

Food safety is defined by the Codex Alimentarius Commission (CAC) as, an assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (1). Food safety can also be defined as the protection of human health by preventing edible substance, which are defined by law, from becoming hazardous and minimizing the risk from those hazards, or the absence of harm to people from food (2,3). All processes involved in keeping food safe to eat is referred to as food hygiene (2,4).

Food can be defined as substance that can be ingested (eaten or drunk) to maintain human life and growth (5). It is a composite of natural ingredients normally referred to as nutrients that are needed by human for the maintenance of the body. Food is necessary for human survival, growth, physical abilities and good health (3). Our bodies need food for energy production, to survive and to remain strong (2). Food can be of animal origin, animal product, plant origin, plant product or reproduction material (3).

The need for food is ongoing as one is continuously reminded to eat by hunger sensation. However, the availability of food does not necessarily guarantee survival unless food is nutritionally complete and contain no hazardous substances. Food should be nourishing and attractive, it should be visibly clean and free from noxious materials (7). Food hygiene and safety ensure measures are in place to protect the food from biologically, physically and chemically hazards (8). These harmful substance may enter food accidentally during growth, cultivation, preparation or storage (8). Contamination can also occur from inadequate preservation methods, unhygienic handling

practices, cross-contamination from food contact surfaces, or from persons harboring the microorganisms. Unhygienic practices during food preparation, handling and storage creates the conditions that allows the multiplication and transmission of disease causing organisms such as bacteria, viruses and other food-borne pathogens (10).

Noxious substance in food give rise to illness called food poisoning or gastroenteritis, which is usually characterized by vomiting or diarrhea and abdominal disturbances (9). Food poisoning result from consumption of food contaminated with a large number of microorganisms or their toxins in large quantity (10).

Center of disease Control and Prevention (CDC) estimates that each year 48 million people get sick from a foodborne illness, 128,000 are hospitalized and 3,000 die worldwide (12). Globally researchers have identified more than 200 foodborne diseases, ranging from diarrhea to cancers (13). Most of them are infections, caused by a variety of bacteria, viruses, and parasites (12,13).

Foodborne diseases are common in the developing countries due to the predominant poor food handling and sanitation practices, weak regulatory structures and lack of appropriate education for food-handlers (13). As much as foodborne illness are common in Africa there is poor documentation of this events. Poor documentation of food borne illness could be due to the fact that most people with a foodborne illness get better without medical treatment, but only few with severe symptoms would visit a doctor (8). In Namibia there is poor surveillance on foodborne illnesses, leading to unknown or poor defined prevalence of food borne illness (16).

Food safety knowledge and proper food handling practices among food handlers were found to be inadequate in studies done in South Africa and Ethiopia and intervention is required to prevent fatal incidences of food borne illnesses (17,18). Other studies have shown good knowledge, but poor handling practices and attitudes towards food safety (10). This study was conducted to determine the food handlers' knowledge, attitude and practice on food safety in Namibia, Opuwo district.

Opuwo is the capital of Kunene region, one of the 14 regions in Namibia, and the largest district in Kunene region, located in the north-west corner of the country. It is dominated by the Himba people and has a population size of approximately 60 000 (19). Opuwo has thirteen boarding schools, one prison, one district hospital and approximately eighteen restaurants.

## **1. 2 Statement of the problem**

The number of foodborne illnesses is increasing in Opuwo District, with five fatal food poisoning cases reported in 2016 (18). The Environmental Health Services (EHS) office under the Ministry of Health and Social Services (MoHSS) has issued up to 50 Contamination Certificates from January 2016 to October 2017, with a total of 953.51 kilograms and 44.56 liters of food stuff condemned in Opuwo District alone (18,19). The food and articles of food condemned were mostly found spoiled due to poor storage temperatures and some were found expired. Eleven (11) food safety complaints were received in the district in 2017 (19).

In 2016 the EHS department inspected a total of 47 institutions for food safety and hygiene of which 23.4% (11) were found unsatisfactory (18). About 13 boarding schools have been inspected

in the past 3 years of which 60% were found to be unsatisfactory in terms of food hygiene standards, while only 40% were found to be adhering to the food hygiene standards (18). Unsatisfactory findings during inspection included vermin infestation, uncovered food, poor storage, absence of hot water, food handlers not having undergone medical examinations, inappropriate clothing and no ablution facilities for kitchen staffs (18,19). It is against this background of a high number of contamination and unsatisfactory hygiene practices that the researcher found the need to conduct a study to assess knowledge, attitudes and practices on food safety among food handlers in Opuwo district. In order to achieve good food safety practices, food handlers need to understand food hygiene and safety standards and to shift their attitudes towards food safety because having good attitudes is one of the keys in developing good food practices.

### **1.3 Purpose of the study**

The purpose of the study was to determine knowledge, attitudes and practices of food safety among food handlers in Opuwo district, in order to identify and understand the gaps in food hygiene and safety in the district and give recommendations on how the gaps can be fixed.

### **1.4 Objectives of the study**

**The objectives of the study were:**

- To assess food handlers' knowledge of food safety in Opuwo district;
- To assess food handlers' attitudes of food safety in Opuwo district;
- To assess food handlers' practices on food safety in Opuwo district;
- To evaluate food hygiene and sanitation of food preparation areas; and

- To determine factors association with food handler's knowledge, attitude and practice on food safety in Opuwo district

### **1.5 Significance of the study**

This study provided information on the interactions of prevailing food safety knowledge, attitudes and practices of food-handlers in Opuwo district. Furthermore, the study serves as a guide for the Environmental Health Services department under the Ministry of Health and Social Services, in coming up with strategies that will ensure strict compliance with food safety laws in Opuwo district, Kunene region and Namibia at large. This study will also help food handlers to understand their social responsibility of safeguarding public health through their operations. Finally, the study will serve as reference material for future studies.

### **1.6 Operational definitions**

**Attitude** – An opinion or feeling about something (20). In this case, it is a predisposition to behave in a particular way towards food safety.

**Food** – any nourishing substance that is eaten, drunk, or otherwise taken into the body to sustain life, provide energy and/or promote growth (5). In this study food is anything edible including ingredients used to prepare the food.

**Foodborne illness** – Any disease of an infectious or toxic nature caused by consumption of contaminated food (12). This remains the same in this study.

**Food handler** – Any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces, and is therefore expected to comply with food hygiene requirements. In this study a food handler is referred to as any person who is directly involved

with handling food, food equipment and utensils, or food contact surfaces. This includes the chefs, waiters and personnel cleaning the kitchens (if different from waiters) (22).

**Food hygiene** – All conditions and measures necessary for the production, processing, storage and distribution of food designed to ensure a safe, sound, wholesome product fit for human consumption (22). In this study food hygiene is referred to all practices in place to keep food safe for human consumption.

**Food poisoning** – any illness, caused by, or thought to be caused by, pathogens or toxin in the food (22). May be used interchangeable with foodborne illnesses.

**Food safety** – Assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (22). In this study food safety is referred to the food handler's assurance that the food prepared does not pose harm to the consumers.

**Knowledge** – Familiarity with someone or something, which can include facts, information, descriptions, or skills acquired through experience or education (23). In this case it can refer to the theoretical or practical understanding of food safety.

**Practice** – The actual application, putting an idea into action, performing an activity or exercise repeatedly in order to improve or maintain one's proficiency (24). In this case the behaviour displayed towards exercising food safety.

## **1.7 Chapter layout**

Chapter 1: An introduction and background information about food hygiene and safety. The purpose and objectives of the study are also covered in this chapter.

Chapter 2: Covers the literature review.

Chapter 3: Present the research design and the methodology of the study.

Chapter 4: Presents the results of the study and interpretation of the results.

Chapter 5: Presents a discussion of the results, similarities, differences and gaps found in studies conducted in Africa and other countries globally. Chapter 5 also present the conclusion, recommendations and limitations of the study.

## **1.8 Summary**

This chapter outlined the overview or background information concerning food safety. It emphasized why the study was conducted. The research problem statement, purpose of study, study objectives, significance of the study, research designs and methods and the definition of concepts were presented. Chapter two will discuss the review of literature on food safety, the knowledge, attitudes and practices of handlers regarding food safety.

## **Chapter 2: Literature Review**

### **2.1 Introduction**

A literature review is both a summary and explanation of the complete and current state of knowledge on a topic as found in academic books and journal articles (25). The purpose of the literature review is to convey to the reader or investigator what is currently known regarding the topic of study (25). Regarding food safety, several studies have been conducted and a lot is known on maintaining food hygiene and safety. This chapter will look at the overview of food safety; food safety policies; epidemiology of food borne illness; role of food handlers in food safety; food premises and equipment; cleaning, waste management and pest control; and the knowledge, attitude and practice of food safety.

### **2.2 Food safety overview**

The hygiene and safety of food is determined by a number of factors, including food handlers' personal hygiene, environmental hygiene, availability of portable water, storage temperature, etc. Food safety is a key component of food security; which is defined as when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life (8,26). Food can only be considered to exist, if it is safe for human consumption. Food that contains microbial, chemical or physical contaminants does not contribute to food security, but rather is a risk to human health (8). Food handlers need to understand, have a good attitude and practices towards food safety to minimize foodborne illnesses.

Food safety is very critical in Africa because of aggravating food insecurity, political instability, communicable diseases and natural disasters that are affecting the continent which may affect food

safety status (26). Several stakeholders need to work together in order to attain national food safety, from production to the plate (8). These include persons who produce food, those who handle and transport it, processors who transform and pack food, food retailers, and food service organizations such as restaurants and homes where food is prepared and served (8). Food safety is only possible when a farm to fork control is applied, because the activities of those stakeholders on the upper part of the chain determine whether or not food will be safe at the fork or consumer level (8).

Food safety can be hindered by numerous factors, varying from characteristics of the food itself, which may allow or inhibit bacteria multiplication. These characteristics include factors such as pH, water activity, redox potential and level of organisms competing with or inhibiting the growth potential pathogens (6). However, there are some other external factors that contribute to food poisoning. These include preparation of food in advance of needs, storage at ambient temperature, inadequate cooling, inadequate reheating, use of contaminated ingredients, undercooking, inadequate thawing and cross-contamination from raw to cooked food (27). This why food handlers should have a good understanding of maintaining food safety at all levels of production.

### **2.3 Food safety policies**

There are legal requirements to ensure food safety worldwide, and Namibia has adopted some of the legal frameworks. In Namibia food safety is regulated by the following legislations:

- The Namibia Food Safety Policy (2014): the policy ensures that control standards are established and adhered to as regards food production safety, food product hygiene, animal health and welfare, plant health and preventing the risk of contamination from external substances. It also lays down conditions for regulations on appropriate labelling of

foodstuffs and food products. The policy addresses the issue of overlapping mandates on food safety by various ministries and other stakeholders involved in any aspect of food safety in Namibia.

- The foodstuff, cosmetic and disinfectants Act 54 of 1972 and relevant regulations: This Act control the sale, manufacture, importation and exportation of foodstuffs and provide rules for the manufacturing, packaging and labelling of such products. It also speculate the power, duties and function of inspectors.
- The Public and Environmental Health Act 1 of 2015: This act give provision to the water and food quality, by giving the powers to inspect food or articles of food and regulating the disposal of food unfit for human consumption.

The International Food Standards (WHO/ the Food and Agriculture Organization (FAO) Codex Alimentarius): The Codex Alimentarius international food standards, guidelines and codes of practice contribute to the safety, quality and fairness of this international food trade. The standards have specification on the quality of food by making provisions in respect of food hygiene, food additives, residues of pesticides and veterinary drugs, contaminants, labelling and presentation, methods of analysis and sampling, and import and export inspection and certification. It is important to adhere to the food safety legislations in all the food premises setups and operations. Restaurant owners should ensure that food handlers understand the content of these legislations in order to ensure that the food served is safe to eat at all times (28).

## **2.4 Epidemiology of foodborne diseases**

Foodborne illnesses refer to infections or irritations of the gastrointestinal tract, usually toxic in nature and caused by bacteria, viruses, parasites or chemical substances entering the body through

contaminated food or water (29,30). Foodborne diseases comprise a broad spectrum of diseases and account for a significant proportion morbidities and mortalities worldwide, it is a major public health concern in both developed and developing countries (31,32). The exact mortality associated with foodborne illnesses is difficult to determine (31).

The World Health Organization estimates that about 600 million, almost 1 in 10 people in the world falls ill after eating contaminated food and 420 000 die every year, resulting in the loss of 33 million healthy life years (29). Children under 5 years of age carry 40% of the foodborne disease burden, with 125 000 deaths every year (29). Diarrheal diseases are the most common illnesses resulting from the consumption of contaminated food, causing 550 million people to fall ill and 230 000 deaths every year (29). Infants, young children, pregnant women, the elderly and those with underlying illnesses are mainly vulnerable (33).

Many foodborne disease incidents are reported every year in Africa, however the surveillance infrastructure for foodborne diseases of both microbiological and chemical etiology is weak or non-existent in most African countries (10). This absence of reliable data on the burden of foodborne disease impedes understanding about its public health importance and prevents the development of risk-based solutions to its management (31). The burden of foodborne diseases to public health, welfare and the economy has often been underestimated due to underreporting and difficulties in establishing causal relationships between food contamination and resulting illnesses or death (29). The true economic cost of foodborne illness in any country is hard to estimate, as it is complicated and time-consuming to calculate the cost of loss of personal amenity and loss of potential business or business reputation (11). Foodborne illnesses do not only burden health

systems but also contribute to decreased workers' productivity, disability, and even early death, thus lowering incomes and food security (35).

Unfit food can causes more than 200 diseases ranging from diarrhea to cancers (29). While food contaminated with pathogens may cause severe diarrhea or debilitating infections like meningitis, chemical contamination can lead to acute poisoning or long-term diseases, such as cancer. Foodborne diseases can also lead to long-lasting disability and death (29). The most common symptoms of foodborne illnesses include stomach pain, vomiting and diarrhea (36). Fever, malaise, general weakness and other symptoms may be experienced depending on the causative pathogen (31). Symptoms may occur very quickly after eating the food, or may take days or even weeks to appear. For most foodborne illnesses, symptoms occur 24-72 hours after the food has been eaten (33).

Food borne illness and deaths are preventable by safe guarding food with safe practices. Food handlers and restaurant owners should learn from previous outbreaks, that food borne can be catastrophic and pick up how to prevent food borne illness or poisoning in their food premises.

## **2.5 The role of food handlers**

The food handlers have an important role to play in food safety. They have a responsibility of preventing the passing of microorganism from person (nose, skin and bowel) to food (9,37). Food handlers' health status is very important in safeguarding food, as food handlers can be the source of food poisoning pathogens (38). They can contaminated the food by sneezing, through infected wounds or through fecal matter clinging to their hands (15,38,39). Employers should ensure that their food handlers are in good health, by requiring medical examination to determine if they have communicable diseases (38). Other researchers stressed the importance of medical checkups even

though most of their respondents did not have medical certificates (40,41). No food handlers should be allowed to work if they are suspected to be sick from diseases that can be transmitted through the food they prepare (40,41).

Food hygiene is usually associated with personal hygiene. Practicing personal hygiene is essential to those handling food, and this includes: maintaining good personal habits or cleanliness, knowing when and how to properly wash hands, wearing appropriate clean cloths, maintaining good health and practicing good hygiene principles (37). Poor personal hygiene of any person involved in food-related operations represents a potential threat to the safety of food and its suitability for consumption (42). In a cross-sectional study done in Saudi Arabia, respondents were asked about their personal hygiene and the results were impressive, whereby 96.6% maintained safe practices and around 86% respondents practiced good personal hygiene (40). Personal hygiene was found to be not well-practiced by the majority of food handlers in Putrajaya (43). Food handlers also have a responsibility to prevent transmission of organisms from raw to cooked food with hands as means of transport as well as surfaces, utensils and clothing (10,15).

Hands are rarely free from bacteria, they are the most important vehicles for the transfer of pathogenic organisms from faces, nose, skin or other sites to food (22). Frequent proper hand washing of food handlers is proven to be one of the effective ways to prevent contamination of food in the kitchen (15,39). 'Most people do not realize that as part of the normal flora, we carry a lot of different diseases causing microorganisms on our hands' (43). Food handlers should wash their hands with soap and under clean portable running water every time after using the toilet, handling waste or soiled materials, handling uncooked food, handling money, eating, smoking,

coughing and sneezing, and most importantly before handling food (40,43,44). A high percentage of respondents in Husain (34) study, always washed their hands with soap and water after using toilets and handling wastes. In a study by Danso & Fenteng (44), about 36% of respondents washed their hands after using the washroom while 24% washed their hands after handling garbage and 28% washed their hands after handling money.

After handwashing, it is recommended to use a disposable paper towel, for hand drying. The use of fabric cloths, dish towels or aprons for hand drying must be discouraged as it can rapidly accumulate a large population of micro-organisms, particularly when left moist, and their use can only increase contamination instead of reducing it (13,41). However, in studies conducted in 2015 by Darko et al., and Sani and Siow, found that a high number of food handlers were using kitchen clothes and aprons to dry their hands (13,41). In a study done in Putrajaya more than half (59.9%) of the respondents never touched food that was not wrapped up with bare hands (43).

Food handlers should always wear protective gears for their own safety and that of food. Some Personal Protective Equipment/Clothing (PPE/C) are designed to protect the wearer from burns, scalds, knives or impact injuries, but most PPE/C are to protect food from contamination (34). Food handler PPE/C should include a hair net or a hat covering all the hair, overall or coat covering own clothes, closed footwear, aprons and gloves (38,45,46). These PPE/Cs should be worn by everyone working directly with food. Protective clothing should be light coloured, to show dirt easily (47). They should be light in weight, washable and always clean or changed frequently if disposable (46,47). Coats or overalls should not have outside pockets to prevent items (like pencils

or coins) falling out of them and into food. Jewellery are prohibited in the kitchen because of the hazard from bacteria and physical contamination (13).

## **2.6 Food premises and equipment**

A wide range of structural methods and materials may be used in the construction of food premises, but the basic requirements are the same (48). Food premise designs and materials used in construction can help in the prevention of foodborne illnesses. The layout of the kitchen should consider work flow to avoid cross-contamination (22). The kitchen should be well-ventilated, with a good flow of air through the building, not only to keep people breathing but also to take away odours and reduce humidity (49,50). The food premise should have enough light, since good light improves concentration and safety, and it deters insects and vermin (48). Walls and floors should be durable, non-absorbent and light in colour (48).

According to the Codex Alimentarius, structures within food establishments should be soundly built of durable materials and be easy to maintain, clean, and where appropriate, able to be disinfected (22). In particular, the following specific conditions should be satisfied, where necessary, to protect the safety and suitability of food:

- The surfaces of walls, partitions and floors should be made of impervious materials with no toxic effect in intended use;
- Walls and partitions should have a smooth surface up to a height appropriate to the operation;
- Floors should be constructed to allow adequate drainage and cleaning;
- Ceilings and overhead fixtures should be constructed and finished to minimize the buildup of dirt and condensation, and the shedding of particles;

- Windows should be easy to clean, be constructed to minimize the buildup of dirt and, where necessary, be fitted with removable and cleanable insect-proof screens. Where necessary, windows should be fixed;
- Doors should have smooth, non-absorbent surfaces, and be easy to clean and, where necessary, disinfect;
- Working surfaces that come into direct contact with food should be in sound condition, durable and easy to clean, maintain and disinfect. They should be made of smooth, non-absorbent materials, and inert to the food, to detergents and disinfectants under normal operating conditions (22).

Equipment and containers coming into contact with food, should be designed and constructed to ensure that they can be adequately cleaned, disinfected and maintained to avoid the contamination of food (22,27). Stainless steel working surfaces and equipment are recommended for the kitchens (47). Equipment should be durable and movable or capable of being disassembled to allow for maintenance, cleaning, disinfection, monitoring, and to facilitate inspection for pests (22).

The source of water supply to the kitchen is very important in maintaining food safety, as many pathogens can be transmitted by water (51). By law, all food premises must have an adequate supply of portable hot and cold water (49). All food premises should have a hand washing basin or sink, which should be separate from the sink for dish washing and vegetables washing sink (48). A handwashing basin should be provided with liquid soap, paper towels for hand drying or electric hot-air blowers and some plastic nailbrush. Liquid soap should be provided in a dispenser container (22,52).

## **2.7 Cleaning, waste management and pest control**

Germes that cause food poisoning can survive in many places and spread around your kitchen (53). Cleaning, disinfection and sterilization aim at preventing both food poisoning and spoilage (50). Food handlers should adopt the concept of “clean as you go” which will help them to clean up after themselves every time wherever they are. Food scraps on the floor and surfaces encourage bacterial growth and attract vermin and insects (48).

Kitchen waste can provide sources of food and refuge for a wide range of insects, birds and small animals (48,51). This is why waste should not overnight in the kitchen as vermin prefer to feed in the dark at night and when they come to feed they can contaminate kitchen surfaces. If premises do not provide food and shelter pests infestation is unlikely to occur (46,48). Pest control can be achieved with other food safety aspects like design of food premises, cleaning and disinfection, safe waste disposal and maintaining hygiene practices (51).

Containers for waste, by-products and inedible or dangerous substances should be specifically identifiable, suitably constructed and where appropriate, made of impervious material (22). Containers used to hold inedible or dangerous substances like cleaning materials should be identified and be in a lockable place, to prevent malicious or accidental contamination of food (22). Good packing and storage does not only prevent food contamination but it also helps in good housekeeping or tidiness.

## **2.8 Knowledge on food safety**

The Codex Alimentarius (2013) recommends that all people involved with food must be aware of their roles and responsibilities in food safety (22). Food handlers must have the necessary knowledge and skills to handle food hygienically (54). Adequate safe food-handling knowledge and perception of food handlers is very key to the overall safety and quality of food delivered on the table for consumption (55).

Training of food handlers is recognized to improve food safety knowledge, practices and hygienic awareness (41). Studies in Putrajaya, Ghana and Malaysia showed that there is a significant difference in knowledge between food handlers who attended food handling training and those who did not attend food handling training (15,32,37). The knowledge of those who have attended food handling training was higher compared to those who did not attend. Training is essential to ensure that workers have the awareness and knowledge necessary to comply with food hygiene demands, although these do not always result in a positive change in food handling behaviour (15,22).

When food is stored or cooked at the right temperature, it is unlikely to cause food poisoning or get spoiled easily. The poor understanding of temperature treatment is the main critical control point in the process of food preparation and a major interference to the effectiveness in the implementation of food safety programs (41). Limited knowledge on reheating food and cooking temperature was found among participants in a Putrajaya study (43). A study conducted by Sani and Siow, revealed that food handlers did not understand crucial aspects linked to temperature values with cooking temperatures needed for the control of microbiological hazards (15). There was significant confusion concerning the effects of temperature during cooking of foods which have an influence on bacterial growth among participants in a study by Darko et al., (41). In a

study by Rahman et al, participants had sufficient knowledge on the dangers of contamination, storage and preparation of food (42).

## **2.9 Attitudes on food safety**

Foodborne illnesses can be reduced by positive attitudes of food-handlers towards the implementation of food safety procedures (10). In a study by Akabanda et al. respondents had acceptable attitudes towards food safety, as the majority indicated that using personal protective equipment/clothing (PPE/C), sanitizing surfaces and utensils, regular handwashing and short unpainted nails can minimize the risk of food contamination (10).

Results of a study by Kunadu et al., showed an overall negative attitude towards food safety, with a mean score of 63% (35). However in the same study, a closer inspection revealed positive attitudes particularly towards safe storage practices; correct handling of food, toxic chemicals, and good personnel hygiene practices (35). Participants also had positive attitudes towards policies on employees suffering from foodborne illnesses or other contagious illnesses, and the use of antibacterial soap or hand sanitizers in handwashing (35).

Sani and Siow found the attitudes of food handlers towards food safety to be at high levels of satisfaction, except topic-related to refrozen or defrosted food (15). A negative attitude was also observed for the appropriate temperature for storage of food, especially regarding attitudes towards refreezing of defrosted foods in a study done by Kunadu et al., (35). A positive attitude is a crucial factor that may influence good food safety behaviour and practices, thus decreasing the occurrence of foodborne diseases and other health hazards.

According to Husain, a good attitude is associated with training of food handlers, however, other studies have shown that increasing the levels of knowledge through training does not necessarily

lead to changes in the attitudes and behaviour of food handlers (40). In the same study by Husain, results showed that having good knowledge could lead to having good attitudes in food hygiene and sanitation among the respective food handlers (40). Sain and Siow believe that levels of education influence food safety attitudes as they found a significant difference in attitudes between different levels of education groups (15).

## **2.10 Practices on food safety**

Practicing food safety ensures that food consumed is clean, wholesome, nutritious and free from harmful additives and dangerous organisms. In a study by Husain there was a significant relationship between knowledge and attitudes, with food safety practice levels (40).

No food-handlers should be allowed to handle food if they are sick from infectious diseases or have an open wound. According to Akabanda et al., over 90% of respondents agreed that it was necessary to take leave from work when sick (10). Food handlers should undergo medical examination prior to employment and this examinations should be repeated regularly (56).

Food can be contaminated from food preparation surfaces. In Darko et al., study, 97.4% of respondents disinfected their work surfaces regularly (41). Surfaces can be of improved hygienic design such as stainless steel and marble. Using the same cloth to clean the surfaces is not recommended as it might contaminate the surface especially if it not well disinfected (40). Up to 72% of participants in Darko et al. study were using a cloth to wipe their hands (41).

## **2.11 Summary**

This chapter presented an in-depth literature review. It gave information on the overview of food safety, food safety legislations in Namibia, epidemiology of foodborne diseases, food handlers' personal hygiene and use of PPE, food premises hygiene, waste management and pest control in food premises. The chapter also discussed gaps, similarities and contradictions on studies conducted on knowledge, attitudes and practices of food safety in other regions.

## **Chapter 3: Research Methods**

### **3.1 Introduction**

Research methods are specific techniques or procedures employed in the execution of the research (57). This section presents an overview of the research design, study population, sampling, data collection, data analysis and ethical considerations.

### **3.2 Research Design**

A research design is a systematic approach that a researcher uses to conduct a scientific study (58). It determines whether a study is capable of obtaining answers to the research questions in a manner consistent with appropriate research methods and theoretical perspective underlying the study (57). In this study a cross-sectional analytical study was employed making use of quantitative approach. This study was cross sectional in nature as the researcher systematically observed and collected data about the subjects without affecting their normal behaviour, and it is analytical as data was presented and analyzed to find associations between variables.

#### **3.2.1 Research population**

A population is any defined group that is selected as a subject for research. It is a group or total amount of people, events, organization units, case records or other sampling units, with some common characteristics which help to address the research questions (57). The group should have a given set of characteristics, about which the researcher wishes to draw conclusions (59).

This study comprised of two populations. The first population were; the food handlers in Opuwo district and the second population was comprised of the kitchens (institutes where food handlers

operate from). These population consist of institutional kitchens such as boarding schools, hospitals, prisons, and restaurants in Opuwo district.

In this study, food handlers include the chefs, waiters and personnel cleaning the kitchens (if different from waiters). Study subjects were recruited on a voluntary base and kitchens with food handlers participating in the study were inspected using a checklist. Opuwo district has about 10 boarding schools, one state hospital, one prison and 13 restaurants.

### **3.3 Sample**

A sample is a group of individuals taken from a large population (60). It is a selection of the accessible population on which a study is conducted (61). A sample is required because in most cases, it is not practical or necessary to study everyone in the population, considering availability of resources, time and financial limitations (60).

#### **3.3.1 Sampling frame**

This study was conducted in state/institutional kitchens (boarding schools, hospitals and prisons or holding cells) and in public restaurants. There are about 200 institutional food handlers in Opuwo district working in approximately 24 kitchens. A sampling frame was divided into two categories: private institutions (restaurants) and public/state institutions (schools, hospital and prison).

A multi-staged probability sampling method was used, whereby the researcher first used a stratified sampling method, using two strata (private and state) to select institutions and then a simple random sampling (fishbowl) method was used to select food handlers.

The second sample size was comprised of all 12 institutional and 12 restaurant kitchens in Opuwo district.

*Table 1: Sampling frame*

<b>Stage</b>	<b>Sampling method</b>	<b>Sample size</b>
1	Stratified sampling	24
2	Simple random sampling	140

*Table 2: Inclusion and exclusion criteria*

<b>Inclusion criteria</b>	<b>Exclusion criteria</b>
All kitchens operating under a well-established structure (corrugated iron, wall or containers/cabinets).	Kitchens operating in an open area.
All food handlers who have worked in that food establishment for six months or more on duty upon visiting their workplace.	Food handlers that worked for less than six months.
All food handlers above the age of 18 years old.	No subject under the age of 18 were recruited in the study or those that are incapacitated due to any conditions (health or mentally).

### **3.3.2 Sample size**

A sample size of 127 food handlers was calculated using Epi Info StaCal population survey, with the following variable: population size of 200, expected frequency 65%, acceptable margin of error

0.5, design effect of 1 and 1 clusters. With an addition of 10% the sample size of 140 food handlers participated in this study. The following formula was used to select food handlers from each institution  $n = (i/200)*140$ . Where  $n$  is the number to be sampled at the institution,  $i$  is the number of food handlers at the institution, **200** is the total number of food handlers in Opuwo and **140** is the total sample size. A sample of 140 participants was calculate, however only 137 food handlers participated in the study as three were dismissed because they returned incomplete questionnaires.

The formula above was used to obtain a proportional representation of food handlers at each institution. The food handlers to be sampled were further selected randomly by writing “yes” and “no” on pieces of papers. The pieces of paper were put in a bowl where each food handler took one piece each. Those who took a piece of paper written “no” were excluded from the study, while the ones who took a piece of paper written “yes” were included in the study and the questionnaires were distributed to them. No sample size was calculated for institutions as all 24 institutions were included in the study.

### **3.4 Research Instruments**

A structured questionnaire was designed based on WHO and United Nations Educational, Scientific and Cultural Organisation (UNESCO) guidelines on conducting Knowledge, Attitudes and Practices surveys. A self-administered questionnaire divided into four sections namely socio-demographic information, knowledge, attitudes and practices was used in this study. It focused on questions about; personal hygiene, use of PPE and foodborne illnesses.

A checklist was used to assess the hygiene of the environment where the food is prepared. A food premises inspection checklist used by the Ministry of Health and Social Services was modified using WHO and FAO food safety standards. The checklist is divided into four sections namely kitchen, food handlers, storage and waste management.

### **3.4.1 Validity**

Validity explains how well the collected data covers the actual area of investigation (57). It is the capacity of the instrument to give true results (62,63). The questions for the research questionnaire were constructed using relevant literature reviews to measure validity. The questions were framed to include items that covered the research objectives. The questionnaire was reviewed by the Environmental Health Practitioners in the district and by a hostel superintendent. Changes to the questionnaire were made prior to the use for the final data collection tools. The pilot test helps in ensuring construct validity and was done on ten food handlers to measure their knowledge, attitudes and practices related to food safety and hygiene. Food handlers that participated in the pilot study were not included in the study.

### **3.4.2 Reliability**

Data is said to be readable when they are reproducible and consistent (57). Reliability refers to the extent to which the independent administration of the same instrument consistently yields the same results when repeated, under comparable conditions (57,59). In this study, reliability of the questionnaires was ensured by designing close-ended questions that measure KAPs of food safety. The observational checklist was tested for reliability, but only assessed during the pilot study.

### **3.5 Data collection procedures**

Food handlers were given a structured close-ended, self-administered questionnaire. The researcher used a checklist to assess the hygiene conditions of the kitchens or food preparation areas and their surroundings. The questionnaire was used to determine the levels of knowledge, attitudes and practices; for correct responses the participants were scored one (1) point and a zero (0) for incorrect responses. The attitudes and practices questions were self-assessment questions that were graded using the scale of three for attitudes (agree, disagree, and do not know) and for practices (always, sometimes and never).

The checklist was used to reassess self-assessment questions. It was graded on a scale of three, with 3 being the highest score and 1 being the lowest score.

A pilot study was conducted to test the instruments before the commencement of the study. The pilot study was conducted in a kitchen that was not part of the study. This helped to identify any ambiguities, relevance, sensitivity and acceptability of the questions and likely duration of administering.

### **3.6 Data analysis**

The Epi Info version 7 classic was used to analyze data. Frequency and proportion were calculated for descriptive analysis on socio-demographic characteristics. Bivariate (odd ratio) analysis was used to find factors significant to the relationships between socio-demographic characteristics and KAP levels, also factors significant to participants' KAPs and hygiene levels of institutions they work in. Odds Ratio (OR) was calculated at 95% Confidence Intervals (CI). Statistical significance

was determined at 0.05 Alpha level. Logistic regression analysis was used to identify the variables that impacted on the observed results.

Every correct answer was assigned a score of 1 and a 0 score for all incorrect or I don't know (uncertain) answers. The overall score was calculated for 10 knowledge questions for each participant. The maximum score was 30; any individual who had a score of 15 and more was categorized as having adequate knowledge and any individual who had a score of 14 and less was categorized as having inadequate knowledge.

Attitudes regarding food safety and hygiene were assessed using ten statements on a 3 point Likert scale: agree, disagree and don't know. The scale was scored as agree + 1, while disagree and don't know scored 0 for the positive questions, and disagree - 1, don't know and agree - 0 for the negative statements. Out of a maximum score of 10, participants who scored 5 and above were classified as having positive attitudes, while participants who scored from 4 and below were classified as having negative attitudes. Practices were assessed based on ten questions scaled on a scale of three, always, sometimes and never. The scale was scored as: always -2, sometimes -1 and never 0. The maximum score is 20, participants who scored 10 and above were classified to have good food safety and hygiene practices and participants who scored 9 and below were classified to have poor food safety and hygiene practices.

A checklist was used to support the practice questions. The checklist consisting of four sections had 32 statements looking at food safety and hygiene standard. The checklist was looking at factors affecting food safety and hygiene practices, and was used to see if food handlers had what they

need in places to implement safety and hygiene measures. A checklist was scaled from 1-3, a score of 3 was given to the highest satisfactory conditions, 2 to a moderate satisfactory and a 1 to unsatisfactory conditions. With a maximum score of 96, kitchens that scored 48 and above were classified to be satisfactory and the ones that scored 47 and below were classified as unsatisfactory in term of food hygiene and safety.

### **3.7 Research Ethics**

The research was approved by the University of Namibia's (UNAM) research ethics committee. The researcher also received approval from the Ministry of Health and Social Services; Ministry of Education, Art and Culture; and from the gate keepers at respective institutions and restaurants.

Participants' wishes were respected as they were treated as autonomous beings, capable of making informed decisions with regards to whether to participate in a research by signing an informed consent. The informed consent forms were translated into the local language (Otjiherero). Participation in the study was voluntary and participants were well-informed on the purpose and objectives of the study and what was expected from them. There was no remuneration or financial benefits offered to participants. The researcher also implemented the principle of justice by randomly selecting study participants, to ensure that everyone had an equal chance of participating in the study.

The principle of beneficence was ensured by confidentiality and not using participants' names in the report or share information of their identities with any other person. The researcher had no ability to link the questionnaire to the participants as there were no names required on the

questionnaire. The data from this research is to be used for research purposes only and will not be made available to a third party that is not involved in the study. In addition, findings from this study will not be linked to any individuals.

All records were kept confidential. Data was stored in a secure password-protected computer, with no personal identifiers of the study participants. Participants were identified primarily by their study numbers, and no individual identities were or will be used in any reports or publications resulting from the study.

Participants were able to directly benefit from the study as at the end of filling the questionnaire they assessed and rated themselves as to where they stood in terms of food safety. This may benefit the whole Opuwo community as food safety is likely to improve in the district if food handlers start practicing good food safety and hygiene.

### **3.8 Summary**

This chapter described how the study was carried out. It provided a brief description of the study design, population, sampling method and sample size determination, pilot study, and study instrument. Moreover, the chapter explained the procedures that were used to collect data and analysis, and ethical considerations as well as measures to ensure validity and reliability were discussed.

## Chapter 4: Results

### 4.1 Introduction

This chapter focuses on the presentation and interpretation of the results obtained from the study. One hundred and forty (140) questionnaires were distributed and the response rate was 98% (137/140). The results are presented in chronological order in the way they were analyzed starting with socio-demographic characteristics of the participants, knowledge levels (adequate and inadequate knowledge) of food safety, attitude levels (positive and negative attitudes) and practice levels (good or poor) relating to socio-demographic characteristics and associations. The last part of the results is focusing on the findings of the observations done during the kitchen inspections.

### 4.2 Socio-demographic characteristics

A total of 137 food handlers participated in the study and 65% (89/137) were females. Up to 58% (79/137) of the study participants were from state kitchens. The mean age was 38 years of age with a standard deviation of 11.4. Age categories ranged from 18 years to 60 years of age with a median of 38 years.

*Table 3: Demographic characteristics of food handlers in Opuwo District, 2018*

<b>Variance</b>	<b>State Kitchen (%)</b>	<b>Private Kitchen (%)</b>	<b>Total (%)</b>
<b>Sex</b>			
Female	49 (55.1)	40 (44.9)	89 (65)
Male	30 (62.5)	18 (37.5)	48 (35)
<b>Age group</b>			
<25	3 (15.8)	16 (84.2)	19 (14.1)

25-34	13 (34.2)	25 (65.8)	38 (28.2)
35-44	22 (68.8)	10 (31.2)	32 (23.7)
45+	41 (89.1)	5 (10.9)	46 (34.1)
<b>Period in the profession</b>			
<1 Year	2 (33.3)	4 (66.7)	6 (4.4)
1-3 Years	21 (41.2)	30 (58.8)	51 (37.2)
4-6 Years	15 (55.6)	12 (44.4)	27 (19.7)
7 + Years	41 (77.4)	12 (22.6)	53 (38.7)
<b>Level of education</b>			
None	5 (71.4)	2 (28.6)	7 (5.1)
Primary	21 (67.7)	10 (32.3)	31 (22.6)
Secondary	51 (54.3)	43 (45.7)	94 (68.6)
Tertiary	2 (40)	3 (60)	5 (3.7)
<b>Undergone food safety training</b>			
Yes	30 (40)	45 (60)	75 (54.7)
No	49 (79)	13 (21)	62 (45.3)
<b>Formality of the training</b>			
Formal	19 (32.8)	39 (67.2)	58 (78.4)
Informal	10 (62.5)	6 (37.5)	16 (21.6)

Thirty-four percent (46/137) of the study participants were aged 45 and above. Up to 39% (53/137) of participants have worked in the food industry for more than 6 years. A majority (68%, 93/137)

of the participants had a secondary educational level. A total of 55% (57/137) participants have undergone a food safety training, of which 80% (60/75) had a formal training and have obtained qualifications. Food handlers from the private sector are more likely to have received training on food safety than food handlers in public sector (P-Value > 0.0001). Moreover, food handlers in the private sector are more likely to have a formal training on food safety than those in the state/public sector (P-Value = 0.03).

### 4.3 Assessment of food handler’s knowledge on food hygiene and safety

A majority (96%, 132/137) of the participants knew that a person can get sick from eating spoiled food.

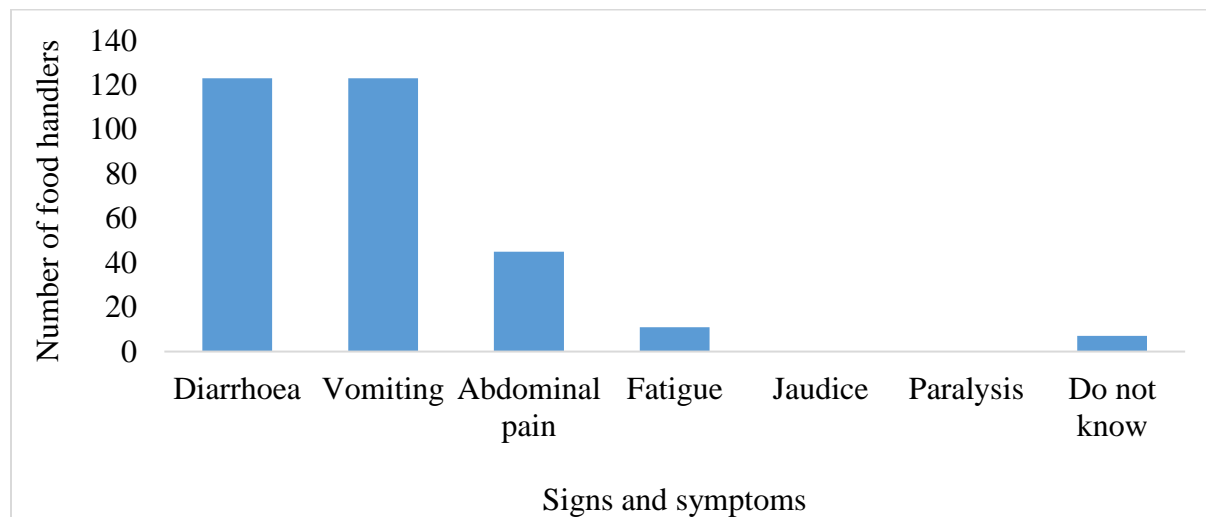


Figure 1: Knowledge of food handlers on the signs and symptoms of foodborne illnesses, Opuwo District, 2018

A majority 90%, (123/137) of the respondents knew that diarrhea and vomiting were signs and symptoms of foodborne illnesses. About 33% (45/137) and 8% (11/137) of the food handlers knew that abdominal pain and fatigue were associated food borne illnesses respectively. Seven (5%) food handlers did not know the signs and symptoms of foodborne illnesses.

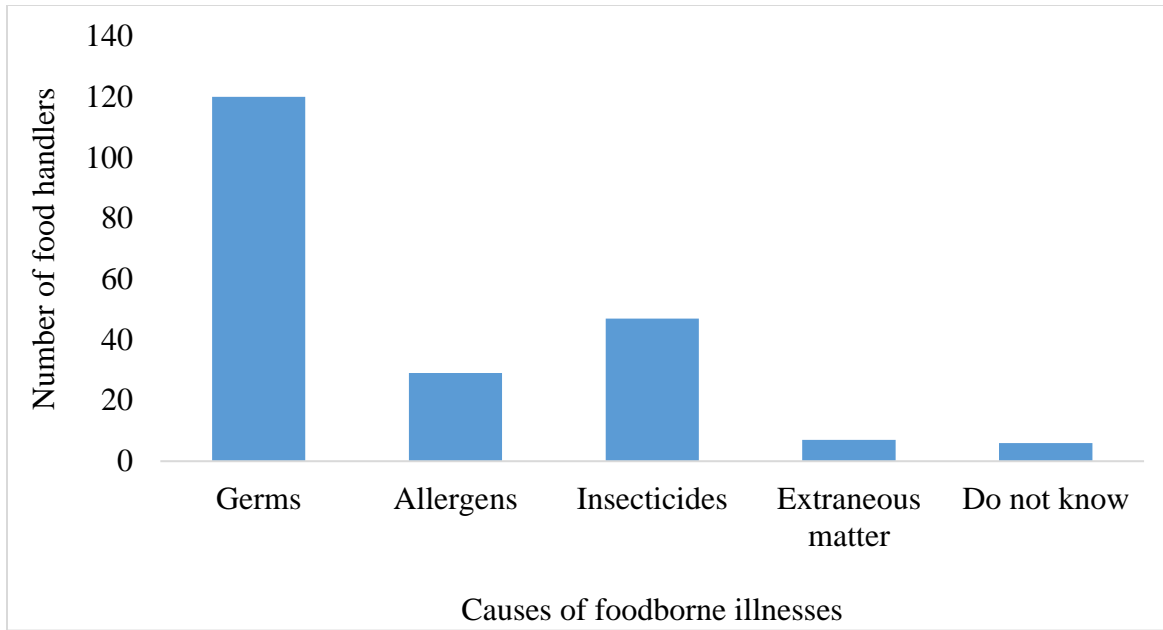


Figure 2: Knowledge of food handlers on the causes of foodborne illnesses, Opuwo District, 2018

Up to 88% (120/137) of the respondents knew that foodborne illnesses are caused by germs. Thirty-four percent (47/137) of the respondents knew that insecticides can cause foodborne illnesses.

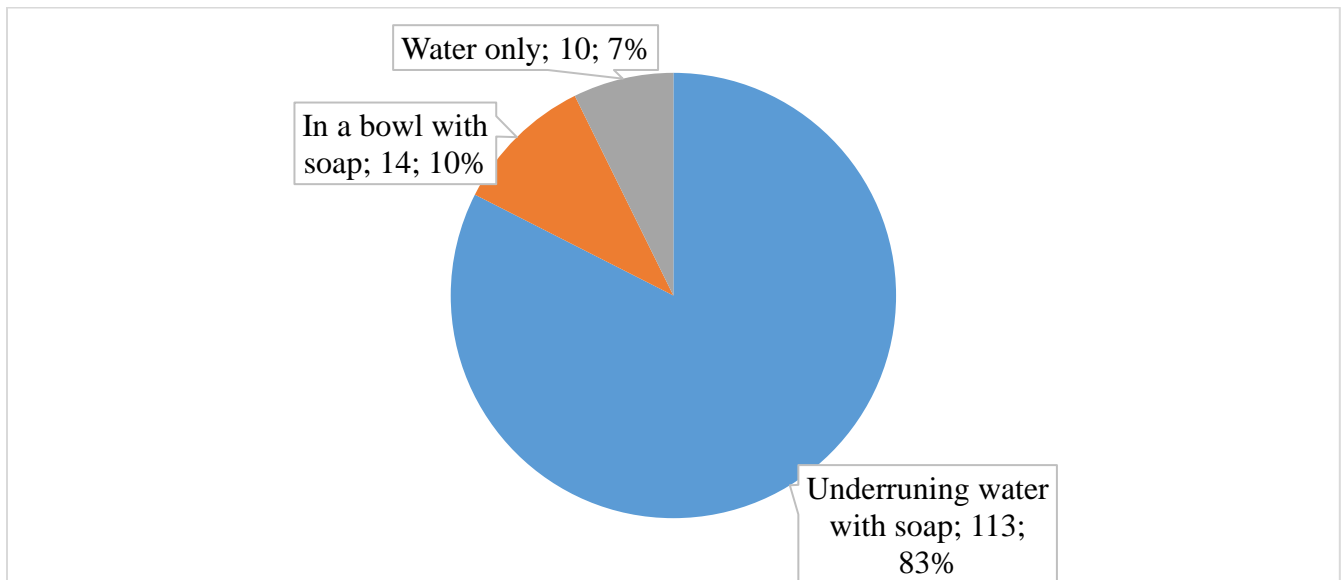
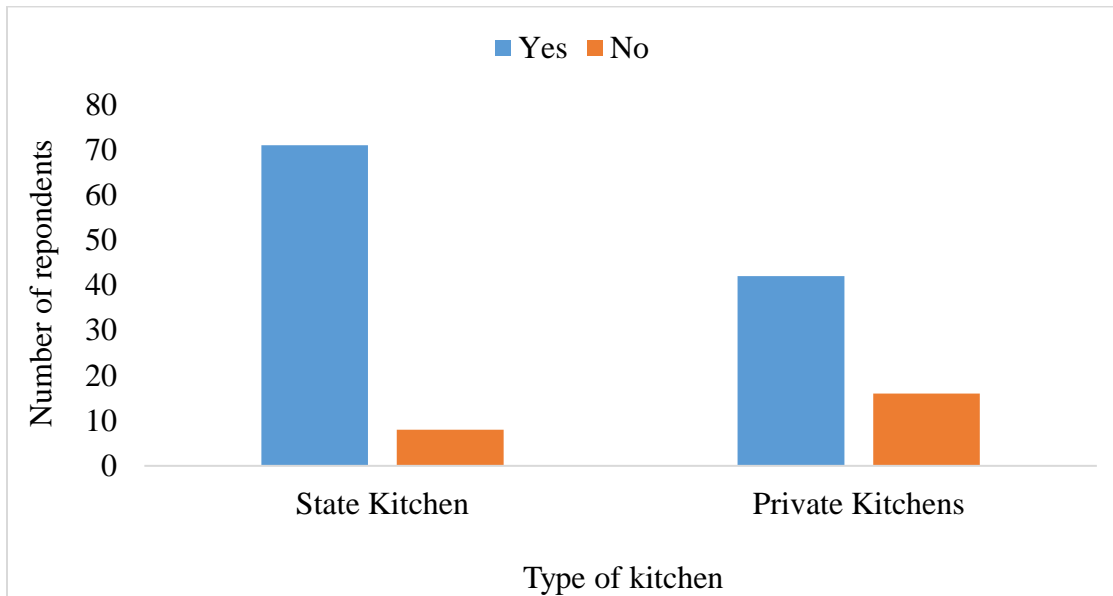


Figure 3: Knowledge on hand washing practices among food handlers, Opuwo district, 2018

About 17% (24/137) of the food handlers in Opuwo district do not know the proper way of washing their hands. Ten percent indicated that food handlers should wash their hands in a bowl or basin.

### Knowledge on hand washing for food handlers



*Figure 4: Knowledge on handwashing with soap and running water by type of kitchen, Opuwo District, 2018*

Proper hand washing was well-known by 90% (71/79) of the respondents in state kitchens compared to 72% (42/48) of the respondents in private kitchens. The odds of knowing the appropriate way of washing hands by food handlers working in state kitchens was found to be at 3.4 higher than the odds of those working in private kitchens (P-value = 0.008).

## Knowledge on temperature control

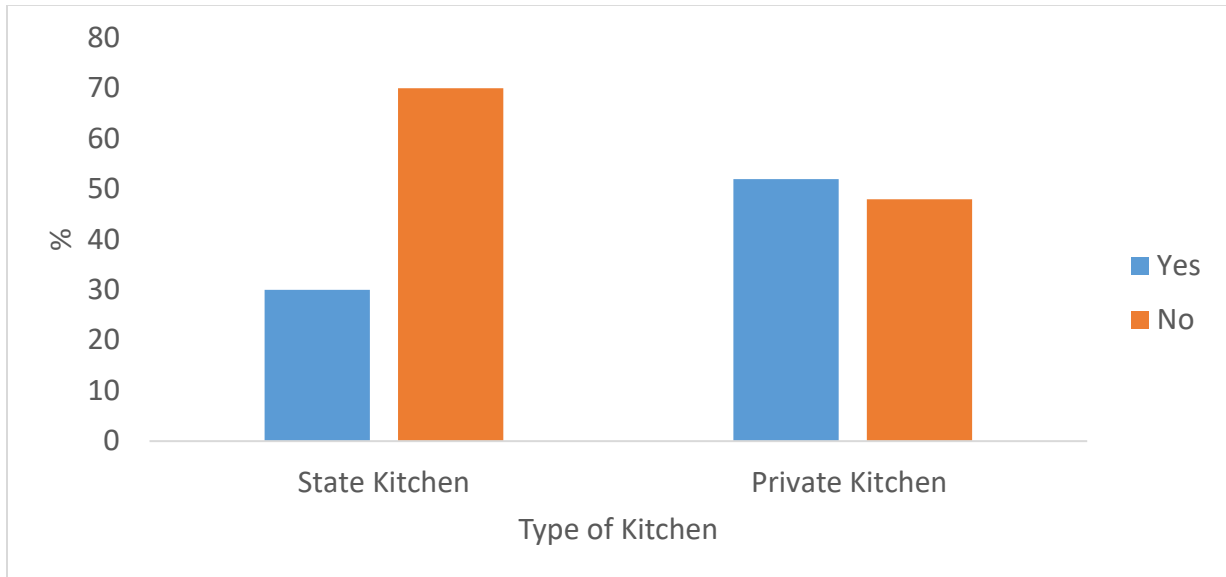


Figure 5: Knowledge on the best temperature to facilitate the growth of germs on food by type of kitchen, Opuwo District, 2018

Fifty-two percent (30/58) of food handlers from private kitchens knew that room temperature was the best temperature to facilitate the growth of germs compared to 30% (24/79) of food handlers from state kitchens (P-value = 0.012). There was no association between knowledge on best temperatures to facilitate the growth of germs and the sex of respondents (P-value = 0.9), working experience (P-value = 0.85) and food safety training (P-value = 0.06).

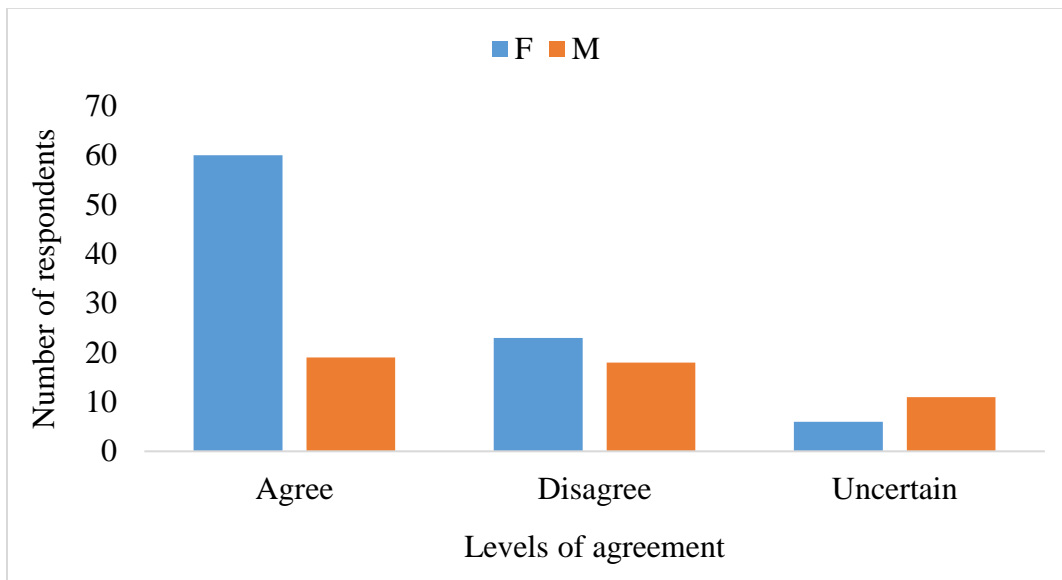
### 4.4 Attitudes of food handlers towards food safety

Respondents had a positive attitude toward food safety, with only two (1.5%) respondents having a negative attitude. The two respondents were female and working in state kitchens, with 4 or more years' working experience and older than 34 years. The mean of attitude score was 8.67 (standard deviation =  $\pm 1.65$ ), while the median was 9 with food handlers scoring from the minimum of 2 to the maximum of 10.

Table 4: Participants' score on attitudes towards food safety, Opuwo District, 2018

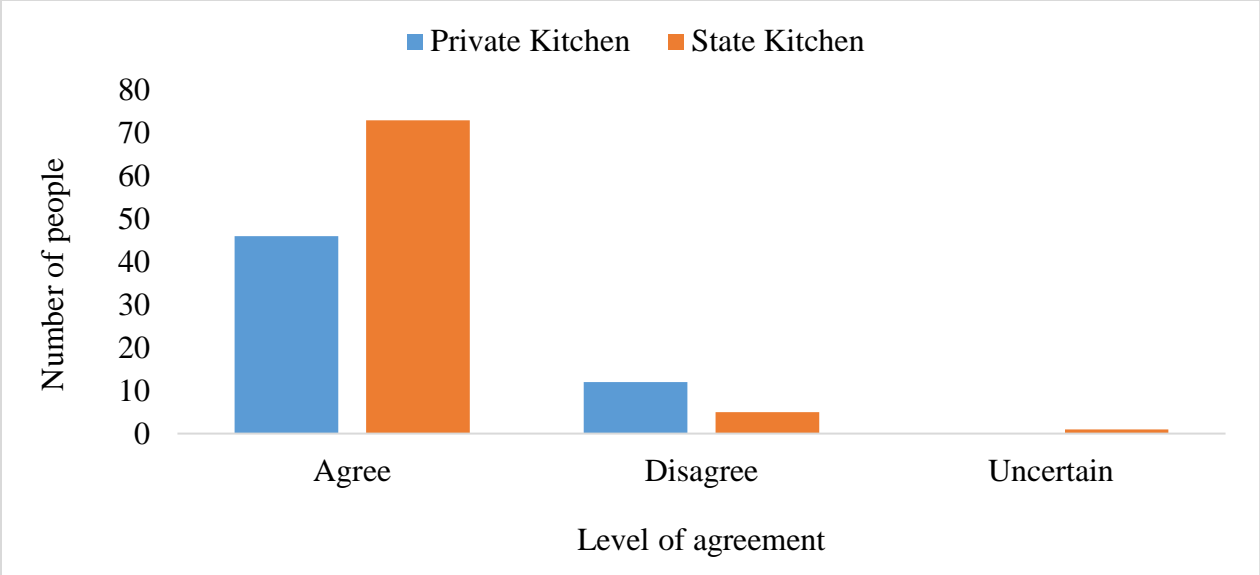
Question	Agree (%)	Disagree (%)	Uncertain (%)
Food safety is an important part of my job responsibility.	135 (98,5)	2 (1,5)	0
It is necessary to use anti-bacterial soap when washing hands.	118 (86,1)	15 (11)	4 (2,9)
Raw food should be kept separated from cooked food.	124 (90,5)	6 (4,4)	7 (5,1)
Toxic chemicals and cleaning solutions should be stored away from the food preparation area.	128 (93,4)	7 (5,1)	2 (1,5)
Defrosted food should not be refrozen.	79 (57,7)	41 (29,9)	17 (12,4)
Employees suffering from foodborne illness and other illnesses should not be permitted to work in the food preparation area.	120 (87,6)	12 (8,8)	5 (3,6)
Long fingernails can harbour harmful micro-organisms	119 (86,9)	17 (12,4)	1 (0,7)
Food handlers with abrasions or cuts on hands should not touch unwrapped food.	119 (86,9)	9 (6,6)	9 (6,6)
Food handlers should have refreshing food safety trainings on regular bases.	124 (90,5)	10 (7,3)	3 (2,2)
It is <b>NOT</b> necessary to have a medical examination, because I am healthy.	14 (10,2)	122 (89,1)	1 (0,7)

Most (98.5%, 135/137) participants agreed that food safety is an important part of their job responsibilities. About 91% (124/137) of the participants agreed to the statement that raw food should be kept separated from cooked food. Up to 30% (41/137) of the food handlers had a negative attitude towards refreezing defrosted food. A majority (89.1%, 122/137) of the participants disagreed with the statement “It is **NOT** necessary to have a medical examination, because I am healthy”.



*Figure 6: Participants’ attitudes on refreezing defrosted food by sex, Opuwo District, 2018*

About 58% (79/137) of the respondents agreed with the statement “Defrosted food should not be refrozen”, while 30% (41/137) disagreed and 12% (17/137) were uncertain about the statement. A significant difference was observed in the attitudes of male and female respondents towards refreezing defrosted food, with more males likely to disagree and to be uncertain about refreezing defrosted food than females (P-value = 0.002).



*Figure 7: Participants' attitudes towards food handlers' long fingernails by type of kitchen in Opuwo District, 2018*

Most (86.9%, 119/137) food handlers know that long fingernails harbour micro-organisms and are not recommended for food handlers. About 17 food handlers disagreed with the statement that said “Long fingernails can harbour harmful micro-organisms”, with most of these food handlers coming from private kitchens.

**4.5 Food handlers' practice of food safety**

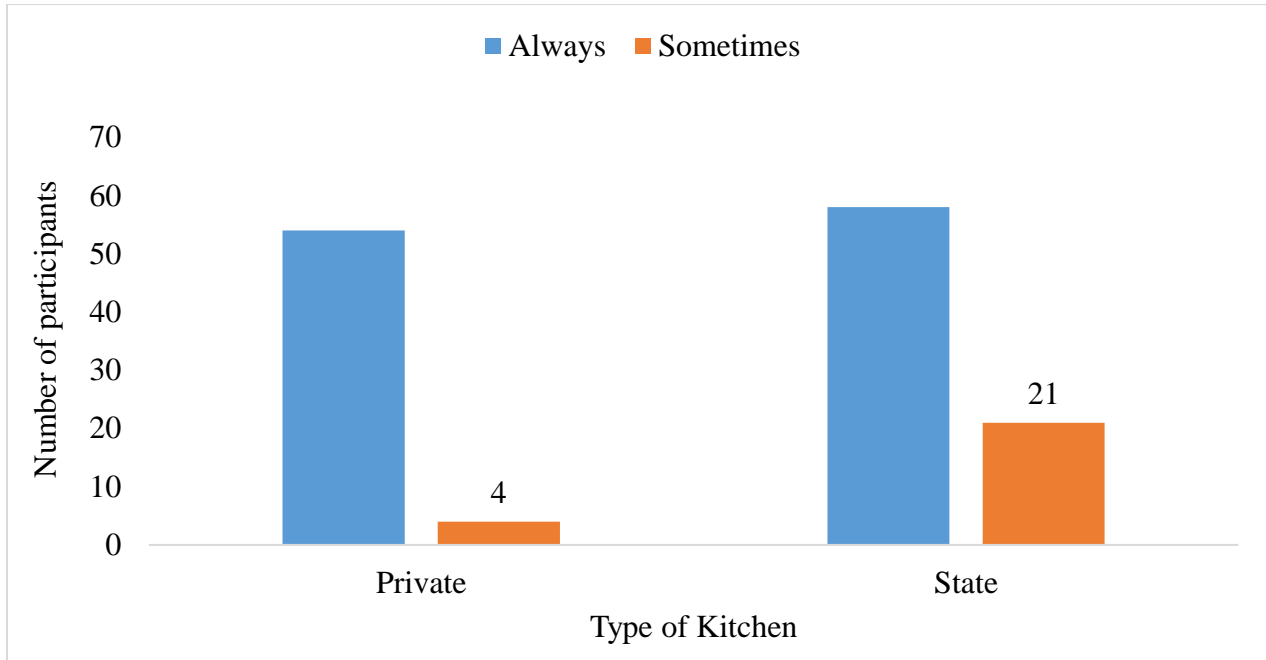
Most (91.2%, 125/137) food handlers are practicing food safety and only 9% (12/137) food handlers were found to have poor practices of food safety. Participants with poor food safety practices were mainly from state kitchen (91.7%, 11/12), and have been working in the profession for more than 4 years (75%, 9/12) and have never been trained on food safety (75%, 9/12).

Table 5: Food handlers' practices of food safety, Opuwo District, 2018

Question	Always (%)	Sometimes (%)	Never (%)
Do you wash your hands with soap before cooking or serving food?	112 (81,8)	25 (18,2)	0
Do you wash food contact surfaces such as chopping boards, tables and knives with soap before food preparation?	105 (76,6)	29 (21,2)	3 (2,2)
Do you use separate kitchen utensils to prepare raw and cooked food?	93 (67,9)	19 (13,9)	25 (18,2)
Do you cook or serve food when you fall sick?	14 (8,2)	37 (27)	86 (62,8)
Do you thaw food at room temperature?	70 (51,1)	41 (29,9)	26 (19)
Do you go for medical examination every six month?	29 (21,3)	45 (33,1)	62 (45,6)
Do you wear an apron while working?	102 (74,5)	24 (17,5)	11 (8)
Do you wear nail polish when handling food?	19 (13,9)	13 (9,5)	105 (76,6)
Do you cover your hair while working?	103 (75,2)	23 (16,8)	11 (8)
Do you check the shelf life of foods at the time of delivery and time of use?	80 (58,4)	43 (31,4)	14 (10,2)

A majority of participants (81.8%, 112/137) always wash their hands with soap before cooking or serving food. In most cases 76.6% (105/137) always wash food contact surfaces such as chopping boards, tables and knives with soap before food preparation. In addition, a majority (62.8%,

86/137) of food handlers reported that they never cook or serve food when they fall sick. About 46% (62/137) had never undergone medical examination; while (51.1%, 70/137) always thaw food at room temperature.



*Figure 8: Hand washing practices among food handlers in Opuwo District, 2018*

Most (93.1%, 54/58) of the food handlers in private kitchens were more likely to always wash their hands with soap before handling food compared to 73% (58/79) of the food handlers in state kitchens (p-Value = 0.003).

#### **4.6 Kitchen inspection**

About 24 kitchens were inspected with 137 food handlers. Only 46% (11/24) of the kitchens were found to be satisfactory. The mean score was 29 (standard deviation = 12.87), with the median of 25 ranging from 12 to 52.

Table 6: Outcome of the kitchen checklist inspection, Opuwo District 2018

#	Description	1	2	3
<b>A. KITCHEN</b>				
1	Kitchen cleanness	7 (29.2)	13 (54.2)	4 (16.7)
2	Kitchen well ventilated	3 (12.5)	15 (62.5)	6 (25)
3	Sinks clean, free from dirt and stains	9 (37.5)	11 (45.8)	4 (16.7)
4	Separate hand washing basin for food handlers, provided with liquid soap and paper towels	17 (70.8)	5 (20.8)	2 (8.3)
5	Portable water available	0	0	24 (100)
6	Kitchen in possession of hot water	16 (69.6)	2 (8.7)	5 (21.7)
7	Prepared (cooked) food well covered	9 (37.5)	10 (41.7)	5 (20.8)
8	Stainless steel surfaces	4 (17.4)	8 (34.8)	11 (47.8)
9	Acceptable chopping board and not hazardous	7 (30.4)	13 (56.5)	3 (13)
10	Equipment (stove, bread slicer, meat cutter, can opener, etc.) clean	6 (25)	14 (58.3)	4 (16.7)
11	Clean floor, wall, ceilings and windows	8 (33.3)	12 (50)	4 (16.7)
<b>B. FOOD HANDLERS</b>				
1	Appropriate clothing	4 (16.7)	15 (62.5)	5 (20.8)
2	Closed shoes	17 (70.8)	4 (16.7)	3 (12.5)
3	Clean aprons	8 (33.3)	10 (41.7)	6 (25)
4	Hair covered	7 (29.2)	3 (12.5)	14 (58.3)
5	Short, clean and unpolished nails	9 (37.5)	13 (54.2)	2 (8.3)

6	No jewelry	11 (45.8)	8 (33.3)	5 (20.8)
7	Medical examination done	21 (87.5)	1 (4.2)	2 (8.3)
8	Regular handwashing observed	22 (91.7)	1 (4.2)	1 (4.2)
9	Smoking, eating, drinking, or chewing gum is observed only in designated areas away from work areas.	1 (4.1)	11 (45.8)	12 (50)
<b>C. STORAGE</b>				
1	Storeroom clean and free from dust	6 (25)	13 (54.2)	5 (20.8)
2	Good house keeping	7 (29.2)	13 (54.2)	4 (16.7)
3	Food item stored off the ground and not leaning on the wall	8 (33.3)	12 (50)	4 (16.7)
4	Raw food well-covered	3 (12.5)	17 (70.8)	4 (16.7)
5	Freezer temperature acceptable	2 (8.3)	10 (41.7)	11 (45.8)
6	Cleaning chemicals and equipment well stored away from food	5 (20.8)	13 (54.2)	6 (25)
7	Utensils clean and well stored	3 (12.5)	15 (62.5)	6 (25)
8	The FIFO (First In, First Out) method is being practiced	2 (8.3)	12 (50)	10 (41.7)
<b>D. WASTE MANAGEMENT</b>				
1	Waste bins available, clean and covered	16 (66.7)	6 (25)	2 (8.3)
2	Left-over food well discarded and not mixed with fresh produce	3 (12.5)	12 (50)	9 (37.5)

3	No sign of pest infestation in and around the kitchen area	5 (20.8)	10 (41.7)	9 (37.5)
4	Toilets available and functional	3 (12.5)	11 (45.8)	10 (41.7)

Although all kitchens had portable water, most of them (69.7%, 16/24) did not have hot water. Only 17% (4/24) of the kitchens were found with clean washing sinks while about 38% (9/24) did not have washing sinks. Seventy-one percent (17/24) of the kitchens did not have a handwashing basin, food handlers use the sinks where utensils are washed, to wash their hands. Six (25%) kitchens were found cooking outside on fire wood because the kitchen could not cater for the number of learners, the number of learners has outgrown the kitchen's capacity.

Up to 58% (14/24) of the kitchen management have provided hair nets for food handlers to cover their hair. About 71% (17/24) of the kitchens had food handlers working with open toe shoes and 45.8% (11/24) of the kitchens had food handlers working with jewelries. Most kitchens (87.5%, 21/24) had food handlers operating without food handlers' examination. The researcher did not observe any handwashing at 92% (22/24) of the outlets, but observed food handlers eating at a food preparation area at one (4.1%) outlet.

The storage of food was acceptable at most kitchens. About one third (33.3%, 8/24) of the kitchens were storing food directly on the floor and leaning on the wall. Despite this, most kitchens had acceptable freezer temperatures, well-covered raw food and were practicing first in fist out (FIFO). Up to 67% (16/24) of the kitchens had no waste bins available on site, while 25% (6/24) had uncovered waste bins. Three kitchens (13%) did not have toilets available for use by food handlers. There were 21% (5/24) of the kitchens that were infested with cockroaches.

Public kitchens were more likely to comply with the food safety standards compared to private kitchens. The researcher has observed poor kitchen hygiene standards in Opuwo District, with only 55% (6/11) of state kitchens and 15% (2/13) of private kitchens found with acceptable levels of general hygiene. Ninety-one percent (10/11) of the state kitchens had acceptable storage facilities while only 31% (4/13) of private kitchens had acceptable storage facilities.

#### **4.7 Factors associated with food handler’s knowledge, attitude and practice on food safety**

The level of knowledge on food safety among food handlers in Opuwo District was inadequate as only 36% (49/137) of the respondents had adequate knowledge, with an average score of 45% (13.5/30). Food handlers in Opuwo District have positive attitude with respondents scoring an average of 87%. Good practice of food safety was also noted with respondents scoring 76% of average.

*Table 7: Factors associated with levels of knowledge on food safety among food handlers, Opuwo District, 2018*

<b>Variable</b>	<b>Total</b>	<b>Adequate</b>	<b>Inadequate</b>	<b>OR (95% CI)</b>	<b>P-Value</b>	<b>AOR (95% CI)</b>	<b>P-Value</b>
<b>Mean score (<math>\pm</math> SD)</b>	<b>13.52 (<math>\pm</math> 3.63)</b>						
<b>Median</b>	<b>13 (ranging from 1 – 23)</b>						
<b>Sex</b>							
Female	89	34	55	1,36 (0,65-2,87)	0,42		
Male	48	15	33				
<b>Age group</b>							

<25	19	10	9				
25-34	38	10	28	0,32 (0,10-1,02)	0,05		
35-44	32	13	19	0,62 (0,2-1,93)	0,4		
45+	46	16	30	0,48 (0,16-1,42)	0,18		
<b>Institutions</b>							
Private	58	18	40	0,7 (0,34-1,42)	0,32		
State	79	31	48				
<b>Period in the profession</b>							
< 4 Years	57	21	36	0,92 (0,45-1,87)	0,82		
≥ 4 Years	80	28	52				
<b>Level of education</b>							
none and Primary	38	8	30	2,65 (1,1-6,37)	0,03*	3.14 (1.2-8.2)	0.02*
Secondary and Tertiary	99	41	58				
<b>Undergone food safety training</b>							
Yes	75	29	46	1,32 (0,65-2,68)	0,44		
No	62	20	42				
<b>Formality of the training</b>							
Formal	58	20	38	0,41 (0,13-1,26)	0,11		
Informal	16	9	7				

\* *Significant*

Respondents with secondary and above level of education more likely to have a better knowledge on food safety comparing to respondents with primary and lower level of education, (OR = 2.65, 95% CI = 1.1 – 6.37). The difference in educational levels was statistically significant at a P-value of 0.03. Sex and undergoing food safety training were among the socio-demographic variables associated with levels of education but not statistical significance. Food handlers from private kitchen knew the proper technique of washing their hands. The odds of always washing hands before food preparation among food handlers in private kitchens was 4.89 (95% CI = 1.58 – 15.16) times the odds of always hand washing among food handlers from state kitchens. Respondents from private kitchens were also more likely to know that room temperature was the best temperature to facilitate the growth of germs compared to respondents from state kitchens (OR = 2.45, 95% CI = 1.21 – 4.96).

*Table 8: Factors associated with attitude of food handlers toward food safety, Opuwo District, 2018*

<b>Variable</b>	<b>Total</b>	<b>Positive</b>	<b>Negative</b>	<b>OR</b>	<b>95% CI</b>	<b>P-Value</b>
<b>Mean score (<math>\pm</math> SD)</b>	<b>8.67 (<math>\pm</math>1.65)</b>					
<b>Median</b>	<b>9 (ranging from 2 – 10)</b>					
<b>Sex</b>						
Female	89	87	2	0	0	0,3
Male	48	48	0			
<b>Age group</b>						

<25	19	19	0			
25-34	38	38	0	0	0	0,48
35-44	32	31	1	0	0	0,41
45+	46	45	1	0	0	0,52
<b>Institution</b>						
Private	58	58	0	0	0	0,22
State	79	77	2			
<b>Period in the profession</b>						
< 4 Years	57	57	0	0	0	0,23
≥ 4 Years	80	78	2			
<b>Level of education</b>						
none and Primary	38	37	1	2,65	0,16-43,44	0,48
Secondary and Tertiary	99	98	1			
<b>Undergone food safety training</b>						
Yes	75	74	1	0,82	0,05-13,45	1
No	62	61	1			
<b>Formality of the training</b>						
Formal	58	58	0	0	0	0,06
Informal	16	15	1			

On average food handlers in Opuwo District have positive attitude toward food safety. Level of education and undergoing food safety training were associated with food handler's attitude but not

statistical significant. However, a significant difference was observed in the attitudes of male and female respondents towards refreezing defrosted food, males were more likely to disagree (OR = 2.47, 95% CI = 1.11 – 5.52) and to be uncertain (OR = 5.79, 95% CI = 1.89 – 17.75) about refreezing defrosted food than females. Negative attitude was also noted among private kitchen respondents, as they more likely to disagree with the statement “Long fingernails can harbour harmful micro-organisms” (OR = 3.81, 95% CI = 1.26 – 11.5).

*Table 9: Factors associated with levels of food safety practices, among food handlers in Opuwo District, 2018*

<b>Variable</b>	<b>Total</b>	<b>Good</b>	<b>Bad</b>	<b>OR (95% CI)</b>	<b>P-Value</b>	<b>AOR (95% CI)</b>	<b>P-Value</b>
<b>Mean (<math>\pm</math> SD)</b>	<b>13.69 (<math>\pm</math>2.63)</b>						
<b>Median (range)</b>	<b>14 (ranging from 7 – 18)</b>						
<b>Sex</b>							
Female	89	82	7	1,36 (0,41-4,55)	0,61		
Male	48	43	5				
<b>Age group</b>							
<25	19	18	1				
25-34	38	38	0	0	0,33		
35-44	32	27	5	0,3 (0,03-2,79)	0,39		
45+	46	40	6	0,37 (0,04-3,31)	0,66		
<b>Institution</b>							
Private	58	57	1	14,07 (1,77-111)	0,001 *	6.23 (0.72-55.7)	0.09

State	79	68	11				
<b>Period in the profession</b>							
< 4 Years	57	54	3	0,44 (0,11-1,70)	0,36		
≥ 4 Years	80	71	9				
<b>Level of education</b>							
none and Primary	38	32	6	2,9 (0,87-9,66)	0,07		
Secondary and Tertiary	99	93	6				
<b>Undergone food safety training</b>							
Yes	75	72	3	4,07 (1,05-15,8)	0,04*	0.41 (0.1-1.69)	0.22
No	62	53	9				
<b>Formality of the training</b>							
Formal	58	55	3	0	1		
Informal	16	16	0				

\* *Significant*

Good levels of food safety practices were significantly associated with the type of kitchen (private or state), food handlers from private kitchens were more likely to have good hygiene practices (OR = 14.07, 95% CI = 1.77 – 111). Good food safety practices were also associated with food safety training, food handlers that have undergone food safety training were more likely to have good food safety and hygiene practices (OR = 4.07, 95% CI = 1.05-15.8) than those who were not trained.

## **4.8 Summary**

Data collected for the study was analyzed; results and findings were presented above. The results were presented by means of tables, charts and graphs in response to the set objectives. Data was analyzed using Epi info 7. The socio-demographic characteristics of participants were described as proportions and frequencies. Bivariate and multivariate analysis was performed on the potential factors associated with KAPs on food safety. Odds ratio for the potential factors were tabulated at 95% confidence intervals and statistical significance set at p value 0.05.

## **Chapter 5: Discussion of results, conclusions, recommendations and limitations**

### **5.1 Introduction**

This chapter focuses on discussions of the main findings of the study based on the study objectives. The interpretation of the findings will be discussed in relation to this study and previous studies conducted by other researchers in different settings, the researchers' own perspectives are also included.

### **5.2 Demographics characteristics**

In this study a majority (66%) of the participants were female, and this finding is consistent with the findings of a study by Rahman et al., whose study's 53% participants were female (42). However, the findings of this study are in contrast with the findings of a study by Gemedu where 68% of participants were male (15). The food industry is more likely to be dominated by females, as cooking and handling of food is considered a woman's responsibility at household level. Therefore, most men would shy away from working in the kitchen, even professionally.

Educating food handlers is the best way to protect the public including food handlers themselves. Properly trained food handlers can improve food safety and reduce risks and behaviors commonly associated with foodborne illnesses and outbreaks. Food safety training will also help in keeping companies of food establishments updated with food safety standards, as public health and safety standards evolve. In the current study more than half (55%) of the participants have undergone a food safety training. Findings in this study are consistent with the findings of Rahman et al., which found 70% of food handlers trained on food safety, however different from the findings of Akabanda et al. where only 9% of food handlers were trained on food safety (9,42).

### **5.3 Knowledge on food safety**

Food handlers in Opuwo were found to have inadequate knowledge on food safety. This can be compared to the findings of a study done in South Africa and Ghana, where food handlers had an unacceptable knowledge level of good food hygiene. In a study done in Ireland, food handlers had an overall average level on knowledge of food safety practices with a passing rate of 67.0%, while the food handlers in Opuwo District had a pass rate of 45% (64).

In as much as food handlers in Opuwo District had inadequate knowledge on food safety, they had great score (83%) on knowledge of hand washing hygiene. A study conducted by da Cunha et al., in Brazil found low knowledge on hand hygiene among food handlers, although hand hygiene is usually a common topic in food safety training for food handlers (65). Food handlers from state kitchens had a high chance of knowing the appropriate hand washing technique compared to food handlers in the private sector (P-value = 0.008). This could be attributed to the ability of organizing in-service training in the state and long working experiences of food handlers in state kitchens, as employees in the government are more likely permanent staff while in the private sector employees are likely to be recruited on contracts.

Another significant difference observed between food handlers in state and private kitchens regarding knowledge was on temperature control. A majority (51.7%) of food handlers from private kitchens knew that room temperature was the best temperature to facilitate the growth of germs compared to (30.4%) food handlers from state kitchens (P-value = 0.012). This can be attributed to in-services training conducted in private restaurants, which may not be common in state facilities. According to Akabanda et al, on job training should be provided to inspire and upgrade food-handlers knowledge, which will affect attitudes and subsequently food-safety practices (9).

Participants in this study were aware that spoiled food cause food borne illnesses. They were also well informed that diarrhoea and vomiting were among the signs and symptoms of foodborne illness and up to 88% respondents knew that germs cause foodborne illness. Adequate knowledge on food borne illness in this study is consistent with finding in a study by Al-shabib, were participants had good knowledge regarding food borne diseases (66). However, our findings were differing with a study in Nigeria; were only 40% of respondent know of the food borne illness causes (10).

#### **5.4 Attitudes of food handlers on food safety**

Attitude is also a crucial factor that may influence food safety behavior and practice, and thus a positive attitude towards food safety could decrease the occurrence of foodborne diseases and other health hazards (10). Food handlers in Opuwo District have showed great attitudes towards food safety, with only two (1.5%) respondents showing a negative attitude. The mean score of 87% was scored under attituded toward food safety, which is considered to be good. Other authors (Al-Shabib et al and da Cunha et al.) have also identified a high percentage (>80%) of positive attitudes of food handlers towards food safety (50,51).

Food handlers in Opuwo District are well aware that food safety is an important part of their job responsibilities. About 91% of the participants agreed with the statement that raw food should be kept separated from cooked food. In a study by Al-Shabib at al. approximately 78.2% handlers keep raw and cooked food during storage; this is comparable to our findings whereby 82.8% respondents in this study mentioned that they would use separate utensils and cuttings (51).

A study on food safety knowledge, attitudes and practices of institutional food-handlers in Ghana found that a majority (88.1%) of food-handlers were aware that food should not be handled with

long and painted fingernails, similar to this study where 87% of food handlers agreed that long fingernails can harbour harmful micro-organisms (10).

Refreezing completely thawed food can present a serious health risk, as freezing food only slows bacterial growth and does not necessarily kill the pathogens (10). The process of refreezing defrosted food leads to faster growth of contaminating bacteria. About 58% of food handlers had satisfactory attitudes towards defrosted and refrozen food, this is lower than the findings of Firdaus Siau et al., where 67.9% of the respondents agreed that defrosted food should not be refrozen (52). This finding differ with a study in Ghana where 82% of the food handlers were refreezing defrosted food (10).

Although a majority (89%) of the participants disagreed with the statement “It is **NOT** necessary to have a medical examination, because I am healthy”. However, none of the food handlers had a valid medical examination certificate in the district. This is in complete opposition to the findings of Darko et al., where 87% of food handlers had medical certificates (41).

## **5.5 Food safety practice**

About 91.2% of the food handlers in this study had good food safety practices, which is the opposite of a study done in South Africa, where participants had poor food hygiene practices (68). According to the Codex Alimentarius Commission, improper food handling is a major cause of foodborne diseases and poor hand washing hygiene is an important risk factor in the occurrence of food contamination (22). Food handlers should always wash their hands at every stage of food production, particularly before handling foods, after eating, after touching contaminated materials, after using the washroom, and after smoking. The majority (82%) of participants in this study

responded that they always wash their hands with soap before cooking or serving food. Findings in this study are in agreement with those reported by Al Shabib et al, who reported that more than 90% of food handlers practice good hand washing hygiene (64,66).

Food handlers should ensure that the food they serve has not reached its shelf life to avoid foodborne illnesses. About 58% of food handlers have indicated that they always check the shelf life of food at the time of delivery and time of use. This is comparable to the findings of da Cunha et al. and Al-Shabib et al, who reported that 92% and 83% of the food handlers respectively, never used expired food, regardless of the sensory characteristics, while in the Akabanda et al. study 83% of the respondents never checked the shelf life of foods at the time of delivery (10,50,51).

The most inadequate or poor practice reported was defrosting food at room temperature, as 51% of food handlers responded to performing this procedure. In a similar study by da Cunha et al. it was reported that 35% of the respondents always defrosted food at room temperature (50). Pathogens can be transferred from one food to another, either by direct contact or by food handlers, contact surfaces or the air (22). Raw, unprocessed food should be effectively separated to ensure food hygiene, either physically or by time, from ready-to-eat food, with effective intermediate cleaning and where appropriate, disinfection (22). A majority (77%) of food handlers in this study have reported that they always wash food contact surfaces such as chopping boards, tables and knives with soap before food preparation to avoid food contamination. Similarly, in study by Akabanda et al., majority of respondents agreed that knives and cutting boards should be properly sanitized to prevent cross contamination of foods (10).

Medical examination is part of the food safety management system in many countries and it is therefore mandatory for personnel who handle food to obtain a medical health certificate (54). According to the Codex Alimentarius Commission, “people known, or suspected to be suffering

from, or to be a carrier of a disease or illness are likely to transmit the disease or illness through food, and should not be allowed to enter any food handling area if there is a likelihood of them contaminating food” (22). In this study about 62.8% of food handlers never cooked or served food when sick, however 45.6% had never undergone a medical examination. A study done in Nigeria found that only 51% of the restaurant managers indicated that allowing a sick person to cook food could lead to a foodborne illness(55).

## **5.6 Kitchen inspections**

Even though all kitchens had portable water, many (69.7%) did not have hot water. This is similar to the findings of Human, whose study found that none of the institutions had an adequate supply of hot water for cleaning (68). While portable water is a requirement for food outlets, hot water is required in the kitchen for cleaning purposes (22).

In order to immunize food contamination during the preparation of food, it is important for the kitchen to have a hand washing basin separate from the kitchen sink, to avoid food handlers washing their hands in the sink used to wash food or utensils (22,56). In this study up to 37.5% of the kitchens did not have any washing sinks available, while 71% of the kitchen did not have a hand washing basin, and food handlers were washing their hands in the sinks where utensils are washed. In addition to hand washing, about 82% of food handlers self-reported that they always practiced hand washing with soap; though the researcher did not observe any hand washing at 22 (91.7%) of the outlets.

Food handlers should maintain a high degree of personal cleanliness by wearing suitable protective clothing, head covering and footwear (22). In this study 58.3% of the kitchen management have provided hair nets for food handlers to cover their hair, on a negative note up to 71% of the kitchens

had food handlers working with open toe shoes and slippers, and about 45.8% of the kitchens had food handlers working with jewelries. The Codex Alimentarius Commission condemn the use of personal effects such as jewelry, watches, pins or other items in the food handling areas because they pose a threat to the safety and suitability of food (22).

Waste management is very crucial in food handling settings, not only to keep the place clean but it also helps with minimizing food contamination as waste attracts and harbours pests (22,56). Up to 16 (66.7%) of the kitchens visited during the study, had no waste bins available on site, while 6 (25%) had uncovered waste bins. The finding of this study is equivalent the findings of a study done in Ethiopia, where waste receptacles did not have a proper covering and an overflowing of waste containers with solid waste was observed (17). According to the General Principles of food hygiene all food establishments should have clean functioning toilets and changing rooms for employees (22). This study has identified three kitchens that did not have toilets available to be used by food handlers.

Five kitchens in this study were found to be infested with cockroaches, a sign of poor hygiene practices by food handlers. Pests pose a major threat to food safety. Pest infestations can occur where there are breeding sites and a supply of food, but good hygiene practices can avoid creating an environment conducive to pests (22).

### **5.7 Factors associated with food handler's knowledge, attitude and practice on food safety**

Levels of knowledge on food safety were found to be impacted by levels of education (OR = 3.14, 95% CI = 1.2-8.2), similar to findings in a study by Akabanda et al., Nora et al. and Samapundo et al. where the level of education was significantly associated with food handlers' levels of

knowledge on food safety (9,64,71). Respondents having advanced educational level demonstrated significantly better understanding of food safety issues, results consisted with Akabanda et al study (10). There was no significant difference in the food safety knowledge levels of the food handlers who have undergone food safety training and those who did not, a contradiction of the findings of a study done in Vietnam, where significant differences occurred between food safety knowledge levels of vendors who had received food safety training and those who had not ( $p = 0.04$ ) (58). In an assessment study conducted by Brown et al. respondents high score was associated with level of education, food safety training and working experience (59).

A positive attitude is a mediator in the relationship between knowledge and practices in food handling. In this study, although food handlers had positive attitudes and good food safety practices, they had a very poor understanding or knowledge on food safety. A study by Al Shabib et al., showed that having good knowledge could lead to having good attitudes in food hygiene and sanitation among the respective food handlers (42). Furthermore, knowledge and attitudes also showed significant relationships with practice levels (42).

Good levels of food safety practices were significantly associated with the type of kitchen and food safety training. Food handlers from private kitchens and those that have undergone food safety training were more likely to have good practices of food safety with the odd ratio of 14.07 (1.77 – 111) and 4.07 (1.05-15.8) respectively. High levels of good practices in handling food in private kitchens can be attributed to the pressure on staff losing their jobs as they are strictly monitored and are at risk of being fired if they do not comply with food safety practices.

Food handlers that have undergone food safety training have showed good food safety practices mainly because they were trained on best practices. This is corresponding with the finding of Adane (2018); who noted a significant difference on food safety practices and the food safety training (38). Effective food safety training and education provide consumers assurance on the safety of food as it can improve food handlers safety practices (9).

## **5.8 Conclusion**

The first objective of this study was to assess food handlers' knowledge of food safety in Opuwo District; and it was concluded that food handlers in Opuwo District had limited knowledge on food safety. However, most food handlers knew the proper hand washing methods.

The second objective was to assess food handlers' attitudes towards food safety in Opuwo District, the research found that there were positive attitudes towards food safety among food handlers in Opuwo District. The third objective was to assess food handlers' practices on food safety, and food handlers were found to have satisfactory food safety practices.

The last objective was to evaluate food hygiene and sanitation of food preparation areas, of which this research found that the hygiene levels of food preparation areas were unacceptable for most kitchens. Food handlers were fully aware of hand washing methods even though they had constraints on proper hand washing due to lack of hand washing basins and availability of hot water. A significant difference was noticed between private and state kitchens on hand washing and temperature control knowledge. Public kitchens were more likely to comply with the food safety standards compared to private kitchens.

## **5.8 Recommendations**

### **Recommendations to the Ministry of Health and Social Services**

- The district's Environmental Health Practitioners (EHPS) in corroboration with the Regional Director for the Ministry of Education, Art and Culture, should identify food handlers in boarding schools and ensure that they have their medical examination done on annual basis.
- The district's EHPs and the department of hostel in the Ministry of Education, Art and Culture should carry out inspections in schools on a regular basis, for early identification of gaps in food safety
- The district's EHPs should look into all aspects of food safety before approving restaurants for business, e.g. the presence of hot water, hand washing basin, pest control plan and waste management plan.
- The district EHPs should facilitate pest control in food establishments by ensuring that pest infestation is dealt with immediately and without adversely affecting food safety or suitability, and that the treatment used whether chemical, physical or biological treatment does not pose a threat to the safety or suitability of food.

### **Recommendations to the Ministry of Education, Art and Culture**

- The Ministry of Education, Art and Culture together with the district EHPs should organize in-service food safety trainings for food handlers.
- The Ministry of Education, Art and Culture should approach stakeholders and developmental partners to donate funds in order to build kitchens and dining halls for students at schools found cooking in the open.

## **Recommendations to the Private Sector**

- Employers should ensure the all food handlers are medical examined and fit to handle food
- Restaurant management should consider sending their food handlers to workshops or conduct in-service trainings for food handlers at work.
- Restaurant managers should install geysers for hot water in their workplaces/food preparation areas.
- Restaurant managers need to ensure that their kitchens are equipped with waste bins, which should be emptied regularly. Waste must not be allowed to accumulate or overnight in the kitchen, food storage and other working areas and the adjoining environment. Waste stores must be kept appropriately clean.
- Restaurant managers should develop and implement pest control plans to avoid food contamination caused by pest infestations in the workplace
- Restaurant management should install hand washing basins supplied with hot water in their kitchens to avoid food handlers washing their hand at the sinks. The hand basin should be provided with liquid soap and paper towels for hand drying.

## **5.9 Limitations**

The main limitation of this study is that the sample was restricted to Opuwo District only. Another important limitation is that the food safety practices were somewhat more challenging to evaluate because of possible self-reported bias. Moreover, the study was also limited by financial resources, time and lack of national updated regulations on food safety. A deficiency of proper documentation of food hygiene related events in Namibia, especially in Kunene region which can serve as a point of reference was also a limitation to this study.

## **5.10 Summary**

This chapter presented the conclusions, recommendations and limitations of the study. This is also the final chapter of this thesis. The way forward was stated in terms of recommendations based on the implications identified by the study.

Recommendations will be submitted to the Ministry of Health and Social Services and the Ministry of Education, Art and Culture, for possible implementation. It is hoped that the findings of this study will help to improve food safety in Namibia.

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# APPENDICES

## Appendix 1: Ethical clearance certificate



**ETHICAL CLEARANCE CERTIFICATE**

**Ethical Clearance Reference Number: SON /430/2017**      **Date: 1 October, 2017**

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

**Title of Project:** Knowledge, Attitude And Practices On Food Safety Among Food Handlers In Opuwo District

**Researcher:** HELENA LAMANGULUKA HAKWENYE

**Student Number:** 201411919

**Faculty:** School of Nursing

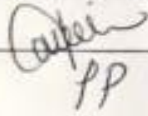
**Supervisors:** Dr. T. Amakali-Nauseb (Main) Mrs E. Mulenga (Co)

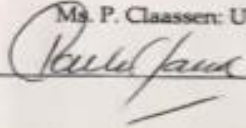
Take note of the following:

- (a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.
- (b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.
- (c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.
- (d) The UREC retains the right to:
  - (i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected.
  - (ii) Request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Prof. P. Odonkor: UREC Chairperson      Ms. P. Claassen: UREC Secretary

  
PP



## Appendix 2: Approval letter from Ministry of Health and Social Services



### REPUBLIC OF NAMIBIA

#### Ministry of Health and Social Services

Private Bag 13198  
Windhoek  
Namibia

Ministerial Building  
Harvey Street  
Windhoek

Tel: 061 - 203 2537  
Fax: 061 - 222558  
E-mail: btjivambi@mhss.gov.na

#### OFFICE OF THE PERMANENT SECRETARY

Ref: 17/3/3 HH  
Enquiries: Mr. B. Tjivambi

Date: 16 November 2018

Ms. Helena Hakwenye  
PO Box 7489  
Katutura  
Windhoek

Dear Ms. Hakwenye

**Re: Knowledge, attitude and practices on food safety among food handlers in Opuwo District.**

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**
  - 3.1 The data to be collected must only be used for academic purpose;
  - 3.2 No other data should be collected other than the data stated in the proposal;
  - 3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;

A handwritten signature in black ink, appearing to be 'MS'.

- 3.4 A quarterly report to be submitted to the Ministry's Research Unit;
- 3.5 Preliminary findings to be submitted upon completion of the study;
- 3.6 Final report to be submitted upon completion of the study;
- 3.7 Separate permission should be sought from the Ministry for the publication of the findings.
4. All the cost implications that will result from this study will be the responsibility of the applicant and **not** of the MoHSS.

Yours sincerely,

  
MR. B.T. NANGOMBE  
PERMANENT SECRETARY



*"Health for All"*

## Appendix 3: Approval letter from Ministry of Education Art and Culture



REPUBLIC OF NAMIBIA

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### MINISTRY OF EDUCATION, ARTS AND CULTURE

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Tel: +264 61 -2933200  
Fax: +264 61- 2933922  
Enquiries: C. Muchila  
Email: [Cavin.Muchila@moe.gov.na](mailto:Cavin.Muchila@moe.gov.na)

Luther Street, Govt. Office Park  
Private Bag 13186  
Windhoek  
Namibia

File no: 11/1/1

Ms Helena L. Hakwenye  
P O Box 7489  
Katutura, Namibia  
Cell: +2648140300019  
[Hhakwenye5@gmail.com](mailto:Hhakwenye5@gmail.com)

Dear Ms Hakwenye

**SUBJECT: REQUEST FOR AUTORIZATION TO CARRY OUT RESEARCH IN THE BOARDING SCHOOLS OF OPUWO HEALTH DISTRICT**

Kindly be informed that permission to conduct research entitled "knowledge, attitude and practices on food safety among food handler in Opuwo district" for your Master Degree (Applied Epidemiology and Laboratory Management) in Kunene region is herewith granted. You are further requested to present the letter of approval to the Regional Director to ensure that research ethics are adhered to and disruption of curriculum delivery is avoided.

Furthermore, we humbly request you to share your research findings with the ministry. You may contact Mr C. Muchila at the Directorate: Programmes and Quality Assurance (PQA) for provision of summary of your research findings.

I wish you the best in conducting your research and I look forward to hearing from you soon.

Sincerely yours

  
SANET L. STEENKAMP  
PERMANENT SECRETARY



*All official correspondences must be addressed to the Permanent Secretary*

**Appendix 4: Approval letter from Kunene Regional Council Directorate of Education**



**REPUBLIC OF NAMIBIA  
KUNENE REGIONAL COUNCIL  
DIRECTORATE: EDUCATION  
THE DIRECTOR'S OFFICE**



Tel: 09264 67 - 335000  
Fax: 09 264 67 - 332226

Private Bag 2007  
KHORIXAS

26 November 2018

**Ms Helena L. Hakwenye  
P. O. Box 7489  
Katutura  
Namibia**



**Dear Ms Hakwenye**

**SUBJECT: REQUEST FOR AUTHORIZATION TO CARRY OUT RESEARCH IN THE BOARDING SCHOOLS OF OPUWO HEALTH DISTRICT**

Kindly be informed that Permission is granted to carry out your research titled "knowledge, attitude and practices on food safety among food handler in Opuwo district] for your Master's Degree in Kunene Region.

You have to consult and get the final approval from the respective principals when entering the schools. This activity should not interrupt the normal curriculum activities.

We humbly request you to share your research findings with the Directorate.

Thank you for your understanding in this regard.

Yours faithfully,



**MRS. ANGELINE. A. JANTZE  
DIRECTOR OF EDUCATION, ARTS AND CULTURE  
KUNENE REGION**

## **Appendix 5: INFORMED CONSENT**

### **Knowledge, attitude and practices on food safety among food handlers in Opuwo District**

Good day, my name is Helena Lamanguluka Hakwenye, a final year student of Master of Science in Applied Epidemiology and Laboratory Management at the University of Namibia. I am conducting a research on: Knowledge, Attitude and Practices on food safety among food handlers in Opuwo District, under the supervisors of Dr. T. Amakali-Nauseb and Dr. E. Mulenga. This study and its procedures have been approved by the research committee of University of Namibia. I am also authorized by the Ministry of Health and Social Services, Ministry of Education Art and Culture and Ministry of Safety and Security to conduct the study in Opuwo Health District, Kunene region.

The purpose is to assess knowledge, attitude and practices on food safety among food handlers in Opuwo District. I would therefore, like to ask you to respond to this questionnaire. Although this study will not benefit you directly, the information obtained will help the decision-makers in the district to plan the improvement of the food safety. There should be no harm to you in sharing your information. Your identity will not be revealed when the study is reported or published. Your participation in this study is voluntary and you have the right to withdraw at any time if you care to, without consequence or penalty. Any information you give will be kept confidential.

If you have any questions about the study, do not hesitate to ask me (Helena L. Hakwenye at 0814030019).

I hereby freely consent to take part in this study

\_\_\_\_\_

Signature of participant

\_\_\_\_\_

Date

## **Appendix 6: Questionnaire**

Dear participants, the aim of this study is to assess knowledge, attitude and practices on food safety among food handlers in Opuwo District.

### **Instructions:**

- (1) This questionnaire is to be completed by the participant
- (2) Answer all questions in all four sections
- (3) Please answer each question as honestly as possible by giving a Tick (√) in the appropriate box
- (4) Identity number and respondent code will be provided by the researcher is used to guarantee confidentiality and anonymity.

Your participation in this research study is highly appreciated.

Yours,

Helena L. Hakwenye

**Identification Number** \_\_\_\_\_

**Name of the institution** \_\_\_\_\_

**Date questionnaire filled** \_\_\_\_\_

**SECTION A: DEMOGRAPHIC INFORMATION OF FOOD HANDLERS**

1. Respondents Code: \_\_\_\_\_

2. Age: \_\_\_\_\_

3. Sex

1.	Male	
2.	Female	

4. What is the highest level of educational you have completed?

1.	None	
2.	Primary	
3.	Secondary	
4.	Tertiary	

5. Have you undergone food safety and practices training?

1.	Yes	
2.	No	

6. If Yes what type of training, formal or informal training?

1.	Formal	
2.	Informal	

7. How long have you been in this profession?

1.	< 1 year	
2.	1-3 years	
3.	4-6 years	
4.	7 and more	

## **SECTION B: KNOWLEDGE ON FOOD SAFETY AND HYGIENE**

8. One can get sick from eating spoiled food?

1.	Yes	
2.	No	
3.	Don't know	

9. What are the symptoms of foodborne illnesses? (You can select more than one)

1.	Diarrhea	
2.	Vomiting	
3.	Paralysis	
4.	Abdominal pain	
5.	Fatigue	

6.	Jaundice	
7.	Don't know	

10. What are the causes of food borne illnesses? (You can select more than one)

1.	Germs	
2.	Allergens	
3.	Insecticides	
4.	Extraneous matter	
5.	Don't know	

11. How should food handlers wash their hands? (You can select more than one)

1.	Under warm running water	
2.	With soap	
3.	In a bowl of water	
4.	Don't know	

12. How can you minimize the risk of food contamination? (You can select more than one)

1.	Cooking food thoroughly	
2.	Refrigerating food	
3.	Keeping fingernails short, unpolished and clean	

4.	Using caps, masks and appropriate clothing	
5.	Using potable water	
6.	Use different surfaces and utensils for raw and uncooked food	
7.	Don't know	

13. What are the sources of contamination in food? (You can select more than one)

1.	Raw materials/ingredients	
2.	Working surfaces	
3.	Cooking utensils	
4.	Germs from handlers	
5.	Don't know	

14. Which of the following temperature conditions best facilitates the growth of germs?

1.	Cold	
2.	Hot	
3.	Room temperature	
4.	Don't know	

15. How should vegetables and fruits be washed?

1.	Soak in detergent	
2.	Wash with hot water	

3.	Wash with running cold water	
4.	Soak in cold water, then wash	
5.	Don't know	

16. Of the following, which is the **least** safe way to /defrost raw meat?

1.	In refrigerator	
2.	On chopping board	
3.	In microwave oven	
4.	In cold water in sealed package	
5.	Don't know	

17. Why should someone avoid eating leftovers that were not kept in a cool place? (You can select more than one)

1.	Foods get spoiled	
2.	Because food is not safe anymore	
3.	Higher temperatures make germs grow faster	
4.	Don't know	

**SECTION C: ATTITUDE ON FOOD SAFETY AND HYGIENE**

No	Question	Agree	Disagree	Do not Know
18.	Food safety is an important part of my job responsibility.			
19.	It is necessary to use anti-bacterial soap when washing hands.			
20.	Raw food should be kept separated from cooked food.			
21.	Toxic chemicals and cleaning solutions should be stored away from the food preparation area.			
22.	Defrosted food should not be refrozen.			
23.	Employees suffering from foodborne illness and other illness should not be permitted to work in the food preparation area.			
24.	Long finger nails can harbor harmful micro-organisms			
25.	Food handlers with abrasion or cuts on hands should not touch unwrapped food.			
26.	Food handlers should have refreshing food safety trainings on regular bases.			

27.	It is <b>NOT</b> necessary to have a medical examination, because I am healthy.			
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**SECTION D: PRACTICES ON FOOD SAFETY AND HYGIENE**

No	Question	Always	Sometimes	Never
28.	Do you wash your hands with soap before cooking or serving food?			
29.	Do you wash food contact surfaces such as chopping boards, tables and knives with soap before food preparation?			
30.	Do you use separate kitchen utensils to prepare raw and cooked food?			
31.	Do you cook or serve food when you fall sick?			
32.	Do you thaw food at room temperature?			
33.	Do you go for medical examination every six month?			
34.	Do you wear an apron while working?			
35.	Do you wear nail polish when handling food?			
36.	Do you cover your hair while working?			
37.	Do you check the shelf life of foods at the time of delivery and time of use?			

Thank you for taking time to fill the questionnaire

## Appendix 7: FOOD PREMISES INSPECTION CHECKLIST

Inspection date: \_\_\_\_\_

Checklist code: \_\_\_\_\_

Name of place inspected: \_\_\_\_\_

#	Description	1	2	3
<b>E. KITCHEN</b>				
1	Kitchen cleanness			
2	Kitchen well ventilated			
3	Sinks clean, free from dirt and stains			
4	Separate hand washing basin for food handlers, provide with liquid soap and paper towels			
5	Portable water available			
6	Kitchen in position of hot water			
7	Prepared (cooked) food well covered			
8	Stainless steel surfaces			
9	Acceptable chopping board and not hazardous			
10	Equipment (stove, bread slicer, meat cutter, can opener, etc...) clean			
11	Clean floor, wall, ceilings and windows			
<b>F. FOOD HANDLERS</b>				
1	Appropriate clothing			
2	Closed shoes			

3	Clean aprons			
4	Hair covered			
5	Short, clean and unpolished nails			
6	No jewelry			
7	Medical examination done			
8	Regular hand washing observed			
9	Smoking, eating, drinking, or chewing gum is observed only in designated areas away from work areas.			
<b>G. STORAGE</b>				
1	Storeroom clean and free from dust			
2	Good house keeping			
3	Food item stored off the ground and not leaning on the wall			
4	Law food well covered			
5	Freezer temperature acceptable			
6	Cleaning chemicals and equipment's well stored away from food			
7	Utensils clean well stored			
8	The FIFO (First In, First Out) method is being practiced			
<b>H. WASTE MANAGEMENT</b>				
1	Waste bins available, clean and covered			
2	Left over well discarded and not mixed with fresh produce			
3	No sign of pest infestation in and around the kitchen area			
4	Toilets available and functional			

Comments:

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