

**PROMOTION OF FOOD SAFETY, HYGIENE AND SANITATION USING HEALTHY
FOOD MARKET CONCEPT IN SELECTED RURAL MARKETS OF CHIKWAWA
DISTRICT, SOUTHERN MALAWI.**

Master of Science in Environmental Health

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**UNIVERSITY OF MALAWI
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Master of Science in Environmental Health

By

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**A thesis submitted to the Department of Environmental Health, Faculty of Applied
Sciences, in partial fulfillment of the requirements for the Degree of
Master of Science in Environmental Health**

University of Malawi

The Polytechnic

July, 2017

DECLARATION

I, **Laston Lucky M, Kamwana**, declare that this thesis entitled: *Promotion of food safety, hygiene and sanitation using healthy food market concept in selected rural markets of Chikwawa District, Southern Malawi*, is my own original work and has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature : _____

Date : _____

CERTIFICATE OF APPROVAL

The under sign certify that they have read and approve for acceptance by the University of Malawi, The Polytechnic, this thesis entitled: *Promotion of food safety, hygiene and sanitation using healthy food market concept in selected rural markets of Chikwawa District, Southern Malawi.*

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DEDICATION

I dedicate this thesis to my beloved wife Evetta, and sons Jonathan and Stanley for the suffering gone through when I was not there for them during my study. Without your unwavering support and sacrifice throughout the three years of study at Polytechnic, this would not have been possible. Thank you and I love you, **GOD BLESS YOU!**

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ABSTRACT

Introduction

Health Food Market (HFM) concept started in 1996 by the World Health Organisation (WHO) to promote sanitation, food safety and hygiene (FSH) in rural food markets. In Malawi the concept was introduced on pilot basis at Mfera and Dembo in Chikwawa district in 2014 to improve FSH and sanitation. The concept was a component of the Healthy Setting Approach that was implemented by the Scotland Chikwawa Health Initiative (S-CHI) Project.

Objectives

The study attempted to ascertain HFM promotion interventions' effect on FSH and sanitation at Dembo market (intervention market) and Bereu (control market). The study looked at the level of hygiene, sanitation, knowledge and practices of food handlers and the level of participation of market stakeholders in FSH activities before and after introducing the HFM concept.

Methodology

The study used an evaluative study design. Study population composed of permanent vendors selected using systematic random sampling, mobile vendors and customers selected using convenient sampling and extension workers and Heads of Departments who were selected using purposive sampling. Data collection methods included face-to-face interviews with vendors and customers, administration of questionnaires by data collectors to key informants who were extension workers and heads of departments and facilitation of focus group discussions by the researcher with local leaders, market committees and village development committees. Observations were also done on personal hygiene of food handlers, actual food hygiene and environmental sanitation using checklists. Numerical data was analyzed using descriptive statistics and categorical data was analyzed using frequencies. All tests were performed at 95% confidence level with statistical significance set at $p < 0.05$.

Findings

Prior to the study, Dembo food market had no usable waste disposal pit and toilets. Food handlers had no comprehensive FSH knowledge with also inadequate participation of stakeholders in FSH development activities. FSH improved at Dembo market following implementation of HFM interventions although this was not comprehensive. Infrastructural improvements included boreholes rehabilitation (n=1); construction of two new latrines, one waste disposal pit and

provision of eight waste bins. Increase in market cleaning and market inspection were observed, 41 % of food handlers trained in FSH with only 25.0% of applying the FSH concepts learnt. The HFM interventions assessed indicated that implementation of the HFM concept can help improve sanitation and provision of safe foods in markets despite facing continuing sustainability challenges affected by poor governance and supervision. Improvement on the establishment of sanitation facilities, training of food handlers in FSH and sanitation and participation of stakeholders in FSH activities incorporating the HFM concept can promote FSH and sanitation in food markets

Conclusion

The HFM interventions assessed indicated that implementation of the HFM concept can help to improve sanitation and provision of safe foods in markets. Improvement on establishment of sanitation facilities, training of food handlers in sanitation and FSH, and participation of stakeholders in FSH activities incorporating the HFM concept can promote FSH and sanitation in food markets.

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LIST OF ACRONYMS AND ABBREVIATIONS

DC	District Council
DHO	District Health Office
FAO	Food and Agricultural Organization
FBD	Food Borne Diseases
FSH	Food Safety and Hygiene
HCP	Health Cities Project
HFM	Health Food Market
MDG	Millennium Development Goals
NSO	National Statistics Office
S-CHI	Scotland-Chikwawa Health Initiative
SPSS	Statistical Package for Social Scientists
WHO	World Health Organization

DEFINITION OF TERMS

Five (5) Keys to Safer Foods: Essential food safety messages or principles linked to behaviors that, if adopted and practiced, will reduce the probability of food borne illness.

Food handler: A worker in the food business whose hand comes in direct contact with food.

Food handling: The act of taking, holding or managing food with the hands.

Food Hygiene: All conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain to make it safe and suitable for human consumption.

Food safety practices: Application of good hygiene practices while preparing food.

Food safety: A discipline describing handling, preparation and storage of food in a manner that prevents transmission of food borne illnesses.

Food vendor: Person involved in food preparation, distribution or selling thereof in places like restaurants, hospitals, catering establishments, food factories, markets etc.

Food: A combination of natural ingredients from proteins, carbohydrates, mineral and vitamins needed by man as energy that supports the daily activities of the body.

Personal hygiene: Maintenance of personal cleanliness from head to toe by food handling personnel.

Potable water: Water that is considered suitable for human consumption (drinkable) as per the WHO Drinking water Guideline.

Street Foods: Ready-to-eat foods prepared and/or sold by vendors and hawkers in streets and other similar public places.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

A Healthy Food Market (HFM) is a setting in which all stakeholders involved in market tasks collaborate to provide safe and nutritious food to the community. A HFM serves to improve the safety of food from farm to table continuum. The promotion of HFM in rural areas act as an approach for promoting food safety and related environmental health issues The HFM concept was developed from the Health Cites Project (HCP) concept which was initiated in 1996 by the World Health Organization (WHO, 2006).

The overall strategy employed by the HCP initiative is to integrate health protection and health promotion activities in urban areas and transform priority health determinants like water supply, hygiene, sanitation and food safety for the better (WHO, 2006). It is from such an understanding that the Health Food Market (HFM) concept was initiated in 1996 (WHO, 2000). The HFM concept is buttressed by three basic principles which include: the provision of safe and nutritious food; the promotion of food safety from production to consumption and the improvement of partnerships between traders, consumers, the Government and other development partners (WHO, 2006).

In Asia the HFM Concept was implemented in China and Philippines while in America it was implemented in Paraguay and Dominic Republic. (WHO, 2006 & Morse, 2014a). In Africa, the first pilot HFM was introduced in 1997, a year after its initiation at Burugumi Market in Dares Salaam, Tanzania under the Dares Salaam HFM Project. It was successfully implemented and it led to improvement in road access; construction of a solid waste storage bay; construction of toilet and hand washing facilities; and the development of a system for the collection and sorting of solid waste for subsequent disposal. This heightened Burugumi Market food safety standards Pilot HFM projects were also initiated in other African countries like Botswana, Mozambique and Rwanda in places like schools, food establishments and vending sites as well as food markets (WHO, 2006).

In Malawi the HFM concept was introduced in 2014 on a pilot basis in Chikwawa at Mfera and Dembo food markets using ‘Healthy Settings’ approach under the Scotland Chikwawa Health Initiative (S-CHI) Project. The S-CHI is an ongoing Health Project which is supported by the

Scottish Government. It is led by the University of Strathclyde, Department of Civil and Environmental Engineering in partnership with the University of Malawi (The Polytechnic), Ministry of Health and the Chikwawa District Health Office (Morse, 2014a).

The S-CHI initiated the 'Health Settings' approach to develop improved standards of health services, water, sanitation and hygiene within communities from 2013 to 2016. It was targeted at developing model communities and integrating these principles into the associated public structures like schools, markets and health facilities. The safety and hygiene of markets was a key component of healthy settings approach under pilot in the HFM concept at Mfera and Dembo Markets. The intention of the S-CHI HFM project was to help in the improvement of the two pilot food markets in Malawi by applying the WHO concept of Healthy Food Markets (Morse, 2014a).

1.2 Statement of the problem

According to a study conducted by Morse (2014b), most of the local markets in Malawi lack basic food safety, hygiene and sanitation amenities. As such the likelihood of poor food safety, poor sanitation and food contamination is very high. When the S-CHI project initiated the pilot HFM at Mfera and Dembo in Chikwawa in 2014, a situation analysis was done in both markets which indicated lack of comprehensive knowledge of food handlers in food safety and hygiene. The report also showed poor market hygiene and sanitation. The only two toilets available then at Dembo were dilapidated and full rendering them unhygienic. There were no waste bins and with a full waste disposal pit. The market committees were inactive with poor participation and coordination of stakeholders like the market committee, the District Health Office, the District Council in market development activities (Morse, 2014b). In response to this, market committees were revamped and a comprehensive food safety, hygiene, sanitation and market management training of market committees and vendors was conducted in the same year 2014 with support from the SCHI project.

At the end of the training, action plans unfolding several interventions were laid down to ensure the provision of safe food to consumers from the food markets. The activities were to be implemented with the involvement of all concerned stakeholders in planning, implementation, monitoring and supervision of all food safety, hygiene and sanitation measures in the two food markets (Chidziwitsano and Ching'anda 2014). The interventions in the pilot HFM were done to empower vendors, market committees and all stakeholders to ensure basic food safety, hygiene and sanitation standards in the two pilot HFM of Mfera and Dembo (Morse, 2014b).

It is against this background that the current study was carried out to assess the impact of food safety, hygiene and sanitation interventions at Dembo Market, a pilot HFM using the HFM concept.

1.3 Research Questions

The study responded to the following questions:

- i. What is the level of hygiene and sanitation in Chikwawa food markets?
- ii. What is the participation level of stakeholders in food safety and hygiene in Chikwawa food markets?
- iii. What is the level of knowledge and practices of food handlers in food safety and hygiene in Chikwawa food markets?

1.4 Objectives of the study

1.4.1 Broad Objective

The broad objective of the study was to ascertain the impact of HFM concept interventions in promoting food safety, hygiene and sanitation at Dembo and Bereu Rural markets in Chikwawa District.

1.4.2 Specific Objectives

Specific objectives of the study were to:

- i. Establish the status of food safety, hygiene and sanitation in Chikwawa food markets.
- ii. Investigate the degree of participation of stakeholders i.e. market committee members, vendors, community, local leaders and extension workers in food safety and hygiene issues in Chikwawa food markets.
- iii. Assess the knowledge and practices on food safety and hygiene among food handles in Chikwawa food markets.

1.5 Significance of the study

It is worth noting that the results of this study will help in providing valuable information which will contribute towards improvement in food safety, hygiene and sanitation in food markets. The study will highlight the areas requiring technical, managerial and operational support in the safety of food and participation of different stakeholders like Government, Non-Governmental

Organizations and individuals in the running of the market to ensure provision of safe food to consumers.

Furthermore, the results will help to inform the process and toolkit used by S-CHI to improve the status of food safety in markets with HFM interventions. The results will also provide information and guidance to policy makers and stakeholders for the scaling up of the HFM concept in Malawi. It is also expected that this study will lead to the accomplishment of the 2030 sustainable development goals numbers 2 and 3 aimed at improving access to safe and nutritious food and ensuring healthy lives and promote well-being for all at all ages (WHO, 2016).

This first chapter has provided a background of the HFM concept, how it started giving reasons why it started and areas it was introduced. It also explains how and where the HFM concept was piloted in Malawi. The next chapter will describe the literature that is related to the research study.

CHAPTER TWO

LITERATURE REVIEW

2.1 A Food Market

A market is said to be a place where organized groups of three or more vendors gather on regular basis in common location to sell products to which they are directly responsible (Nova Scotia, 2015).

According to Rockefeller Foundation (2013) a food market is defined as the economic activity around the purchase and sale of food. This is part of the larger system which includes; agricultural inputs, production through processing to consumption. For the purpose of this study a food market is a facility or location in which food is processed, served, sold, offered for sale, dispensed, displayed, stored or distributed, but does not include a dwelling except a dwelling used for commercial food production (Nova Scotia, 2015).

Food markets are important sources of affordable food for millions of people. These markets vary significantly between countries, regions or areas depending on the local culture, socioeconomic conditions, food varieties and dietary preferences. However, all food markets should have one major thing in common in that “they should provide the community with safe and nutritious food” (WHO, 2006)

2.2 Food Safety in Markets

Food safety is a measure of the risk to health and well-being posed by handling and consuming agricultural products or prepared foods purchased at a food market.

Food markets offer a diversity of foods ranging from meat, poultry, fish, eggs and dairy products, including processed and semi-processed foods. In most local markets, live animals such as goats, pigs, cattle and chicken which are often slaughtered and dressed in the market or at home are also sold. Food markets also offer a wide range of street-vended foods like fried meat, doughnuts, bread and scones, which are an important source of ready-to-eat (RTE) foods that are accessible and affordable for even the lowest income earning members of the community. Therefore, food markets are essential places for sustaining the health and nutritional status of urban populations especially in developing countries (WHO, 2006). Thus, food safety needs to be a priority in all food markets as it serves an important role to the general population in an area.

According to WHO (2006), food markets have been linked with some of the common global illnesses like cholera, influenza, food borne and diarrheal diseases. One of the important causes of morbidity and mortality worldwide are food borne diseases. The global burden of food borne diseases in 2010 was 33 million Healthy life years lost daily with about 600 million food borne illnesses and 420,000 deaths, of which 230,000 deaths were due to diarrheal diseases, the most frequent cause of food borne illnesses. Africa stands out, as having the highest burden per population of food borne diseases. In Sub-Saharan Africa, food safety still remains a major issue that has been exacerbated by the peoples' ignorance on the importance of food safety and hygiene. Uncoordinated approach to food safety control influences the risks associated with food production, storage and distribution and therefore has placed greater responsibility on food vendors to ensure the safety of food that they prepare for public consumption WHO (2006)

Food borne diseases outbreak have economic effects on both an individual and the nation at large. Huge amount of money may be lost due to reduced productivity and expenditures on medical care. In some cases, costs for investigating and controlling outbreaks can be significant. Large quantities of food may need to be destroyed resulting to significant economic losses especially important to developing countries. In markets, loss of business from both traders and consumers will result from unhygienic food service and handling practices, unclean and poorly managed facilities. All these losses are undesirable because they are avoidable by improving food safety with basic investments in training and infrastructure. Globally, the incidence of foodborne diseases is increasing and international trade and economy is disrupted by frequent disputes over food safety and quality requirements (FAO/WHO, 2001).

2.3 Healthy Food Markets

According to WHO (2006), healthy food can be defined as products that are purchased for desired health benefits. As explained earlier, a Healthy Food Market is a setting in which all stakeholders collaborate to provide safe and nutritious food to the community. This is particularly important for developing countries as they seek to achieve improved food safety, quality and nutrition

For the success of a healthy food market, WHO stipulates that all stakeholders, including local authorities, market managers, market committees, suppliers, vendors, food market workers and consumers themselves must share a common vision of promoting a food market that continuously seeks to provide safe food to better serve the health and well-being of the community (WHO, 2006). Combining their resources, all stakeholders should work together to implement incremental

changes to improve food safety in the market. Thus a HFM is not an end in itself, but a mutually beneficial process serving the interests of all stakeholders, especially food vendors and consumers in ensuring food safety.

Adewole (2009) states that food safety in markets is often not up to date. Hygiene and sanitation services and facilities in markets are often times very poor. Market cleaning services provided by the public sector are commonly inadequate and not even available. Water services like borehole or taps often do not exist or if available suffer from serious management problems. If sanitary facilities like toilets, water sources are present, they are overpopulated, expensive or do not work properly and consequently suffer from poor hygienic conditions. In most of the markets, sanitation facilities are informally managed by traders, as such food safety is not considered as a priority and it is compromised.

In food markets, water as a resource has different uses like drinking, cleaning equipment and food items and this resource should be potable. To ensure that it meets the recommended guidelines, it should be sampled from time to time for laboratory analysis to check for fecal and pathogen contamination (WHO, 2002).

Food may be contaminated by polluted water, insects e.g. flies, rodents and pets, unclean utensils, dust and dirt (Gudeta, 2007). Equipment and containers that come into contact with food should be designed to enable easy cleaning and disinfection. The materials used for making the equipment should not have a toxic effect on food. Adequate facilities should be made available for the different core functions in food handling. The area where food is prepared, stored or served should be kept clean to prevent contamination. All food stalls and containers and other equipment should be also constructed in a manner that enables easy cleaning and be kept in good repair (Muinde and Kuria , 2005) Raw foods should be well separated from ready to eat and cooked foods, with intermediate cleaning or disinfection where ever applicable. Poorly cleaned utensils and equipment surfaces leads to further spread of pathogens. Equipment and utensils used in food handling need to be cleaned with dishwashing liquid followed by disinfection (Dun-Dery & Addo, 2016).

A greater number of Malawian markets have inadequate basic sanitation services. This increases the chances of food contamination in the markets. In the country, most food and water contamination prevention interventions concentrate more in the home but contamination can

basically occur anywhere along the food chain. In this case markets also are equally important as homes for food safety intervention programs (Morse, 2014a).

As hygiene and sanitation issues in markets become more pressing, Adekunle (2016) indicate that new waste management methods have been continually introduced over time including source reduction, segregation, recycling, composting, energy recovery and landfill. When these methods are combined properly, they can effectively manage solid waste; enhance food safety while protecting human health as well as the environment.

Adewole (2009) examined the major effects of waste management on the quality of life in two perspectives such as environmental and health effect. The major environmental effects include air pollution and waste pollution, while the health effects include flies which carry germs, mosquitoes that breed in stagnant water in blocked drains which cause malaria, rat's spreading typhus, salmonella, leptospirosis and other diseases. Unhealthy markets provide such environments which lead to food contamination thereby putting lives of market users in jeopardy.

2.4 Healthy Food Market Guiding Principles

Three basic principles buttress the concept of a Healthy Food Market: the provision of safe and nutritious food; the promotion of food safety from production to consumption; and the improvement of partnership between traders, consumers, Government and other development partners (WHO, 2006).

2.4.1 Provision of Safe Food

Healthy Food Markets have the crucial function of providing consumers with safe and nutritious food. This is the most important fundamental principle of a HFM in addition to environmental and occupational health issues. Food contamination may occur at any point of production and distribution along the farm to plate continuum. Food may be contaminated and become unsafe before it enters the market; when at the market safe food may be contaminated and become unsafe after it leaves the food market. Since hazards in food can arise at different points in the food-chain, coordinated efforts are essential in ensuring supply of safe food to consumers. (WHO 2006)

Food hazards associated with raw food are most often introduced during production, harvest and storage and even during transportation to the markets. Individual responsibility for the safe handling of food in the home and for choosing safe food at the community food markets is crucial

in reducing the incidence of foodborne diseases. Food safety control then is a responsibility shared by all components in the food supply chain to ensure the supply of safe food to the consumer. But unfortunately, a large proportion of food borne diseases are caused by improperly prepared and mishandled food by food vendors and also food handlers. The challenge being that these food handlers lack understanding of their roles in ensuring proper personal and environmental hygiene accompanied with the basic food hygienic practices when handling food (WHO 2006)

2.4.2 Promotion of food safety from production to consumption

According to Mustaffa, Rahman, Hassim & Ngadi (2017) improper handling of food has been found as the major cause of food borne illness. In general, food handlers should pay serious attention towards food hygiene and safety in order to avoid foodborne disease. WHO, (2006) explains that reasons for inappropriate food handling include: i) lack of knowledge concerning food borne diseases, their causes, symptoms and implications; ii) lack of perception of the extent of the threat or risk; and iii) lack of knowledge about how to change behavior. These barriers can be addressed by providing education about food borne diseases, their causes, health effects and impact on human and public development and methods of avoiding such issues.

Provision of food safety information, education and communication should be emphasized to different stakeholders to help them make informed decisions on food safety (Mwamakamba, Mensa, Kwakye-Takyiwa, Darkwah-Ordame, Jallow & Maiga, 2012).

Food safety and good food handling practices are often neglected by food handlers. (Seaman and Eves, 2010). Poor environmental sanitation, insufficient safe water supply and unhygienic food handling practices are also some of the factors that affect food safety and quality. This starts from handling of utensils, handling of raw foods, food covering and regular hand washing. The role of the food handlers especially the food vendors in effectively reducing the risk of food borne diseases is critically important as they are in direct contact with the consumers and also, they are the least challenging in terms of implementing food safety control measures (Dun-Dery & Addo, 2016)

FAO/WHO (2001) says that in Malawi, one of the challenges reported in the implementation of food safety and hygiene programs is the inadequate awareness among the communities on the dangers of food hazards and unsafe foods. Limited coordination among the stakeholders involved in food safety and hygiene programs means that the public do not get consistent messages and information on food safety.

2.4.3 Improvement of partnerships among stakeholders

For the success of HFM concept, WHO (2006) has stressed that this concept should be carried out in a participatory mode. It further states that HFM project should act to mobilize and empower the market and its community to create a Healthy Food Market, which serves its needs and is sustainable (WHO, 2006). It further stipulates that for the realization of a HFM, all stakeholders, including local authorities, market managers, market committees, suppliers, vendors, food market workers and consumers themselves must share a common vision of promoting food market that continuously seeks to provide safe food to better serve the health and well-being of the community. In Malawi, according to FAO /WHO (2001) there are wide variations in the expertise for food safety and hygiene service provision different stakeholders. The available numbers of staff and their areas of specialization are reported to be inadequate to perform the required tasks in food markets to ensure food safety and food quality control.

Partnership among all stakeholders should be encouraged and where possible, active involvement in the HFM project should be sought. Guaranteeing food safety all along the food chain requires partnerships and education among all stakeholders. Empowerment and participation of stakeholders on sound knowledge of food safety is supreme. Stakeholders should know their discrete role to improving and reducing food-related risks. Combining their resources, all stakeholders should work together to implement incremental changes to improve food safety in the market (Mwamakamba et al. 2012).

Curtis in a project called “Rochinha Project” in Rio de Janeiro, Brazil (as cited by Adekunle 2016) reported that there was a strong element of community involvement in voluntary efforts with local government officials in their action for environmental health projects, like rubbish collection and rebuilding of sewage disposal systems.

Curtis also explains (as cited by Adekunle, 2016) about the “Baldi project” in the slums of Karachi, Pakistan which were designed after the Rochinha model that women coordinated and took voluntary action on sanitation by constructing soak-pit latrines. Curtis further states (as cited by Adekunle, 2016) that in Tegicugalpa, Honduras, a group of local women petitioned for construction of sand-pipes in their neighbourhood and organized supervision of water supply points and maintenance of their sites. All this was being done to ensure efficient sanitation and hygiene for the safety of food in their markets.

Based on the literature reviewed, it is shown that food may be contaminated right from the source, during transportation, storage, display and handling by food vendors, handlers and customers. Literature suggested that if the HFM concept is implemented effectively, may help to promote provision of safe food to consumers in food markets. It is therefore imperative to explore the effects of the interventions in the food markets under the HFM concept in the pilot HFM of Dembo in Chikwawa in order to allow for a better understanding of their effect in relation to Food Safety. The next chapter describes the methodology used in exploring the effects of the HFM interventions.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter defines the research methodology used during the study. It includes the study design chosen; the study area and study population; sampling; data collection techniques and tools used; data analysis; ethical consideration, study limitations and dissemination of study results.

3.2 Study design

The study used an evaluative study design. This design was chosen as the researcher anticipated giving details of the effect of the HFM concept in the promotion of food safety. This was to be obtained from different respondents, relationships of variables, making predictions for the development of conclusion.

3.3 Study area and study population

Chikwawa District has a total land area of four thousand seven hundred and fifty- five (4,755) square kilometers. It has a total population of 434,648 of which 219,050 are females (50.39%) and 215,598 are males (49.61%). There are two main ethnic groups in the District and these are; Mang'anja and Sena. Other minority tribes include the Nyanjas, Chewas, Ngonis and Nyungwes (National Statistical Office, 2016). The main source of livelihood in Chikwawa is Agriculture with maize, rice and sorghum being the main food crops and cotton as the main cash crop. Livestock raised include like chicken, goats, cattle and pigs with fish as the main source of protein (Chikwawa District Council, 2011).

Chikwawa District has a total of thirty registered markets with only twelve as established markets while the other eighteen are just make up markets. Established markets are under the control of the District Council and are allocated staff like Market Master and Market Cleaner to manage them. This study was conducted in two markets of Dembo and Bereu. Dembo is an established market and this dictated taking only one established market of Bereu as a control. Dembo market is located in Traditional Authority Katunga within the catchment area of Mfera Health Facility with a total population of 17,374 (48%). It is along Thabwa – Makhanga road, 15 kilometers from Chikwawa District Headquarters and 5 kilometers from Thabwa. Bereu market is in Traditional Authority Maseya within Bereu Health Facility catchment area with a total population of 18,506 (52%). It is

along the Blantyre-Nsanje road 10 kilometers south of Chikwawa District Headquarters. (Chikwawa District Council, 2011). (Figure 1)

The targeted population during this study was 35,880 people, with Dembo (17,374) and Bereu (18,506) respectively. This comprised of vendors, community leaders, extension workers and heads of Government Departments and Non-Governmental Organizations.

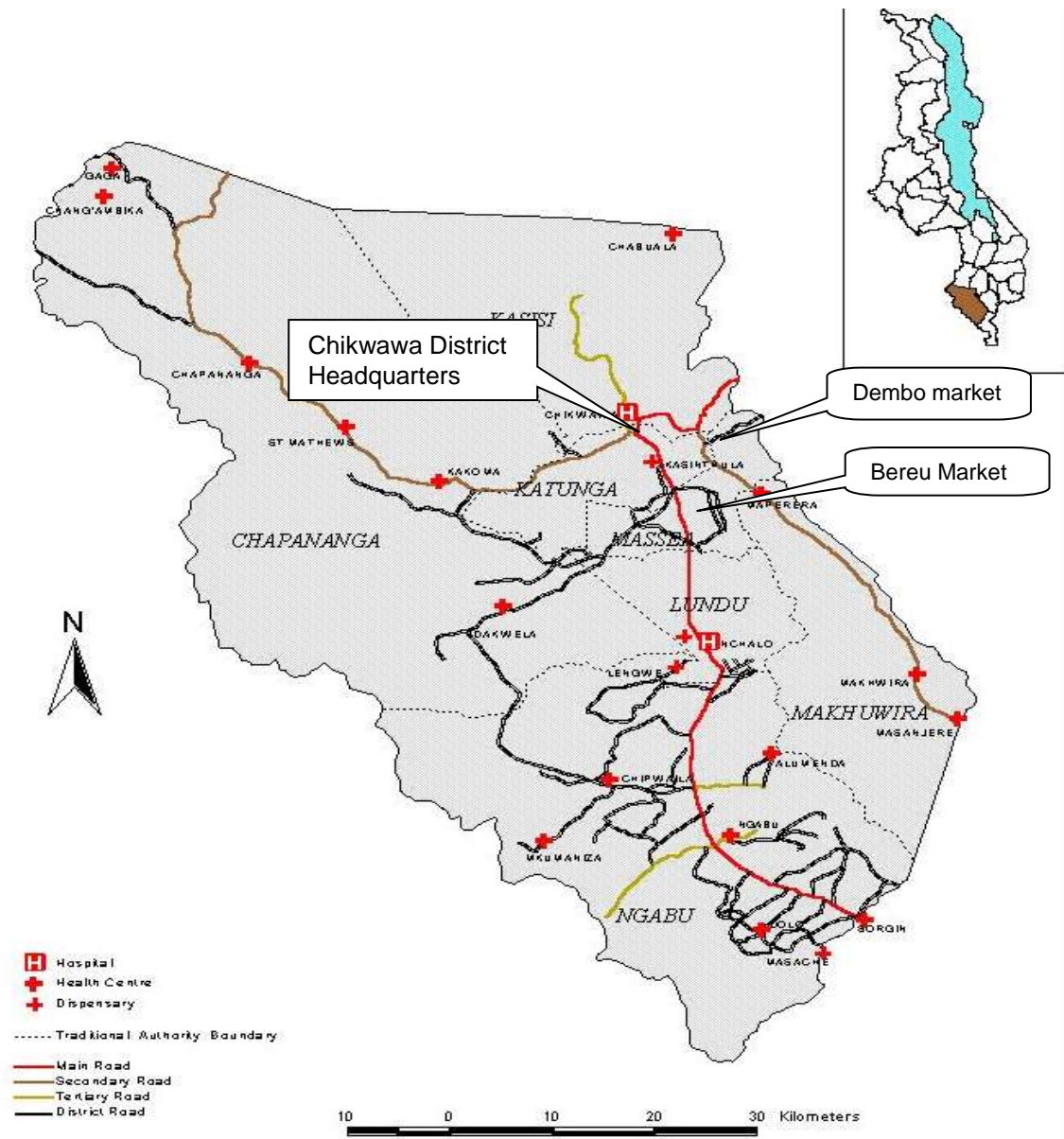


Figure 1. Map of Chikwawa District Showing location of Bereu and Dembo Markets (Source: Chikwawa District Council, 2011)

3.4 Sampling

3.4.1 Sample size and sampling procedure.

For this study, the targeted sample size was 652 study units sampled from a population of 2389 people (Dembo = 1281, Bereu = 1588). These study units comprised of 142 vendors and 510 customers. Of the 142 vendors, 53 were mobile vendors while 89 were permanent vendors. (Table 1). Sample size for permanent vendors, mobile vendors and customers was calculated using the Yamane formula (1967) at 95% Confidence interval (CI) with 0.05 precision levels as shown in Appendix 1. Seven Heads of Departments from Health, Agriculture, Water and Community Development, District Council (Finance), Public Works and Trade with fourteen extension workers, seven from each market also involved in the study. The Departments were selected using convenient sampling considering that they are the main Departments that work with the markets in Chikwawa.

Table 1: Total Number of Study Units

Respondent / Market	Bereu	Dembo	Total
Mobile vendor	40	13	53
Permanent vendor	61	28	89
Customers	264	246	510
Total	365	287	652

Out of the two pilot HFM where interventions were initiated (Mfera and Dembo), only Dembo was studied since it was an established market in the district while Mfera was just a small make up market at Mfera Health Facility but registered. Bereu Market was identified using systematic random sampling as a control market because it was located outside the S-CHI project area hence avoiding information diffusion from the HFM intervention market. The names of registered established markets outside the S-CHI were written on pieces of paper, folded and Bereu was randomly picked as a control market.

From each market a sampling frame of all permanent vendors was prepared. Systematic random sampling was used to select the 89 permanent vendors as respondents. All names of permanent vendors were written down. From the sampling frame using an interval of seven, a total of thirteen permanent vendors were left out. Convenient sampling was also used to sample mobile vendors

and customers considering that they were not stationed at the market. Key informants comprising of extension workers, councilors, market masters and heads of Government and Non-Governmental Organizations were sampled using purposive sampling. Each market has a market committee and a Village Development Committee (VDC) responsible for the market. These two committee composed of 10 members each were conveniently selected for Focus group discussions at each market.

3.4.2 Inclusion and exclusion criteria

All people coming from the catchment area of the two markets were involved in the study except visitors. Children less than five years were also excluded as they could not be able to give an informed decision at their age. Vendors and customers visiting the market for the first time were also excluded.

3.4.3 Data collection strategies and tools

Data collection was conducted from 14th to 26th July, 2016. Primary data was collected using Focus Group Discussions (FGD), Key Informant Interviews (KII), survey questionnaires and observation (using a checklist). Secondary data was collected through extensive literature review by searching on the internet, relevant records, reports, books, journals and papers presented in both international and local workshops and seminars.

Survey questionnaires were developed using information from questionnaires used in other documented studies on the formal sector as well as general information in the literature review. To ensure proper translation of the questionnaires by the interviewers, the survey questionnaires were translated in Chichewa which is a common language spoken in the study area. For key informants, the questionnaire was in English as they were able to speak and understand the language.

The questionnaire was divided into five sections which included general information such as type of food and food products sold in the markets, availability and accessibility of hygiene and sanitation facilities, participation of different stakeholders in market food safety and hygiene activities, knowledge and practices of food handlers on food safety and hygiene conditions in the markets. Permanent vendors were interviewed at their stalls while mobile vendors were interviewed upon entry or coming out of the market.

To ensure validity and reliability of the data, the data collection tools were further reviewed by the Environmental Health Department experts at University of Malawi, the Polytechnic. To further assess the applicability and understanding of the tool to the local setting, pre-testing was carried out. The pre-testing was conducted with ten randomly selected vendors, ten customers and two key informants at Thabwa Food Market located at Chikwawa District Headquarters. Slight amendments were made to some of the questions for clarity and improved understanding.

Customers and traders, both permanent and mobile were interviewed face to face using trained interviewers with a standard questionnaire (Appendix 3). The questionnaire was uploaded in Android phones using software called *Magpi*. Responses were recorded directly in the phones and uploaded on website for further processing and analysis using Excel and Statistical Package for Social Scientists (SPSS) PASW Statistics (18) computer packages.

Key Informant Interviews (KII) were conducted using a self-administered questionnaire which was in English (Appendix 4). Information was collected from Heads of Departments, Extension workers and ward councilors. All the interviewees were conversant with English and were able to understand the questions without problems. Key informants were given the questionnaires and were collected within the data collection period.

A total of four focus group discussions (FGD) were conducted by the researcher and the Disease Control Assistant was the one who was recording the discussions. At each market there were two FGDs, one with market committee members and another one with local leaders combined with Village Development Committee (VDC) members around the markets. A focus group discussion guide was used to give direction to the discussions (Appendix 5).

Complete participant observations were done by the researcher to collect data on hygiene and environmental sanitation practices related to food safety and hygiene using an observation checklist (Appendix 6). This data collection technique was employed because practices are sometimes related to the culture of the society (Saunders, 2011). The researcher collected data on availability of tools, equipment and condition of sanitation facilities. Thirty one food safety and hygiene critical elements were listed on the observation checklist.

The major limitation with participant observation is that they are regarded as being subjective. This problem was addressed by use of FGDs which helped to support the observations as some of the elements observed were also discussed during FGDs.

3.5 Data organization and analysis

Preceding data collection, data from KII interviews and questionnaires were checked by the principal investigator. Data from android phones (*Magpi*) was uploaded and saved as an Excel spreadsheet that was exported to Statistical Package for Social Scientists (SPSS) 18 for analysis. Data cleaning was done to ensure data quality that may result from possible capturing errors.

Focus group discussion data from checklist was grouped and tabulated according to variables and thematic areas. Observational data from checklist was categorized or coded to facilitate statistical analysis after being entered into excel. All numerical data was analyzed using descriptive statistics while categorical data was analyzed using frequencies. The significance of relationship ($p < 0.05$) and Confidence interval (CI) of 95% to test the difference between proportions was used. Chi-Square test and Independent Paired t-test was used to test whether groups were significantly different while correlation was used to assess the strength of relationships between variables.

3.6 Ethical considerations

Permission to conduct the research was sought from the District Commissioner (Appendix 2). Before conducting an interview to an individual, the interviewer explained the objectives and methodology employed in the study to the participants and only those respondents who voluntarily agreed to be interviewed were involved. Written informed consent was obtained from the key informants and FGDs prior to the commencement of the study. To ensure confidentiality, participant's personal information details were not included on the questions used during the interview and the interviewer assured the respondents that their responses were confidential.

3.7 Dissemination of research findings.

Findings and recommendations made from this study were shared with all those who patronized the market like local leaders, traders, market committee, Government departments, S-CHI Project and all other concerned stakeholders.

3.8 Study Limitations

The study focused on two markets throughout the country in the same geographical location, socio-economic and cultural setting in Chikwawa district. As such conclusions drawn from the study may not be representative or applied to other districts since this research only took place in markets of Chikwawa district.

The other limitation was that there were no correct records of permanent vendors in the markets. Poor record keeping in the council's office resulted in having no correct records on the total number of permanent vendors in the markets. To do away with this limitation; the Disease Control Assistant with support of Market Master responsible for each market did a physical count of all permanent vendors prior to the study since they were conversant with the markets.

This chapter highlights the research methodology used for this study. The study used an evaluative design. The study population were market users like customers, vendors and stakeholders like extension workers, community leaders and heads of departments. Data was collected through surveys questionnaires, key informant interviews, focus group discussions and observations. Chapter four discusses in detail the results obtained after data collection.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents and discusses the main results of the study and briefly compares the findings of the current study with published literature. The results attempted to provide information on the level of food safety, hygiene and sanitation in food markets. Additionally, it aimed at establishing the degree of participation of different stakeholders in food safety and hygiene services in food markets and the level of knowledge and practices of market committees, vendors, community, local leaders and extension workers in food safety promotion in food markets of Bereu and Dembo in Chikwawa.

4.2 Description of the Respondents

Data from the targeted of 652 respondents was collected but 76 questionnaires (62 customers and 14 vendors) failed to upload from offline to online *magpie* indicating a 13.19% failure rate. A total of 285 (49.5%) questionnaires from Dembo and 291 (50.5%) questionnaires from Bereu market were successfully uploaded. A greater number of the respondents 448 (77.87%) were customers. At Bereu, the majority of the respondents were females 179 (54.2%) while at Dembo it was the opposite, the majority were males 134 (54.5%). Considering age, a large number of respondents (43.1%) were of the age range of 15 – 24 years (Table 2)

Table 2. Demographic profile of study units.

Characteristics		Bereu Market	Dembo Market	Total
Respondent	Customer	202 (69.4%)	246 (86.3%)	448 (77.8%)
	Mobile Vendor	36 (12.4%)	13 (4.6%)	49 (8.5%)
	Permanent Vendor	53 (18.1%)	26 (9.1%)	79 (13.7%)
	Total	291 (50.5%)	285 (49.5%)	576 (100%)
Sex	Male	112 (45.5%)	134 (54.5%)	246 (42.7%)
	Female	179 (54.2%)	151 (45.8%)	330 (57.3%)
	Total	291 (50.52%)	285 (49.5%)	576 (100%)
Age Range (Years)	5 – 14	14 (4.8%)	7 (2.5%)	21 (3.7%)
	15 – 24	122 (41.9%)	126 (44.2%)	248 (43.1%)
	25 – 34	119 (40.9%)	109 (38.2%)	228 (39.6%)
	35 and above	36 (12.4%)	43 (15.1%)	79 (13.7%)
	Total	291 (50.52%)	285 (49.5%)	576 (100%)

4.3 Hygiene and Sanitation situations in food markets

4.3.1 Availability and use of hygiene and sanitation facilities in the markets

4.3.1.1 Availability of waste bins or baskets

Table 3 shows that the majority of the respondents at Dembo, 276 (96.8%) indicated availability of waste bins compared to about one third of respondents at Bereu, 107 (36.8%) who indicated availability of waste bins in their markets and this was statistically significant ($p=0.001$). At Dembo all mobile and permanent vendors (100%) and the majority of customers (96.3%) indicated the presence of waste bins at the market. At Bereu, the majority of customers, close to half (45.5%) with about quarter of permanent vendors (28.3%) with very few mobile vendors (5.6%) indicated the presence of waste bins. This shows that Dembo market is likely to have waste bins as compared to Bereu Market. This may be because of the FSH training that was provided with support from the S-CHI project to market committee members and food vendors.

Table 3. Availability of waste bins/baskets in the markets.

Variable	Bereu Market				Dembo market				Total
Have Waste Bins	Customer	Permanent Vendor	Mobile Vendor	Total	Customer	Permanent Vendor	Mobile Vendor	Total	
Yes	90 45.50%	15 28.30%	2 5.60%	107 36.80%	237 96.3%	26 100%	13 100%	276 96.8%	383
No	112 55.40%	38 71.70%	34 94.40%	184 63.20%	9 3.7%	0 0%	0 0%	9 3.20%	193
Total	202 100%	53 100%	36 100%	291 50.50%	246 100%	26 100%	13 100%	285 100%	576

On quantity of waste bins available in the markets, the majority of respondents at Dembo (88.5%) indicated that there were 5 to 8 bins while at Bereu the majority (85.0%) indicated availability of only 1 to 2 bins. During focus group discussion and observations, it was discovered that there were 8 bins at Dembo market and only one waste bin at Bereu Market. It was also observed at Dembo market that waste was not properly disposed as some waste was seen around some waste bins.

Shortage of waste bins at Bereu made people from the market throw waste anywhere in the market i.e. in open drains (27.6%) open spaces (29.9%) and along the road (26.4%) (Fig 2) as reported by almost one third (30 ± 3 %) of all types of respondents.



Figure 2. Waste thrown anyhow at Bereu Market

Poor sanitary conditions affect food quality as explained by Obuobie, Keraita, Amoah, Cofie, Raschid-Sally, and Drechsel (2006). Poor sanitation and unhygienic conditions in the market threaten the safety of ready to eat food (King, 2013)

The support from SCHI has helped Dembo market to have waste bins which have never been there before. A total of 8 bins were in use at Dembo market at the time of the research. This was different with Bereu as they once had waste bins but were vandalized and were never replaced as indicated by the majority (66.7%) of the respondents.

Waste bins play an important role in waste management in markets as they prevent scattering of waste and harboring of disease vectors, pathogens and also acting as nuisance. This affects the safety and hygiene of food in the markets thereby allowing spread of food borne diseases and sanitation related infections (Clayton, Griffin, Price, Peters, 2002)

4.3.1.2 Reasons for not having waste bin or basket in markets

The respondents who indicated unavailability of waste bins in the markets were asked to explain the reasons for not having waste bins. The main reason given by respondents at Bereu Market 85 (46.2%) was that Chikwawa District Council did not buy the waste bins. Most of the mobile vendors (64.7%) identified this as the main reason followed by customers (43.8%). The other reason given by respondents at Bereu market for not having waste bins was that they were never replaced after being damaged (23.4%) as indicated by the majority of permanent vendors (31.6%).

FGDs results with local leaders and market committees at Bereu concurred with these findings that bins were bought but were never replaced. The Market committee said that Chikwawa District Council sometime back (more than 10 years ago) bought metal waste bins that were never replaced after they were worn out. Local leaders on the other hand, reported that together with the committee once bought a few bamboo baskets using collections from traders but never lasted long (Figure 3). The waste baskets were worn out and were never replaced because traders refused to contribute money for their replacement.



Figure 3. Damaged bamboo waste baskets at Bereu Market.

At Dembo market the main reason for not having waste bins was that they were vandalized (66.7%). The other reason given for not having waste bins was that they had never been replaced (22.2%). However, focus group discussions with local leaders and market committees indicated that the market has never had any waste bins until S-CHI Project through Chikwawa District Council supported them to buy the metal bins that were available at the time of the study.

4.3.1.3 Other waste disposal sites other than the waste bins

Upon further inquiry on other disposal areas other than waste bins at Bereu, it was established that waste was being disposed haphazardly as almost one third of respondents mentioned open drains (29.7%), open spaces (29.9%) and along the road (26.4%) (Table 3). Almost one third (30% ± 3%) of all types of respondents said that waste was being thrown in open drains, along the road and open areas and less than a quarter indicating designated places. This was true with what was observed. There was waste almost everywhere in the market. In some areas, the traders swept their areas and dumped the waste within their vicinity and left for several days without being taken to a disposal pit.

At Dembo on other disposal areas other than waste bins, the issue was different. The majority of the responses given indicated that waste was thrown in open drains 12 (41.4%) and along the road 12 (41.4%). The majority of permanent vendors (55%) indicated open drains while the majority of mobile vendors (60%) indicated throwing waste along the road (Table 4). This was because they conducted their business outside the market along the road as well. However, during observation, it was seen that despite having waste bins in the markets, some waste was not thrown inside the

bin but was scattered around the bins. This shows that people fail to use the bins appropriately and may be due to inadequate knowledge on sanitation, food safety and hygiene.

Table 4. Other areas where market waste is disposed at market other than waste bins

Disposal area	Bereu Market				Dembo Market			
	Customer	Permanent Vendor	Mobile Vendor	Total	Customer	Permanent Vendor	Mobile Vendor	Total
Open drains	74 (27.7%)	36 (33.3%)	19 (31.7%)	129 (29.7%)	3 (30%)	5 (55%)	4 (40%)	12 (41.4%)
Along the road	71 (26.6%)	31 (28.7%)	13 (21.7%)	115 (26.4%)	2 (20.0%)	4 (0%)	6 (60%)	12 (41.4%)
Any open space	79 (29.6%)	31 (28.7%)	20 (33.3%)	130 (29.9%)	4 (40.0%)	0 (0%)	0 (0%)	4 (13.8%)
Designated areas	43 (16.1%)	10 (9.3%)	8 (13.3%)	61 (14.0%)	1 (10%)	0 (0%)	0 (0%)	1 (3.4%)
Total	267 (100%)	108 (100%)	60 (100%)	435 (100%)	10 (100%)	9 (100%)	10 (100%)	29 (100%)

4.3.1.4 Waste separation into different categories during disposal

The respondents were also asked whether they separate waste into different categories like solid waste, liquid waste, degradable and non-degradable waste during disposal. The majority of people 275 (94.5%) at Bereu market do not separate waste during waste disposal while at Dembo slightly above half 164 (57.5%) of the people who patronize the market do not separate waste before disposal. This was statistically significant ($p=0.001$). During observation and focus group discussion it was also realized that segregation of waste was not being done at Dembo despite results indicating 57.5% only 55.5% not segregating waste

Respondents who were not segregating waste at Bereu were mainly mobile vendors (97.2%) with the majority being male respondents (57.1%), followed by customers (95%) which were half males and half females and finally permanent vendors (90.6%) who were mainly females (67.2%). Using Pearson product-moment correlation coefficient, there was a negative correlation between sex and

segregation of waste ($r=-0.036$, $n=291$, $p=0.549$), as well as between the type of respondent and waste segregation ($r=-0.003$, $n=291$, $p=0.963$). This indicates that sex and type of respondent may not affect the behavior of respondents in waste segregation at Bereu.

At Dembo it was similar that waste was not being separated as indicated by the majority of mobile vendors (84.6%) dominated by males (72.7%) followed by customers (78.9%) dominated by males (55%). The least that were not separating waste at Dembo were permanent vendors (56.4%) with majority being males (53.4%). Using Pearson product-moment correlation coefficient, there was a negative correlation between sex and segregation of waste ($r=-0.183$, $n=285$, $p=0.002$) and a weak positive correlation between waste segregation and type of respondent ($r=-0.175$, $n=285$, $p=0.003$). This may indicate that sex may not affect the behavior of respondents in segregating waste but type of respondent may affect waste segregation. This may be because of the FSH training the permanent vendors received from SCHI.

Efforts were made to identify the reasons for not separating the waste during disposal. Nearly half of the respondents at Bereu Market 132(48%) said that they were not separating waste because they felt that there was no need to do so. This was said by the majority of the customers (56.7%) followed by permanent vendors (33.3%). The other reason that was given by the respondents was that there were inadequate bins 105(38.2%). This also came from most of the customers (43.2%) and permanent vendors (29.2%).

At Dembo market the main reason for not separating wastes was that there were inadequate waste bins 122 (74.4%). This was reported by the majority of Permanent vendors (95.5%), mobile vendors (72.7%) and customers (71.4%)

4.3.1.5 Waste bin covering and emptying of waste to waste disposal pit

The respondents who indicated the presence of bins in markets were asked to explain whether the bins were being covered and emptied when necessary. Table 5 shows that the waste bins were being covered in both markets as indicated by the majority of respondents of Dembo market 259 (93.8%) and Bereu 96(89.7%) and this finding was statistically significant ($p=0.001$). The majority of customers confirmed this in both markets of Dembo (96.6%) and Bereu (88.9%) followed by Permanent vendors (Dembo 88.5%, Bereu 99.3%), showing that the bins were being covered.

It was also shown that the bins in both markets were being emptied when necessary as indicated by the majority of the respondents at Dembo 267 (96.7%) and Bereu 104 (97.2%) and this was statically significant ($p=0.001$). Almost all customers in both markets Dembo (99.1%) and Bereu (100%) and the majority of permanent vendors, Dembo (96.2%) and Bereu (86.7%) indicated that bins were being emptied. Results from FGD and observations showed that the only waste bin at Bereu was not being covered, always full and not frequently emptied. An observation showed that the wastes that were in the bin had stayed for several days without being emptied to a disposal pit.

Waste bins from the markets require covering and emptying immediately when they are full. This prevents multiplication of vectors, rodents, pathogens and production of foul smell which have a negative impact on food safety and hygiene in the markets (Adewole, 2009).

Table 5. Waste bin covering and emptying practice in markets

Type of Respondent	Response	<u>Waste Bin Covering</u>				<u>Waste Bin Emptying</u>			
		Bereu		Dembo		Bereu		Dembo	
		Freq	%	Freq	%	Freq	%	Freq	%
Customer	Yes	80	88.9	229	96.6	90	100.0	235	99.1
	No	10	11.1	8	3.4	0	.0	2	.8
	Total	90	100.0	237	100.0	90	100.0	237	100.0
Permanent Vendor	Yes	14	93.3	23	88.5	13	86.7	25	96.2
	No	1	6.7	3	11.5	2	13.3	1	3.8
	Total	15	100.0	26	100.0	15	100.0	26	100.0
Mobile Vendor	Yes	2	100.0	7	53.8	1	50.0	7	53.8
	No	0	.0	6	46.2	1	50.0	6	46.2
	Total	2	100.0	13	100.0	2	100.0	13	100
Total	Yes	96	89.7	259	93.8	104	97.2	267	96.7
	No	11	10.3	17	6.2	3	2.8	9	3.3

On responsibility of emptying the waste bins, majority of the respondents, Dembo 84 (93.6%) and Bereu 270 (96.8%) indicated that waste bins were being emptied by council market cleaners. It was encouraging to note that the waste bins were being emptied daily (Bereu 74.0%, Dembo

76.0%) by the market cleaner (Bereu 84.6%, Dembo 96.8%). At Bereu, what was observed and what came out during FGDs was different. It was observed and explained during FGDs that full waste bins were staying for several days before being emptied.

Talking about availability of waste disposal pits, a greater number of respondents at Bereu 268 (92.1%) and Dembo 270 (94.8%) said that disposal pits were available in the markets. It was encouraging to note that the waste disposal pits were not just available, but were also being used. This was indicated by 91 (87.5%) and 243 (87.1%) of respondents from Dembo and Bereu respectively who said that the wastes from the bins were being emptied into the available waste disposal pits. This finding was not statistically significant ($p=0.202$). An observation by the researcher confirmed the presence of waste disposal pits. Waste was also seen in the waste disposal pit but actual observation of waste being carried to disposal pit was not done at Dembo.

These waste disposal pits are located within a distance of not more than 200 meters from the markets as reported by 257(88.3%) and 238(83.5%) respondents from Bereu and Dembo respectively. The waste disposal pits in both markets are not properly located as they are very close to the market within a distance of less than 200 meters. It was worrisome to note that at Dembo, the Disposal pit is located adjacent to a restaurant whose proprietor is a member of the Market Committee and very close to dwelling houses adjacent to the market. At Bereu it is located adjacent to the market toilets across the main road. This is undesirable as foul smell, scavengers and wind may blow the wastes back to the market thereby exposing food to contaminants making it unsafe for human consumption (Adewole, 2009).

It was revealed during FGD that there is inadequate space for market expansion and place to dig a waste disposal pit in both markets. For instance, there is no space to construct a slaughtering place for animals at Dembo. One of the local leaders had this to say during FGD:

“The market does not have space for a slaughtering place for animals. Currently we use a piece of land located around people’s houses. This is not safe as animal dung and other wastes are piling up and are a nuisance and poses danger especially to our children”

The researcher visited the slaughter place, located some 500m meters away from the market where animals like goats are slaughtered. It was observed that a lot of dung and dry blood was all over the place not properly disposed. This may provide a breeding ground for vectors like flies that may spread diseases.

4.3.2 Availability and use of market toilets.

4.3.2.1 Availability of toilets

Table 5 below shows that a greater number of respondents from both Bereu 259(89.0%) and Dembo 242(84.9%) disclosed the presence of latrines in the markets. This was not statistically significant ($p=0.145$.)

At Bereu market, most of the respondents who indicated the presence of latrines were a greater proportion of customers (92.6%) with mobile vendors being the least (75.5%). At Dembo it was a greater proportion of permanent vendors (92%) as compared to mobile vendors and customers who had an equal proportion of 84% each (Table 6).

A greater proportion of respondents who knew the presence of latrines at Bereu were females (92.2%) as compared to males (83.9%). At Dembo there was a very small difference on the proportion of females (83.4%) from males (86.6%) who knew the presence of latrines at their market. (Table 6)

Table 6. Availability of toilets in Food Markets

Availability of toilet	<u>Type of Respondent</u>				<u>Sex of Respondent</u>			
	Customer	Permanent Vendor	Mobile Vendor	Total	Male	Female	Total	
Bereu	Yes	187 92.60%	40 75.50%	32 88.90%	259 89.00%	94 83.90%	165 92.20%	259 89.00%
	No	15 7.40%	13 24.50%	4 11.10%	32 11.00%	18 16.10%	14 7.80%	32 11.00%
	Total	202 100%	53 100%	36 100%	291 100%	112 100%	179 100%	291 100%
Dembo	Yes	207 84.10%	24 92.30%	11 84.60%	242 84.90%	116 86.60%	126 83.40%	242 84.90%
	No	39 15.90%	2 7.70%	2 15.40%	43 15.10%	18 13.40%	25 16.60%	43 15.10%
	Total	246 100%	26 100%	13 100%	285 100%	134 100%	151 100%	285 100%

It was encouraging to note that over 75% of respondents in both markets of Bereu and Dembo knew that there were toilets in their markets. This showed that latrines were available in both markets. Latrines play an important role for safe disposal of human excreta for the prevention of diarrhea infections through fecal contaminated food.

On the location of the toilets, in both markets the toilets were at a distance of not more than 30 meters from the markets as indicated by 71.4% % and 63.2%% respondents from Bereu and Dembo markets respectively. At Bereu it was observed that the toilets were located across the tarmac road from Chikwawa to Nsanje very close to shops, making it difficult for people to use them due to traffic and lack of privacy.

Those who indicated that there were no toilets in the markets were further asked to give the reasons. The main reasons given by the respondents at Bereu market were that the council did not build toilets (40.6%) and that the ones that were available were full (37.5%). At Dembo the main reason given by majority (60.9%) of respondents for not having toilets was that those available were also full.

During FGD, it was noted that the toilets at Bereu were built over five years ago by the council and were full but were still being used. At Dembo, there were two toilet structures, a newly constructed latrine and an old full latrine, both locked and not in use. The toilets are located very close to the market and close to dwelling houses, within 10 meters and adjacent to a waste disposal pit. It was learnt from FGDs that the new latrine was built with support from SCHI through the Chikwawa District Council. During FGD, one of the members of the market committee at Dembo had this to say;

“We as market committee members appreciate the efforts made by SCHI to support us with a new latrine. What we want is to make it payable at a small fee for proper care, sanitation and maintenance. The only problem is that this is taking long since keys are still with SCHI Project Officers and people have nowhere to go despite having a finished latrine”

Respondents were asked to state if there were separate male and female rooms. It was realised that in both markets male and female rooms were designated as indicated by the majority of Bereu 164(68.8%) and Dembo 233(90.0%) respondents. It should be noted that this finding was not

statistically significant ($p=0.147$). There were only very few squatter holes in both markets. Respondents indicated that Dembo had only one to two (57.9%) while Bereu had three to four (67.4%) squatter holes.

During observation, it was found that there were four squatter holes at Bereu but not labelled for males and females and without adequate privacy and security. At Dembo market there were two rooms with one squatter hole each nicely designated with satisfactory privacy and security. These were not adequate as supported by Morse (2014b) that most Malawian markets have inadequate sanitation facilities.

4.3.2.2 Use of toilet by those who patronize markets.

Respondents who indicated availability of toilets in the market were further asked whether they themselves use the toilets or not. Table 7 shows that only about half 130 (53.7%) at Dembo claimed using the toilets while at Bereu, slightly above one third 95(36.7%) claimed using the toilets and this was statistically significant ($p=0.003$). Considering use of toilets by type of respondent, at Bereu the trend is the same just slightly above one third of customers (38.0%), permanent vendors (32.2%) and mobile vendors (34.4%) were using three toilets. This was similar with proportion of males (38.3%) and females (35.8%) that were using the toilets as well as different age groups at Bereu. At Dembo, it was slightly over half of the customers 122 (58.9%) claimed to be using the market toilets and this trend was common with all types of respondents.

Table 7. Use of market toilets.

Characteristic of respondent		Bereu		Dembo	
		Yes	No	Yes	No
Type of Respondent	Customer	71(38%)	116(62.0%)	122(58.9%)	85(41.1%)
	Permanent Vendor	13(32.2%)	27(67.5%)	6(25.0%)	18(75.0%)
	Mobile Vendor	11(34.4%)	21(65.6%)	2(18.2%)	9(87.8%)
	Total	95(36.7%)	164(63.3%)	130(53.7%)	112(46.3%)
	Sex of Respondent	Male	36(38.3%)	58(61.2%)	56(48.3%)
	Female	59(35.8%)	106(64.2%)	74(58.7%)	52(41.3%)
	Total	95(36.7%)	164(63.3%)	130(53.7%)	112(46.3%)
Age Group (Years)	6 - 14	8(38.1%)	13(61.9%)	4(57.1%)	3(42.9%)
	15-24	41(41.8%)	57(58.2%)	60(57.7%)	44(42.3%)
	25-39	37(35.6%)	67(64.4%)	47(49%)	49(51%)
	40 and above	9(25%)	27(75%)	19(54.3%)	16(45.7%)
	Total	95(36.7%)	164(63.3%)	130(53.7%)	112(46.3%)

Results from observation and focus group discussions with local leaders and committee members at Dembo indicated that the old toilets were full, closed and locked while new toilets were not yet operational, locked and not yet handed over. As such, permanent vendors were either going home or using the toilets from neighboring households around the market. One of the committee members said this:

“You know, answering a call of nature is anybody’s business, most of the permanent traders like me use the toilets of traders with drinking places or video show rooms around, as the owners of toilets in adjacent houses do not allow people from the market to use their toilets”

Those respondents who indicated that they do not use the market toilets were further asked to give reasons for not using the toilets. The majority said that it was because of poor hygiene (Dembo 46.7%, Bereu 49.4%) and that the toilets were full (Dembo 31.9%, Bereu 32.0%). This was also worrisome to market committee members and community leaders who lamented that the toilets were not cared for. This was very true as it was observed that the toilets at Dembo were producing bad smell despite being closed.

The majority of those who do not use the market toilets from Bereu indicated that they go home to defecate (68.4%) and one third (33.0%) claimed to be using toilets of houses near the market. At Dembo it was the opposite where by the majority (56.4%) were going to toilets present in the houses near the market and nearly one third (29.8%) preferred going home to defecate.

It was worrisome to realize that in both markets, there were some, 10% who were defecating in the open or bush present near the markets. At Bereu, these were mainly 5% of mobile vendors and permanent customers who do this behavior which is very unhealthy and at Dembo there were also nearly 15.4% of mobile vendors.

At the time of the study, toilets at Dembo had doors while at Bereu the toilets had no doors making them fail to provide security and privacy to users. The toilets were also located very close to market in both markets possibly making it impossible for the people to use them since they were shy to enter as explained by a FGD member at Bereu. The bad smell produced due to poor toilet sanitation and fullness of pits render them unusable. This could be the reason why market users at Dembo ended up using video show-room and beer-hall toilets with some of them defecating in the bush both at Bereu and Dembo. Marocchino (2009) explains that most sanitary facilities in markets are often inadequate, overpopulated and with poor hygiene conditions suffering from serious management problems as was the case with the full latrines in both markets of Bereu and Dembo. The toilets were supposed to provide security and privacy that will encourage users to feel free to use them. Otherwise people are forced to use the bush thereby necessitating food contamination by feces.

4.3.2.3 Management of toilets

On management of the toilets, the majority 215(72.9%) of the respondents from Bereu and around half of respondents from Dembo Market 138(51.9%) said that the District Council through the

Market Master and Market Cleaner were taking care of the toilets. The market committee was also said to take some care of the toilets as indicated by 25% and 27.4% of respondents from Bereu and Dembo. It was also surprising to note that one fifth of respondents from Dembo (20.7%) said that the market toilets were being managed by a private individual.

During Market committee focus group discussion, community leaders and market committee members highlighted that plans were underway to make the toilets payable. They also said that this could only be successful if an independent person was given the chance to manage the toilet other than the committee or the council.

The toilets at Bereu were being taken care of by a market cleaner from the District Council while the newly built toilets at Dembo were expected to be run by a private individual. Marocchino (2009) says that toilets run by a private individual have good sanitation standards as compared to those run by councils and market committees. Formal procedure need to be followed as informally managed sanitation services suffer from poor hygienic conditions as food safety is not well thought-out as a priority.

4.3.3 Availability of water source and hand washing practice

Almost all respondents from Dembo (99.6%) indicated the presence of a borehole within the market for hand washing as well as for cleaning food items for sale as well as food handling utensils. At Bereu only few respondents (27.5%) indicated the availability of a borehole but outside the market (87%) located at a distance of more than 200 metres. As such 35% of the respondents at Bereu were washing hands using water bought from vendors. This made 35% of respondents to buy water from vendors for hand washing and cleaning food and food handling utensils and tools. The majority of respondents 209 (71.8%) and 261 (91.6%) from Bereu and Dembo reported that they were washing hands after visiting the toilet while at the market and the finding was statistically significant ($p=0.001$) (See Figure 4)

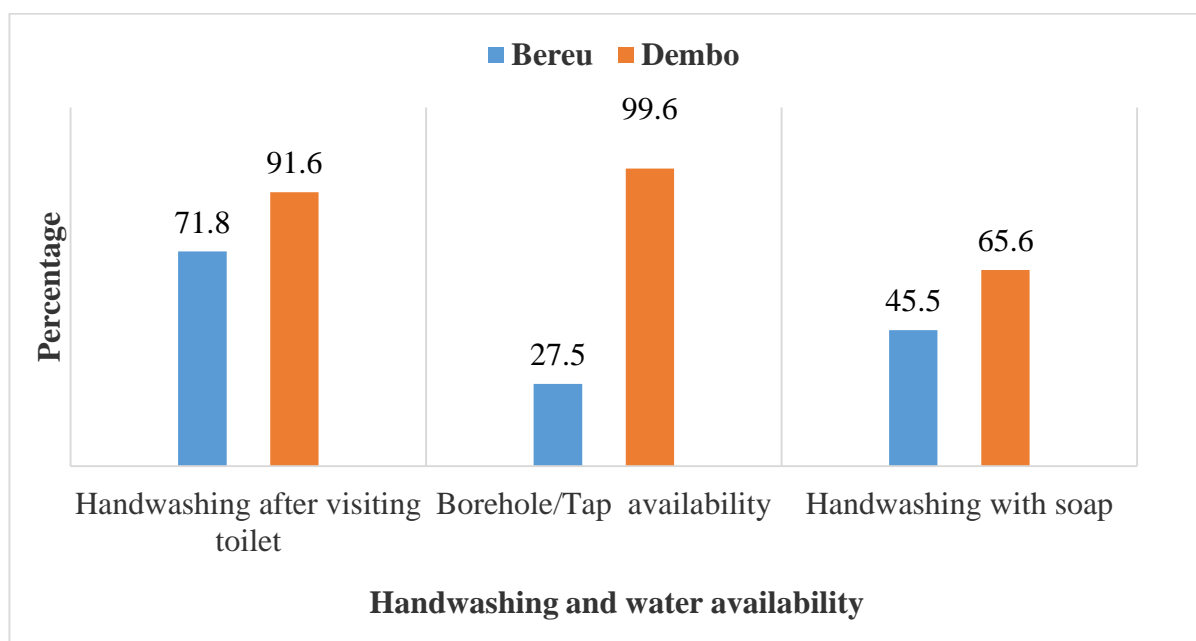


Figure 4. Availability of a water source and hand washing practice in markets

On the use of soap for hand washing, majority 65.6% of those who were washing hands at Dembo were using soap with only 45.5% at Bereu washing their hands with soap. This finding was statistically significant ($p=0.001$). This showed that use of soap for hand washing at Dembo was somehow better compared to Bereu market

Over half (54.2%) of those who were not washing hands after visiting the toilet at Bereu claimed doing so because of lack of soap and 61.2% of respondents at Dembo said hand washing was not important. Such reasons given by respondents indicated inadequate knowledge of the respondents on the importance of hand washing with soap. Food and food handling utensils and tools can be contaminated by unwashed hands with soap. Hand washing with soap using potable water after visiting the toilet is very important as it helps in killing pathogens and remove dirt (Dun-Dery, & Addo 2016).

4.4 Participation of different stakeholders in FSH activities in markets.

4.4.1 Stakeholders available for the management of markets.

Respondents were asked to indicate the stakeholders available for the management and running of the markets. Results show that the majority 91.41% and 89.57% of the respondents indicated availability of market committees in the markets of Bereu and Dembo respectively. This was followed by 61.51% and 66.55% of the respondents at Bereu and Dembo respectively indicating

the presence of a market masters in their markets. Slightly above half of respondents at Dembo (56.84%) and over three quarters of respondents at Bereu (78.35%) indicated presence of market cleaners. Other stakeholders who were mentioned as being involved in the running of the markets were extension workers (69.21%, 44.32%) and local leaders (17.66%, 32.45%) at Bereu and Dembo respectively.

During FGD, it was echoed by members that one market cleaner was not enough to clean the whole market alone on a daily basis; as such different sections of the market were cleaned in different days. One of the committee members at Bereu had this to say:

“You can see that there is a lot of waste being piled in different sections of the market because the market cleaner is not able to sweep the whole market and transfer the waste to the disposal pit alone in a day”.

Markets in Malawi are managed by District Councils using their market master and market cleaner, with support of market committees. The markets of Bereu and Dembo have a market committee, market master and a market cleaner in order of respondents’ familiarity. The Market master is responsible for managing the market in areas like market sanitation using the only one market cleaner available with support of the market committee. Having only one market cleaner in the markets is inadequate. The markets of Bereu and Dembo were not being fully cleaned on daily basis due to workload to the only market cleaner available. This could be the reason why waste was left piled up and failing to be taken to the disposal pit regularly. Marocchino (2009) explains that market cleaning services provided by the municipal sector are commonly inadequate and sometimes not existing in most of the markets.

4.4.2. Food safety and hygiene activities

Respondents were asked to say FSH activities being conducted in their markets. From Table 7, the majority indicated that in both markets, review meetings, Bereu (89.70%), Dembo (84.20%) and awareness campaigns Bereu (91.80%), Dembo (73.90%) were taking place. On the other hand, market general cleaning and market inspection were being conducted. But only slightly above half at Dembo indicated market general cleaning (53.50%) and market inspection (52.10%) while at

Dembo over three quarters indicated occurrence of general cleaning day (81.10%) and market inspection (77.0%).

According to WHO (2006) several FSH activities like awareness campaigns, market general cleaning days, market inspection, planning and review meetings are supposed to take place in food markets to ensure food safety and hygiene. At Dembo, almost all FSH campaign activities were shown to be done as indicated by nearly over three quarters of the respondents while at Bereu general cleaning and market inspections were not taking place efficiently as indicated by only half of the respondents. This was clearly evidenced by the scattered waste and presence of piles of waste in most of the places in the market. Such waste harbor vectors and acts as breeding places for pathogens that contaminate food items thereby putting consumers at risk of food borne and food related infections. (WHO, 2006 and King, 2013).

4.4.3 Participation of stakeholders in different FSH activities.

Respondents were asked to state stakeholders involved in market review meetings. It was indicated at Bereu that committee members 278 (96.53%), extension workers 216 (75.00%) local leaders 214 (74.31%) and Market master 128(44.40%) were taking part in review meetings. At Dembo the majority indicated participation of Market committee 252 (88.73%) and Extension workers 173 (60.92%) in market planning and review meetings.

For food safety and hygiene awareness campaigns, Table 7 shows that at Bereu the campaigns were being attended by the majority of extension workers 262 (90.97%), market committees 173(60.92%) local leaders 135(46.88%) and mild participation of the market master 88(30,56%) and Heads of Departments 77(26.74%). On the contrary, at Dembo only the majority of extension workers 225(79.23%) and market committee members 192(67.61%) were participating in FSH awareness campaigns.

On participation of stakeholders in general market cleaning days, the majority at Bereu indicated participation of the market committee 228 (79.17%) and the market cleaner 227(78.72%), market master 153(53.13%) and slight participation of local leaders 104(36.11%) and extension workers 99(34.38%). On the other hand, at Dembo it was only the market committees that were mentioned by the majority 210 (73.94%), market cleaner 169 (59.61%) and slightly local leaders 64(22.54%) and extension workers 103(36.27%) that they were participating in market general cleaning days.

Looking at market inspection, (Table 8) shows that at Bereu it was mainly conducted by extension workers 233(80.90%) with partial support of market committees 157(54.51%) HODs 97(33.68%) and market master 80(28.17%). On the other hand, at Dembo market inspection was almost equally done by Market Committee 181 (63.17%) and extension workers 1984 (64.31%) with a slight participation of the market master 74(26.06%). At Bereu 38.9% indicated that they did not know whether such inspections were taking place, whereas at Dembo, only 14% had no knowledge of the occurrence of market inspections.

Table 8. Market management stakeholders' participation in FSH activities

Type of Stakeholder		Review Meeting		Awareness Campaign		General Cleaning		Market Inspection	
		Bereu	Dembo	Bereu	Dembo	Bereu	Dembo	Bereu	Dembo
Market committee	Freq	278	252	174	192	228	210	157	181
	%	96.53	88.73	60.42	67.61	79.17	73.94	54.51	63.73
Vendors	Freq	30	25	9	16	42	28	0	9
	%	10.42	8.80	3.13	5.63	14.58	9.86	0.00	3.17
Market masters	Freq	128	73	95	49	153	80	105	74
	%	44.44	25.70	32.99	17.25	53.13	28.17	36.46	26.06
Market Cleaners	Freq	109	49	88	41	227	169	91	43
	%	37.85	17.25	30.56	14.44	78.82	59.51	31.60	15.14
Extension workers	Freq	216	173	262	225	99	103	233	194
	%	75.00	60.92	90.97	79.23	34.38	36.27	80.90	68.31
Head of Department	Freq	92	38	77	26	72	23	97	34
	%	31.94	13.38	26.74	9.15	25.00	8.10%	33.68	11.97
Customer	Freq	13	6	8	3	23	2	8	2
	%	4.51	2.11	2.78	1.06	7.99	0.70	2.78	0.70
Local leaders	Freq	214	99	135	56	104	64	34	17
	%	74.31	34.86	46.88	19.72	36.11	22.54	11.81	5.99
None of the above	Freq	5	0	12	6	26	3	134	70
	%	1.74	0.00	0.69	1.76	0.00	0.70	46.18	24.65
Total	Freq	261	239	267	210	236	152	224	148
	%	89.7	84.2	91.8	73.1	81.0	53.5	77.0	52.1

The FSH activities mentioned above cannot be conducted by only the market master, committee and cleaner. All stakeholders that use the market like market committee, market master, market cleaner, local leaders and extension workers of different government and non-governmental organizations need to be involved in order to ensure provision of safe and nutritious food to consumers. For markets to produce safe and nutritious food to the consumers there is need for

proper collaboration among stakeholders in the running of the operations of the market (WHO, 2006).

At Bereu market, there is more participation in FSH planning and review meetings as well as awareness campaigns by market committee, market master, local leaders and extension workers while at Dembo it is only extension workers and market committee that participate more in review meetings and awareness campaigns.

From these findings, for market general cleaning and market inspection, it is shown that at Dembo, it is mainly the market committee, the market master and the market cleaner that mostly participate in general market cleaning days. Conversely at Bereu, mainly the market committee and the market cleaner mostly participate in general cleaning days. In both markets, market inspection was mainly conducted by extension workers, mostly Environmental Health Officers and market committee with little participation of the market master.

Routine market planning, management and review meetings, general cleaning days and inspections are intended to prevent food-borne illness by ensuring safe food handling and preparation. It was established from this study that all these activities were not often taking place. This can be detrimental because most food handlers and the management are likely to ignore pertinent food safety standards and this can lead to food borne disease outbreaks.

Mathias, Sizto, Hazlewood and Cocksedge (1995) conducted a study in thirty randomly selected food stalls inspected by one of three senior inspectors. FSH worsened when the inspection interval was greater than 12 months, but did not worsen when the interval was shorter. Additionally, in that there is indication that those food stalls in which supervisors and food handlers had completed food handler education courses had better inspection scores than those without. Other studies carried out in US in 2001 indicated that food stalls with poorer results on inspections were more likely to have food-borne disease outbreaks (Miguel, Cruz, Dolores, Katz & Suarez, 2001). Mwamakamba et al (2012) emphasizes that inspection plays a critical role in food safety and quality control in the food industry, applied by inspectors who are well trained not only to apply these procedures but also for quality assurance.

4.5 Food safety and hygiene knowledge and practices of food handlers

4.5.1 Knowledge of food handlers on FSH

4.5.1.1 Knowledge of food handlers in FSH Key Area in markets

Food handlers both permanent and mobile were asked several questions to evaluate their knowledge on the key areas of food safety and hygiene in markets. Table 9 shows that the majority in both markets Bereu 80(89.89%) and Dembo 32 (82.05%) had knowledge that food has to be kept clean, the majority of over 90% being permanent vendors. On the other key food areas, slightly over two thirds of the respondents from Bereu indicated to have knowledge on separation of raw and cooked food (61.80%), thorough cooking (75.28%), keeping food at safe temperatures (62.92%) and use of safe water 63 (70.79%). On the other hand, at Dembo (51.28%) respondents had knowledge that raw food has to be separated from cooked food, less than half (41.01%) knew that food has to be thoroughly cooked, 46.15% knew that food needs to be kept at right temperatures and 48.72% realized the importance of using potable water.

Table 9. Knowledge of food handlers on FSH key areas

Food Safety and Hygiene Key Area	Bereu			Dembo		
	Permanent Vendor	Mobile Vendor	Total	Permanent Vendor	Mobile Vendor	Total
Keep Clean and covered	49 92.45%	31 86.11%	80 89.89%	24 92.31%	8 61.54%	32 82.05%
Separate raw and cooked food	32 60.38%	23 63.89%	55 61.80%	13 50.00%	7 53.85%	20 51.28%
Cook thoroughly	38 19.10%	29 80.56%	67 75.28%	12 46.15%	4 30.77%	16 41.01%
Keep food at safe temperatures	32 71.70%	24 66.67%	56 62.92%	12 46.15%	6 46.15%	18 46.15%
Use safe water and raw materials	34 64.15%	29 66.67%	63 70.79%	13 50.00%	6 46.15%	19 48.72%
Total	53	36	89	26	13	39

Food in markets has to be cleaned, cooked thoroughly, covered and kept at safe temperatures, raw and cooked food separated and making use of safe potable water for cleaning food items and food handling materials (WHO, 2002). At Dembo, most food handler's especially permanent ones indicated to have adequate knowledge only on keeping food clean and covered with average knowledge on separating cooked and raw. This was in harmony with a study by Monney, Agyei and Owusu (2013) which observed that 55% of vendors were covering their food to protect it from flies and dust whilst 45.0% had no protection, thus exposing their food to flies and dust. This is similar to FAO and WHO (2001) recommendation that food should be adequately protected from airborne contaminants and pests in such a way so as not to compromise food safety which poses a threat to human health.

In a study by Nyamari (2013) showed that without actually observing the food handling behaviors, it is hard to determine that food handlers will adopt safe food handling behaviors as a result of training. Supporting this, Redmond & Griffith (2003) showed that self-reported practices on FSH did not match with observed behaviors, suggesting that observational studies provide a more accurate indication of the food safety practices. Another study by Clayton *et al* (2002) reported that food safety training does not necessarily guarantee that food handlers will apply the safe food handling behaviors. Meer & Misner (2000) in their study also found that food safety knowledge scores had a small positive effect on food safety practices.

4.5.1.2 Knowledge of food handlers on FSH requirements of a food handler

Results on food safety and hygiene requirements of a food handler are shown in Table 10 which indicates that at Bereu, the majority (73.9%) had knowledge that a food handler is supposed to wear clean clothes. This was different with Dembo, where the majority reported that food handlers should wear clean clothes (81.8%), with half knowing that food handlers should wear an apron (49.2%) with their hair covered (39.4%). At Bereu, only few had knowledge that a food handler should regularly wash hands (4.35%), should not decorate hands (4.35%), with some having no knowledge on hair covering, use of forceps, handling money and food as well as eating while preparing. In contrast Table 10 also show that at Dembo, at least 6-20% of all the food handlers had knowledge on all the above requirements of a food handler.

Table 10. Knowledge of food handlers on requirements of a Food Handler

Requirement	Bereu		Dembo	
	Frequency	Percent	Frequency	Percent
Wear clean clothes with sleeves	68	73.91	96	81.36
Wear aprons	4	4.35	58	49.15
Hair covered	0	0	47	39.83
No decorated hands	4	4.35	15	12.71
Short clean nails not coated	8	8.7	22	18.64
Use forceps or ladles to pick up RTE food	0	0	8	6.77
No communicable disease	8	8.7	16	13.55
Regularly hand washing	11	11.9	13	11.02
Don't handle money and then handle food	0	0	14	12.71
Don't eat while preparing food	0	0	25	21.19
Total	92	14.8	118	85.2

Most of the food handlers, over three quarters in both markets had knowledge that a food handler has to wear clean clothes with sleeves. It was encouraging to realize that at least half of the food handlers at Dembo had knowledge on the wearing of aprons (49.15%) and hair covering (39.83%) with little knowledge in almost all the other requirements. This was different with Bereu as most of the food handlers had little knowledge on wearing aprons (4.35%) no decorated hands (4.35%), no communicable disease (8.7%) with some having no knowledge at all on hair covering, picking food with forceps, no eating while preparing food and no handling of money while handling food. It was also worrisome to realize that Dembo food handlers from HFM pilot area, only 11.02% had knowledge on the requirement of regular hand washing the same way with 11.9% of food handlers at Bereu without any FSH interventions.

According to Ferron, Morgan & O'Reilly (2007) the hands of food vendors are frequently the supreme perilous means of transferring pathogens from contaminated areas and objects. This results into cross contamination upon contact with food and food items especially in situations where food vendors handle money from customers with the same hand. This can promote and exacerbate the condition due to possibility of accumulation of dirt on the money (Skovgaard, 2009). Ferron et al (2007) further says that poor FSH practices and poor personal hygiene contribute significantly to the spread of food borne diseases.

4.5.1.3 Knowledge of food handlers on food safety requirements of a food stall

On food safety requirements of a food stall, Table 11 shows that the majority of the food handlers, over three quarters at Bereu 20 (87.0%) and two thirds at Dembo 85 (64.4%) know that food needs to be covered while on display. At Dembo only half of the food handlers' indicated to have knowledge that there should be a hand washing station (49.2%) and a quarter (24.5%) realizing that there should be potable water available at a food stall.

In both markets, it is indicated that the respondents' knowledge is little on keeping food 60cm above the ground, need for adequate lighting and ventilation as well as need for food stall materials that are easy to clean. On observation, only 40% of the food stalls had hand washing stations and almost all ready to eat (RTE) foods that were supposed to be covered like scones were not covered.

Table 11. Knowledge of food handlers on FSH requirements of a Food Stall

Requirement	Bereu		Dembo	
	Frequency	Percent	Frequency	Percent
Have a hand wash station set up	2	4.34	65	49.24
Keep food on display covered	40	86.96	85	64.39
Food preparation or cooking area or display set at least 60 cm above the floor	2	4.34	26	19.70
Adequate lighting and ventilation	6	13.04	21	15.91
Potable water available at point of use	2	4.34	32	24.24
Made of material easy to clean	0	-	18	13.64
Total	46	0.15	132	85.2

The environment in which food is handled determines the safety of food in markets (Obuobie, Keraita, Amoah, Cofie, Raschid-Sally and Drechsel 2006). On food handling in both markets, food handlers know that RTE food has to be covered while on display. At the same time, in both markets less than a quarter of food handlers indicated to have little knowledge on the requirement of a food stall that it should provide food preparation and storage of food items 60 cm above the ground, adequate lighting, ventilation and food stall made of materials easy to clean. Almost half of food handlers at Dembo indicated to have knowledge that a food stall should have potable water

(64.39%) and a hand washing facility. This could be from the fact that they were once trained on food FSH by SCHI project and they still could remember what they learnt.

4.5.2 Food safety and hygiene handling practices of food handlers

4.5.2.1 Tools and materials used in food handling.

On availability of food handling tools and equipment that are used by food handlers for picking and wrapping food items in markets. Table 12 shows that at Bereu, around half (51.69%) of the food handlers indicated using plastic Jumbo, 42.70% using newspapers and 13.48% using folk. On the other hand, at Dembo just around half of the respondents indicated using used newspapers (58.97%), fork (51.28%), sticks or wires (47.72%) with plastic jumbo as the least (33.33%).

It is seen that at Bereu, a high proportion of mobile food handlers were using sticks/wires (54.72%) and mobile vendors were using newspapers (52.78%). The case was different at Dembo as it was a greater proportion of permanent food handlers that indicated using used newspapers, with 61.54% of mobile food handlers using fork and sticks/wires.

Table 12. Food handling tools and materials used by food handlers

Name of Tool	Bereu			Dembo		
	Permanent Vendor	Mobile Vendor	Total	Permanent Vendor	Mobile Vendor	Total
Fork	7 13.21%	5 13.89%	12 13.48%	12 46.15%	8 61.54%	20 51.28%
Tong	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
Plastic jumbo	29 54.72%	17 47.22%	46 51.69%	8 30.77%	5 38.46%	13 33.33%
Sticks / wires	21 39.62%	12 33.33%	33 37.08%	11 42.31%	8 61.54%	19 47.72%
Used Newspapers	19 35.85%	19 52.78%	38 42.70%	18 69.23%	5 38.46%	23 58.97%

Proper food handling plays a vital role in safety of food during preparation and storage (Azanza and Zamora-Luna, 2005). Pathogens may also be introduced into the food due to poor handling of the food specially RTE foods (Green, Selman, Banerjee, Marcus, Medus and Angulo (2005).

None of the vendors in the study used bare hands to handle food. In both markets there was common use of stick and /or wires for picking RTE food, plastic papers and used newspapers for wrapping RTE food (Fig 5). This differs from findings by Muinde and Kuria (2005) in Nairobi who reported that 60% of street food vendors handled food with their bare hands. According to Ferron et al. (2007) the hands of food vendors are usually the most critical means of transmitting pathogens from contaminated places and items and hence could result in cross contamination upon contact with food. Particularly, in the case where vendors use the same hands to handle money from consumers, as this can further aggravate the situation due to possible accumulation of dirt on the money.



Figure 5. Materials used for handling food

4.5.2.2 Cleaning and storage of food handling tools and utensils.

Cleaning of utensils used in food handling in both markets was seen that over three quarters of the respondents at Bereu (82.61%) and slightly above half at Dembo (56.08%) were cleaning utensils after use by a single customer, 17% at Bereu cleaning after use by several customers with 27.27% at Dembo cleaning after use by several customers.

Talking about disinfectants used for cleaning food handling utensils, at Bereu, the majority(95.70%) were not using any disinfectant while at Dembo, 67.4 % were reported to be using soap (tablet) and 7.27% not using anything. On the safe storage of the tools after cleaning, the majority of over three quarters (82.6%) of food handlers at Bereu reported keeping them in

covered containers with very few (8.70%) keeping them above 60cm above ground and washing them with disinfectants. On the other hand, two thirds of food handlers at Dembo indicated keeping food handling tools above the ground 44 (65.15%) and 30 (45.45%) keeping the tools 60 cm above the ground and washing them with disinfectants respectively (Table 13)

Table 13. Practice of food handlers on cleaning and storage of food handling tools

	Times when food handling utensils are cleaned					Total
	After use by one customer	After use by several customers	Wait until dirty	Upon request by customer	Don't know	
Bereu	57(82.61%)	12 (17.39%)	0 (0.00%)	6 (8.70%)	0 (0.00%)	69
Dembo	37(56.06%)	18 (27.27%)	9 (13.63%)	1 (1.52%)	0 (0.00%)	66
	Materials used for cleaning food handling tools				Total	
	Soap tablet	Soap Powder	Soap paste	Nothing		
Bereu		3(4.30%)	0(0.00%)	0(0.00%)	66(95.70%)	69
Dembo		45(68.5%)	3(4.55%)	1 (1.52%)	18(27.27%)	66
	Safe way of keeping food handling tools					Total
	Covered containers	Keep at 60cm above the ground	Washed with disinfectants like soap	Avoid using dish clothes	Don't know	
Bereu	57(82.61%)	6(8.70%)	6(8.70%)	0 (0%)	0(0.0%)	69
Dembo	44(65.15%)	14(22.73%)	30 (45.45%)	1 (1.52%)	4 (6.06%)	66

Tools and equipment used for food handling needs to be cleaned and stored well covered in safe places to protect food from contamination thereby protecting consumers from food related infections (Hertzman and Bannash, 2007). Cleaning of utensils after use by every customer is greatly practiced at Dembo (82.61%) as compared to only half at Bereu (56.08%). The problem at Bereu was that the utensils were reported being cleaned with water only without any disinfectant while at Dembo 82.6% of food handlers were using soap. In both markets, tools and equipment after cleaning were being covered while in storage but it was only at Bereu where they were being kept 60 cm above the ground (Skovgaard, 2009) stipulates that poor FSH practices and use of

contaminated equipment and poor personal hygiene considerably contribute to the spread of food borne diseases.

4.5.3 Food handlers FSH training and medical checkup.

Food handlers in both markets were asked more on their knowledge and practices in food safety and hygiene as well as status of medical checkup as a requirement for a food handler. Figure 6 show that less than a quarter (15.73%) of food handlers at Bereu and slightly above half of food handlers at Dembo (53.85%) heard and knew about the need for a food handler to go for a FSH medical checkup and this was statistically significant ($p=0.001$). At Bereu only 8.99% once went for the checkup while at Dembo, only less than half (46.25%) once underwent the checkup and this was also statistically significant ($p=0.001$)

On frequency of the medical checkups, the majority at Bereu market indicated that they go once in every three months (68.3%) while at Bereu the majority indicated going for a medical checkup once in every six months (78.7%).

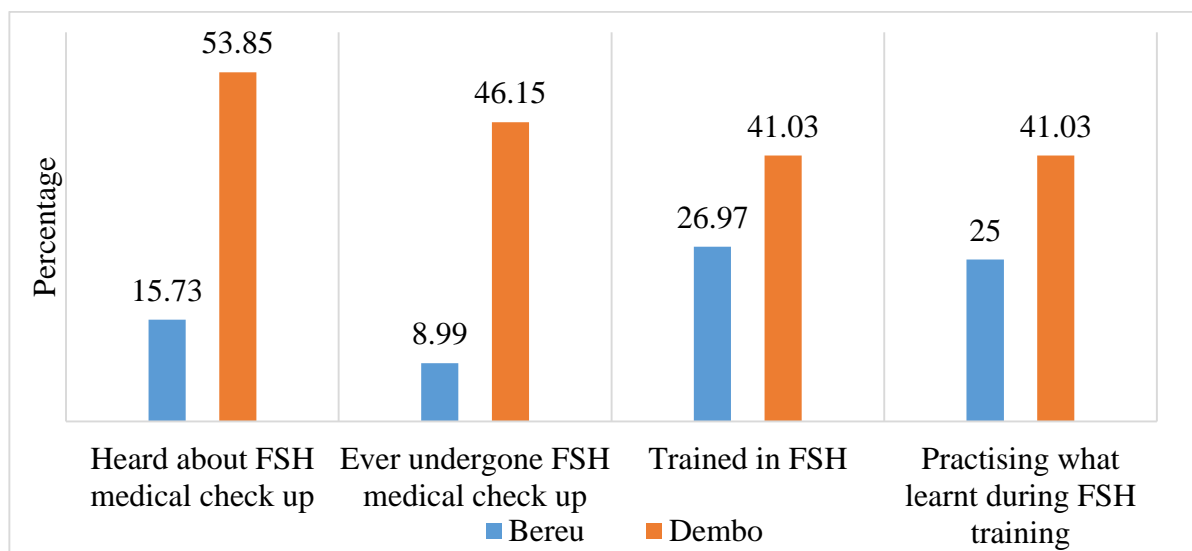


Figure 6. Food handlers' Training on FSH and Medical check up

Figure 6 indicates that only a quarter of food handlers at Bereu (26.97%) were trained in FSH as compared to 41.03% of food handlers that were trained at Dembo and this was statistically significant ($p=0.001$). After the training, only 25.00% of the trained food handlers at Bereu

indicated to be practicing what they learnt compared to 41.03% of food handlers at Dembo that were trained indicated practicing what they learnt. This was also statistically significant ($p=0.002$). Despite the food handlers having some knowledge on the FSH requirements, it was realized during observation that they were not practicing what they knew.

Looking at the main issues learnt during the training and being practiced in the markets, at Bereu food handlers indicated to have learnt about personal hygiene (97.5%), food hygiene (84.0%) with half (50.6%) indicating to have learnt waste management. At Dembo, the majority also indicated to have learnt only personal hygiene (83.6%) and food hygiene (84.9%).

Medical checkup is also one of the prerequisites of a food handler. At Dembo, less than half knew this with only 8.99% having had a medical checkup only once as compared to 15.73% at Bereu who knew but nobody having ever undergone any medical checkup. All this was happening despite 41.03% of food handlers at Dembo and 26.97% of food handlers at Bereu having been trained in FSH. The main issues indicated by food handlers was that they were taught about personal hygiene, food hygiene and waste management with almost all in both markets indicating practicing what they learnt during the training.

Despite having knowledge on FSH, Food handlers in the market of Dembo and Bereu reported lacking safe practices indicating a gap between knowledge and actual food safety practices. Another study by Roberts (2008) revealed that food handlers who had received training on food safety knowledge did not translate the knowledge into practice. This suggests that food FSH and hygiene information is not a new concept in the markets. Such findings are similar to findings from a report given by Onyeneho (2013) which observed that education on food safety and hygiene alone may not lead to actual behavioral changes. On the other hand, findings by Azanza and Zamora-Luna (2005) showed a significant discrepancy between reported food safety knowledge and actual food safety practice. In a study by Githiri, Kimiywe and Okemo (2013) in Kenya, food handlers performed well in knowledge items compared to the hygienic practice. This shows that knowledge in food hygiene does not always result in a positive change in food handling practices. This indicates that there is need for educational programs to improve knowledge but also to emphasize on translation to practices.

Regardless of this observation, Hertzman and Bannash (2007) recommended that food handlers must be knowledgeable enough and stick to hygiene and sanitation guidelines and practices. The same opinions were also echoed by King (2013) that formal trainings to food handlers is a prerequisite to ensure optimum knowledge of food handlers in FSH.

Basic training in personal and food hygiene according to Abdelrazig, Mustafa & Mohamed, 2017) is needed for food handlers. This is to ensure that they follow the required rules for proper hygiene and sanitation. Mustaffa et al (2017) in his study in in Malaysia recommended that by enforcing regular check-up or periodic training, it is possible to have a better and much healthier environment for food services.

4.6 Summary of results and discussions

The results presented in this chapter show that the HFM concept has brought some improvements on food safety, hygiene and sanitation at Dembo Market, the pilot Healthy Food market. This is seen by the availability of sanitation facilities like waste bins (Dembo, 8 bins; Bereu, 1 bin) and a waste disposal pit which was not there. Furthermore, a new toilet structure though not yet operational, and a borehole that has been rehabilitated at Dembo.

On food hygiene, food in both markets is handled using picking tools and wrapping materials. Food handlers at the pilot market of Dembo have at least some FSH knowledge as compared to Bereu the control market. Considering knowledge on requirements of a food stall like having a hand washing facility (Dembo 49.24%, Bereu 4.34%) and placement of food 60 cm above the ground during preparation or display (Dembo,19.70%, Bereu, 4.34%). More food handlers were also trained in FSH at Dembo (41.03%) as compared to Bereu (26.97%). Despite being trained, few food handlers in both markets practiced what they learnt (Dembo 25.0%, Bereu 41.0%). This include food handler medical checkup (Dembo 46.15%, Bereu 8.95%), regular hand washing with soap (Dembo 45.5%, Bereu 65.6%) wearing of aprons (Dembo 49.15%, Bereu 4.35%) indicating a gap between knowledge and actual food safety practices.

On implementation of FSH activities in the markets, Dembo, the intervention market is not vibrant enough as compared with Bereu the control market. Bereu is doing better in awareness campaign, (Dembo 73.1%, Bereu 91.8%), general cleaning days, (Dembo 53.5%, Bereu 81.0%) and market inspection (Dembo 52.1%, Bereu 77.0%).

There is inadequate participation of stakeholders in FSH activities in both markets. At Bereu, there is more participation in FSH planning and review meetings as well as awareness campaigns by the market committee, market master, local leaders and extension workers. Whereas at Dembo, the HFM intervention market, it is only extension workers and market committee that participate more in review meetings and awareness campaigns. One worrisome thing is the availability of only one market cleaner in both markets which makes it difficult for him or her to clean the market efficiently on a daily basis.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS.

5.1 Conclusion

The HFM concept, despite bringing some improvements on food safety, hygiene and sanitation in general at Dembo market, the management of Bereu market is doing better than Dembo in awareness campaigns, general cleaning and market inspection. Dembo market is better in sanitation as seen by the availability of sanitation facilities like waste bins, a waste disposal pit and a new toilet structure. Both markets are doing better on food hygiene as food is handled using picking tools and wrapping materials. On food knowledge, food handlers at the pilot market of Dembo have at least some FSH knowledge as compared to Bereu the control market. This is due to the fact that more food handlers were trained in FSH at Dembo than Bereu. On the other hand despite being trained, few food handlers in both markets practice what they learnt like medical checkup, hand washing, wearing of apron etc. indicating a gap between knowledge and actual food safety practices.

On implementation of FSH activities in the markets, Dembo, the intervention market is not vibrant enough as compared with Bereu the control market. There is also inadequate participation of stakeholders in FSH activities in both markets with a one major problem of having only one market cleaner.

In conclusion, the HFM concept can provide a perfect basis for a HFM but require professionally implementation like improving on infrastructure, coordination and capacity building for it to be an efficient model in the promotion of food safety and hygiene in food markets in Malawi.

5.2 Recommendations.

5.2.1 Recommendations

- i. Chikwawa District Council should facilitate improvement of FSH knowledge to market users through FSH awareness campaigns, FSH training to food handlers and market committees.

- ii. Chikwawa District Council should ensure that food markets have adequate waste bins and staff like market cleaners to ensure adequate market cleaning and waste disposal for the provision of safe food to consumers.
- iii. Chikwawa District Council should facilitate the demolition of full toilets at Dembo and opening of the new ones as well as construction of new ones at Bereu market.
- iv. Ministry of Health through Chikwawa District Health Office should provide FSH Medical Tests to food handlers to prevent spread of communicable diseases through food handling.

5.2.2 Areas requiring further study

- i. Without microbial analyses of food, it is impossible to determine if the food is safe for human consumption. Therefore more research is needed to determine the types of microbes and the microbial load in food sold in the markets.
- ii. Although food and food premises inspection like food market inspections are based on scientifically sound principles of food safety, they have not yet been evaluated in Malawi. Therefore there is need to evaluate them to determine whether they actually prevent food-borne outbreaks or not.

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APPENDICES

Appendix 1. Sample Size Calculation

The general formula is $n = N / (1 + Ne^2)$
 Where:
 n = Sample size to be found
 N = Target population size
 e = 0.05 (Alpha level at 0.95 Confidence Interval)

Sample size for Vendors and customers

Market	Variable	Mobile vendors	Permanent vendors	Total
Bereu	Population	45	72	117
	Sample size	$45 / 1 + 45(0.05)^2 = 40$	$72 / 1 + 72(0.05)^2 = 61$	101
Dembo	Population	13	30	43
	Sample size	$13 / 1 + 13(0.05)^2 = 13$	$30 / 1 + 30(0.05)^2 = 28$	41
Total		53	89	142

Sample size for customers

Market	General Formula $n = N / (1 + Ne^2)$	Adjusted Formula $n = n_o / (1 + ((n_o - 1) / N))$
Bereu	$1558 / 1 + 1558(0.05)^2 = 318$	$318 / (1 + ((318 - 1) / 1558)) = 264$
Dembo	$1281 / 1 + 1281(0.05)^2 = 305$	$303 / (1 + ((305 - 1) / 1281)) = 246$

Total Study units

Market	Bereu	Dembo	Total
Mobile vendor	40	13	53
Permanent vendor	61	28	89
Customers	264	246	510
Total	365	287	652

Appendix 2. Letter requesting for permission from Chikwawa District Council

Annex 2. Request for permission from Chikwawa District Council to conduct research

From : Laston Kamwana. University of Malawi, The Polytechnic. P/Bag 303, Chichiri, Blantyre 3.

To : The District Commissioner. Chikwawa District Council. P/bag 1, Chikwawa

Date : 10th June, 2016.

Dear Sir,

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT DEMBO AND BEREU MARKETS

I am a student of the University of Malawi, the Polytechnic pursuing a Master of Science Degree in Environmental Health (MSc H). I am also an Employee of the Ministry of Health working as at Nsanje District Hospital as an Environmental health Officer.

As a requirement of my studies, I am supposed to submit a thesis in partial fulfillment of the above course. I therefore write to request for permission from you to conduct my research at Dembo and Bereu market. The research topic is *"Promotion of food safety, hygiene and sanitation in rural markets using healthy food market concept: A case study of Dembo and Bereu markets of Chikwawa"* The study units will be customers, food handlers and vendors, extension workers, selected heads of departments, market committees, village development committees and councilors within the market catchment areas.

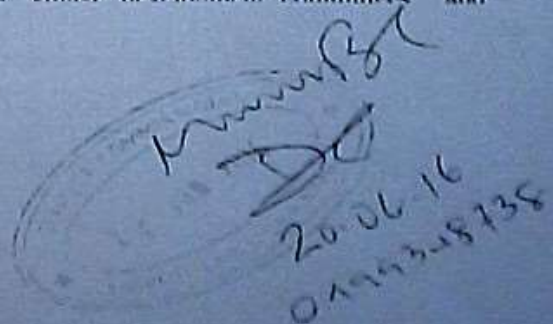
I will be very grateful if my request will be favorably

Yours faithfully,



Laston Kamwana

ENVIRONMENTAL HEALTH OFFICER



20.06.16
01993-18738

Appendix 3. A Questionnaire for Market Vendors and Customers

Assessment of Food Safety, Hygiene and Sanitation Interventions in Food Markets in Chikwawa District

Date..... 2016

Questionnaire No.....

Consent form for Vendors and Customers

My name is..... from University of Malawi, The Polytechnic. I am conducting a study on the impact of food safety, hygiene and sanitation interventions in food markets of Dembo and Mfera here in Chikwawa. I am very interested to hear your valuable opinion on the status of our market in ensuring provision of safe food to consumers.

- I understand how important it is that this information is kept private and confidential, as such I would like to assure you that the information you give is completely confidential, and I will not associate your name with anything you say.
- To ensure that our discussion is on track, I have a questionnaire to guide us. I will document the thoughts, opinions, and ideas I hear from you.
- Feel free to give me as much information as possible. You may refuse to answer any question or withdraw from the study at any time.
- If you have any questions now or after, you can always contact a study team member like me, or you can call the Dean of Postgraduate studies at Polytechnic using phone numbers at the bottom of this form.

I therefore ask you to sign below to show that you agree to take part in this interview:

Designation	Name	Signature/Thumb Print	Date	Contact Number
Interviewee				
Interviewer				
Dean				

NOTE: Make sure that you proceed with the interview only after the respondent has given consent by signing above

Thank you for your time.

No	Question / Instruction	Response	Choice	Go to
1	Market	Bereu	1	
		Dembo	2	
2	Type of Respondent	Customer	1	
		Permanent vendor	2	
		Mobile vendor	3	
3	Sex of respondent	Male	1	
		Female	2	
4	Age of respondent	6-14	1	
		15-24	2	
		25-39	3	
		40 and above	4	
5	<i>Availability and accessibility of hygiene and sanitation facilities in the markets</i>			
6	Do you have waste bins or baskets Kodi muli ndi ma bini kapena mabasiketi otayila zinyalala mu nsika muno	Yes	1	
		No	2	
7	Where do you dispose waste in the market Kodi zinyalala zamunsika mumakazitaya kuti?	Thrown into open drains	1	
		Thrown along the road	2	
		Anywhere	3	
		Designated open sectional disposal area	4	
8	Why you don't have waste bins Ndi chifukwa chiyani mulibe mabini otayila zinyalala munsika muno	Never bought by council		
		Never replaced after worn out		
		Vandalised		
		Other		
		I don't know		

9	<p>Explain other reason why you don't have bins?</p> <p>Ngati ndi zifukwa zina, , mungandiuze chifukwa chomwe mulibile mabini (Mungafotokoze zifukwa zinanzo)</p>			
10	<p>Do you separate/segregate the waste into categories like liquid waste, solid waste, organic or non-organic waste when throwing into any other place?</p> <p>Kodi mumasiyanitsa potaya zinyalala zomwe zimatha kubvunda ndi zomwe sizimavunda.</p>	Yes	1	8
		No	2	
11	<p>If No, what is the reason?</p> <p>Ngati simusiyanitsa, tafotokozani, ndichifukwa chiyani</p>	Inadequate bins	1	
		There is no need for separation	2	
		Tiresome	3	
		Time wasting		
		No reason		
		Other	4	
12	<p>Explain</p> <p>Ngati ndi zifukwa zina, , mungandiuze (Mungafotokoze zifukwa zinazo)</p>			
13	<p>If waste bins/basket, How many are there in the market?</p> <p>Ngati mumataya zinyalala mu ma bini/mumabasiketi, kodi mabiniwo /mabasiketiwo alipo angati munsika muno.</p>	1-2	1	
		3-4	2	
		5-8	3	
		9 and above	4	
		Don't know	5	
14	<p>How did you get the waste bins/baskets</p> <p>Kodi ma bini/mabasiketi munawapeza bwanji</p>	Council	1	
		Traders	2	
		Committee	3	
		Contributions of all	4	
		Donations	5	

		Other	6	
		Don't know	7	
16	Are the waste bins covered Kodi mabini/mabasiketi wo amavindikiridwa	Yes	1	12
		No	2	
17	If No Why are they not covered Ngati savindikiridwa, ndi chifukwa chiyani	There are no covers	1	
		Negligence	2	
		No reason	3	
		Others (Indicate)	4	
18	Specify other Ngati pali zifukwa zina zomwe mabiniwo savindikiridwa, mungafotokoze			
19	Are the waste bins/baskets emptied Kodi zinyalala zikazaza mubini zimakatayidwa.	Yes	1	14
		No	2	
20	If No explain why Ngati sizikatayidwa, ndichifukwa chiyani	The cleaner takes time to empty them	1	
		Nobody takes care	2	
		I don't know	3	
		Others (indicate)	4	
21	If other reasons, specify Ngati pali zifukwa zina zomwe mabiniwo savindikiridwa, mungafotokoze			
22	Who empties the bins/baskets Amakataya zinyalala za mubini kotayila ndani	Council Cleaner	1	
		Traders	2	
		Committee members	3	
		Customers	4	
		Don't know	5	

23	How frequent are the bins/baskets removed / emptied. Kodi mabiniwo akazaza amatenga nthawi yotalika bwanji kuti zinyalala zitayidwe.	Daily	1	
		Weekly	2	
		Fortnightly	3	
		>2 weeks	4	
		No schedule	5	
		Don't know	6	
24	Where are the bins/baskets emptied to Kodi zinyalala zikazaza mu bini, zimakkakhuthulidwa kuti?	Road side	1	
		Waste disposal site	2	
		Anywhere outside the market	3	
		Others (Indicate)	4	
25	Specify other disposal sites Ngati pali malo ena otayila zinyalala, tawatchulani			
26	Is there a market waste disposal pit Kodi nsikawu uli ndi malo (zala) lotayila zinyalala	Yes	1	
		No	2	
27	How far is the waste disposal site from the market Kodi zala lotayila zinyalalalo ili kutali bwanji ndi nsika	< 500 m	1	
		500 m – 1 km	2	
		1km – 2 km	3	
		>2 km	4	
		Don't know	5	
28	Where do you dump your waste? Kodi zinyalala zimakatayidwa kuti?	No specific place		
		Road side		
		Open drains		
		Other		
29	Are toilets present at the market Kodi pa nsika pano pali zimbudzi	Yes	1	20
		No	2	

30	If No Why are there no toilets? Ngati palibe zimbudzi, ndichifukwa chiyani palibe?	Council did not build	1	31
		Fell down	2	
		Full	3	
		Others	4	
		Don't know	5	
		Other reason (Specify)		
31	Who takes care or manage the toilets Kodi ndi ndani yemwe amasamala zimbuzi za pa nsika	Council (Market Master/cleaner)	1	
		Market committee	2	
		Vendors	3	
		Private individual	4	
		Others (Indicate)	5	
		Average	2	
		High	3	
32	How many rooms/squatter holes are there Kodi zimbuzi zili ndi zipinda zingati	1-2	1	
		3-4	2	
		>4	3	
		Don't know	4	
33	Are there separate toilets for male and female Kodi pali kulejanitsa pakati pa zimbuzi za amuna ndi akazi	Yes	1	
		No	2	
		Don't know	3	
34	How many rooms/squatter holes are there for males Kodi kuzimbuzi za amuna kuli zipinda zingati	1-2	1	
		3-4	2	
		>4	3	
		Don't know	4	
35	How many rooms/squatter holes are there for females	<30m (2-3 minutes)	1	
		>30m (3-5minutes)	2	

	Kodi ku zimbuzi za akazi kuli zipinda zingati	Don't know	3	
36	How far are the toilets from the market	< 30 m	1	
	Kodi zimbuzi zili kutali bwanji ndi nsika	> 30 m	2	
		Don't know	3	
37	Do you use the market toilets	Yes	1	32
	Kodi mumagwiritsa ntchito zimbuzi za pansika pano	No	2	
38	If NO, why don't you use them	No privacy	1	
	Ndichifukwa chiyani simugwiritsa ntchito zimbuzi za pa nsika	Poor hygiene	2	
		Always engaged	3	
		Full	4	
		No money to pay	5	
39	Where then do you go when you want to urinate/defecate while you are at the market	Bush	1	
	Tsono inu mukafuna kuzithandiza, mumapita kuti	Nearby house	2	
		Home	3	
40	Specify			
	Ngati muapita kwina, fotokozani			
41	Do you wash hands after visiting a toilet/ latrine	Yes	1	34
	Kodi mumasamba mmanja mukachoka kuchimbuzi	No	2	
42	If No Why don't you wash your hands	Lack of water	1	
	Ndichifukwa chiyani simusamba mmanja	No HWF at the toilet	2	
		No reason	3	
43	Where do you wash your hands	Borehole	1	35
	Mumakasamba kuti mmanja mukachoka kuchimbuzi	Tap	2	36
		Water from water vendors	3	36

		Water brought from home	4	
		Others: indicate.....	5	
44	Do you wash hands with soap Kodi mumasamba mmanja ndi sopo	Yes		
		No		
45	If Yes, Why do you wash hands Ndichifukwa chiyani mumasamba mmanja ndi sopo	Yes		
		No		
46	If No can you explain why Ndichifukwa chiyani simusamba mmanja ndi sopo			
47	Specify other reason Fotkozani ngati ndi zifukwa zina			
48	Is there a bore hole or tap for the market Kodi mu nsika muno muli njigo kapena mpope wa madzi	Yes	1	
		No	2	
49	If Borehole or tap where is it located Kodi njigo/mpope uli kuti	Inside the market	1	
		0-20 m from market	2	
		>20m from market	3	
		Not important	2	
		Negligence	3	
		No reason	4	
		Others indicate	5	
50	<i>Participation of and coordination among market committee members, vendors, community and all stakeholders in food safety and hygiene</i>			
51	Which of the following people or structures are available at the market (Tick all mentioned) Kodi ndi anthu ati kapena magulu ati omwe amapezeka pansika pano.	Market Master	1	
		Market cleaner	2	
		Market committee	3	
52		Market committee	1	

	Which groups of people, committee or organisations take part in food safety and hygiene activities at the market? Kodi ndi magulu ati omwe amathandizila pa nkhani yotukula okhondowa zakudya pa nsika pano	Boreole committee	2	
		Vendors	3	
		Market Master	4	
		Market cleaner	5	
		Extension workers	6	
		Heads of departments	7	
		Customers	8	
		Local leaders (Chief, VDC, councilor) indicate	9	
		Others (indicate)	10	
		Don't Know	11	
		None	12	
53	Specify groups taking part in hygiene campaign activities Tchulani magulu omwe amatenga nawo mbali polimbikitsa ukhondo wa zakudya pa nsika pano			
54	What activities are conducted together by these people and/or organisations to ensure food safety at the markets? Kodi ndi ntchito iti yomwe magulu amenewa amagwilira limodzi polimbikitsa ukhondo wa zakudya	Market management and review meetings	1	
		Awareness campaigns	2	
		Market general cleaning days	3	
		Market inspections	4	
		Others (indicate)	5	
		None of the above	6	
55	Specify other activities for food safety Thulani ntcito zina zomwe zimachitika polimbikitsa ukhondo wa zakudya pa nsika pano			
56		Market committee	1	

	Who takes part in market review meeting	Vendors	2	
	Ndi ndani amakhala nawo mu misonkhano younikira zaukhondo mu nsika	Market Master	3	
		Market cleaner	4	
		Extension workers (Health, Vet, Trade, Water, and NGO, others.....)	5	
		Heads of departments	6	
		Customers	7	
		Local leaders (Chief. VDC, councilor) indicate	8	
		Others (indicate)	9	
57	Who takes part in food safety awareness campaigns	Market committee	1	
	Ndi ndani amatenga nawo mbali popangitsa misonkhano yophunzitsa anthu za ukhondo wa zakudya pansika	Vendors	2	
		Market Master	3	
		Market cleaner	4	
		Extension workers (Health, Vet, Trade, Water, and NGO, others.....)	5	
		Heads of departments	6	
		Customers	7	
		Local leaders (Chief. VDC, councilor) indicate	8	
Others (indicate)	9			
58	Specify others			
	Ngati alipo ena tawatchulani			
59	How frequent are the food safety awareness campaigns conducted	Monthly	1	
	Kodi Misonkhano yophunzitsa anthu za ukhondo wa zakudya pa nsika	Quarterly	2	
		Bi annually	3	
		Others	4	

	imachitika pkapita nthawi yaitali bwanji	Don't know	5	
60	Who takes part during market general cleaning days Ndi ndani amatenga nawo mbali pa masiku oikika osesa pa nsika	Market committee	1	
		Vendors	2	
		Market Master	3	
		Market cleaner	4	
		Extension workers (Health, Vet, Trade, Water, and NGO, others.....)	5	
		Heads of departments	6	
		Customers	7	
		Local leaders (Chief. VDC, councilor) indicate	8	
		Others (indicate)	69	
61	How frequent are the market general cleaning conducted Kodi masiku osesa nsika amachitika pakadutsa nthawi yaitali bwanji	Weekly	1	
		Monthly	2	
		Quarterly	3	
		Bi annually	4	
		Others indicate.....	5	
		Don't know	6	
62	Who takes part in market inspections Ndi ndani omwe amatenga nawo mbali poyendera nsika	Market committee	1	
		Vendors	2	
		Market Master	3	
		Market cleaner	4	
		Extension workers (Health, Vet, Trade, Water, and NGO, others.....)	5	
		Heads of departments	6	

		Customers	7	
		Local leaders (Chief. VDC, councilor) indicate	8	
		Others (indicate)	9	
63	How frequent are these market inspections conducted Kodi nsikawu umayenderedwa pakapita nthawi yaitali bwanji	Monthly	1	
		Quarterly	2	
		Bi annually	3	
		Others indicate.....	4	
		Don't know	5	
64	<i>Knowledge and practices in safe food handling. Like Ready to eat foods cooked/fried at home or market, fruits – people who handle or sell ready to eat foods.</i> <i>Type of respondent : Vendor of RTEF 1 Customer = 2 Any other person (Use they if any other person)</i>			
65	What are the key areas in food safety (Tick all mentioned) Kodi zinthu zofunikira ndi ziti pa nkhani ya yosamalira zakudya pa nsika	Keep clean	1	
		Separate raw and cooked food	2	
		Cook thoroughly	3	
		Keep food at safe temperatures	4	
		Use safe water and raw materials	5	
		Any other	6	
		Don't know	7	
66	Do you have food handling tools or equipment Kodi muli ndi zida kapena ziwiya zogwilira zakudya	Yes	1	
		No	2	54
67	What do you use for handling the cooked food (Circle applicable)	Fork	1	
		Tong	2	
		Hands	3	

	Kodi mumagwiritsa ntchito ziwiya zANJI pogwira zakudya zophika kale	Sticks / wires	4	
		Hands	5	
		Don't know	6	
		Others, indicate.....	7	
68	How frequent are the serving utensils cleaned Kodi zida kapena ziwiya zogwiritsira ntchito pa zakudya mumazituka nthawi ziti	After use by one customer	1	
		After use by several customers	2	
		When dirty	3	
		Others, indicate.....	4	
69	Indicate other times Thculani ngati pali nthawi zina			
70	What do you use for cleaning the utensils Kodi ziwiya zanu mumatsukira chani	Soap	1	
		Nothing	2	
		Ant other (Indicate)	3	
71	What is the safe way of keeping food handling tools and equipment Kodi njira yabwino ndi iti yosamalira ziwiya za zakudya	Kept in covered containers	1	
		Kept high at 60 cm above the ground	2	
		Washed with disinfectants like soap	3	
		Avoid using dish clothes	4	
72	What is the safe way of transporting ready to eat foods Kodi njira yabwino yonyamulira zakudya zdyeratu pompo zokaguitsa kunsika ndi yotani			
73	What are the safety requirements of a food stall Kodi malo kapena kanyumba pomwe pamagulitsidwa zakudya payenela kukhala potani	Have a hand wash station set up	1	
		Keep food on display covered to prevent contamination from customers, flies, etc.	2	

		Any area for preparation or cooking set at least 60 cm above the floor	3	
		Ensure essential services are in place as necessary, adequate lighting, ventilation	4	
		Potable water available at point of use	5	
		Made of material easy to clean	6	
74	What are the requirements of a food handler? Kodi munthu ogulitsa zakudtdya ayenela kuchita ndi kukhala wotani	Wear clean clothes with sleeves	1	
		Wear aprons	2	
		Hair covered	3	
		No decorated hands	4	
		Short Clean nails. Not coated.	5	
		Use forceps or ladles to pick up ready-to-eat food	6	
		No communicable disease	7	
		Medical check up	8	
		Regularly wash your hands	9	
		Don't handle money and then handle food - have different people doing different roles if possible	10	
		Do not eat while preparing food	11	
75	Have you ever heard about medical checkup of a food handler? Fill in Yes if they already ticked about checkup.	Yes	1	
		No	2	
		Keep food on display covered to prevent	2	

	Kodi munayamba mwamvap kuti aliyense ogulitsa zakudya ayenela kukapimidwa kuchipatala kuti aone ngati alibe matenda opatsilana	contamination from customers, flies, etc.		
		Any area for preparation or cooking set at least 60 cm above the floor	3	
		Ensure essential services are in place as necessary, adequate lighting, ventilation	4	
		Potable water available at point of use	5	
		Made of material easy to clean	6	
<i>Food Handlers – be clear that this section should only be answered by food handlers</i>				
76	Have you ever gone for medical check-up? Munayambba mwayezetsapo matenda okhudza anthu ogwira ntchito ya zakudya	Yes	1	
		No	2	Q65
77	When did you last go for check up Munakayezetsa komaliza liti	< 3 months ago	1	
		> 3 months ago	2	
78	At what interval do you go for medial check up Kodi mumakayezetsa pakapita miyezi ingati	Once every three months	1	
		Once every six months	2	
		Once a year	3	
79	Have you ever been trained in food safety and hygiene Kodi mwaphunzirapo za maphunziro a ukhondo wa zakudya	Yes	1	66
		No	2	
80	Who trained you Anakuphunzitsani ndani zaukhondo wa zakudya za pansika.	NGO workers	1	
		Government workers	2	
		Others (indicate)....	3	

81	What did you learn during the training Kodi munaphunzirako zotani kumaphunzirako	Hand washing	1	
		Food safety and hygiene	2	
		Cross contamination	3	
		Waste management	4	
82	Do you put in practice what you learnt during the training Kodi mumapanga zomwe munaphunzirazo	Yes	2	
		No	3	70
83	If yes, what are you putting in practice now Ndiziti zomwe mumapanga	Hand washing	1	
		Food safety and hygiene	2	
		Cross contamination	3	
		Waste management	4	
		None		
84	If No, Why not Ngati simupanga, ndichifukwa chiyani	I Can't do it alone	1	
		Forgot what I learnt	2	
		No reason	3	

Thank you for sparing your time to provide this information. The results will be documented and shared with all stakeholders. I hope that you will do the same next time to me and others. Good luck.

Appendix 4. Key Informant interview Questionnaire

Consent form for Key Informants

My name is **Laston Kamwana** from University of Malawi, The Polytechnic. I am conducting a study on the impact of food safety, hygiene and sanitation interventions in food markets here in Chikwawa. I am very interested to hear your valuable opinion on the status of our market in ensuring provision of safe food to consumers.

- I understand how important it is that this information is kept private and confidential, as such I would like to assure you that the information you give will be completely confidential, and I will not associate your name with your thoughts, opinions, and ideas you give.
- Feel free to give me as much information as possible. You may refuse to answer any question or withdraw from the study at any time.
- If you have any questions, you can always contact a study team member like me, or you can call the Dean of Postgraduate studies at the Polytechnic using phone numbers at the bottom of this form.

I therefore ask you to sign below to show that you agree to take part in this interview:

Designation	Name	Signature/Thumb Print	Date	Contact Number
Interviewee				
Interviewer				
Dean				

NOTE: Make sure that you proceed with the interview only after the respondent has given consent by signing above

Thank you for your time.

Date.....2016

Questionnaire No.....

No	Question / Instruction	Response
1	Market	Bereu 1 Dembo 2
2	Type of Respondent	Market Master 1 Councillor 2 Head of Department 3 Ext Worker 4
Availability and accessibility of Sanitation facilities		
3	What sanitation facilities are available at the food markets (Record all mentioned)	
4	Are these facilities enough (Indicate for each given)	
5	Which ones are not enough	
6	How are the sanitation facilities being taken care?	
7	Who is responsible for taking care of these facilities	
8	Are there any problems being faced concerning sanitation facilities	
9	What do you think can be done to solve such problems	
10	What do you think can be done to ensure proper care and management of these facilities	
Participation of stakeholders if food safety at the market		
12	Who is responsible for taking care of the market	
13	Which sectors both Government and non-governmental sectors help in food safety at the market	
14	What food safety activities do they do at the market	
Coordination of stakeholders in food safety at the market		

15	Which sectors or departments work together in food safety and hygiene activities at the market	
16	Which food safety activities do these sectors work together	
17	Why do you think makes them not to work together in food safety activities	
18	What can be done to ensure that they work together	
	<i>Safe food handling practices in the markets</i>	
19	What can you say about the way food items are transported to markets in relation to food safety?	Fresh food
		Ready to eat foods
		Cereals
20	What can you say on the way food items are stored in markets	Fresh food
		Ready to eat foods
		Cereals
21	What can you say on the way potentially hazardous foods that require to be kept under cold conditions stored (at 5°C or below or 60°C or above) are stored.eg Milk, meat, fresh fish, juices	
22	What is your comment on the way food is displayed for sale in markets in relation to food safety	
23	What do you think can be done to ensure food safety in the following areas	Food preparation Food transportation Food storage Food display
24	What is can you say about hand washing among vendors in markets	
	Knowledge on food safety (record all responses)	
25	Which food commodities require strict safety measures	

26	How can food commodities be contaminated at the market.	
27	How can food be protected from contamination at the market	
28	How can we ensure that food handlers do not contaminate food?	
29	Can you explain the critical times when a vendor has to wash hands?	
30	Are food handlers medical checks important- Explain	
31	What are the critical times for hand washing for food handlers.in markets	
32	Who is responsible for ensuring food safety in markets (List all mentioned)	
33	What is the role of the following stakeholders if ensuring FSH	
	Market committee	
	Local leader	
	Councillor	
	NGO	
	HOD	
	Extension workers	
	Health:	
	Agriculture/veterinary:	
	NGO	
	Trade:	
	Heads of Departments	
	Health:	
	Agriculture/veterinary	
NGO		
Trade		

34	What do you think can be done to ensure food safety at the market in the following areas	Toilets
		Water
		Stalls
		Waste disposal
		Food display
		Food storage
		Ready to eat foods
35	What is the biggest challenge in managing the market?	
36	Finally, What is the most important food safety issue at your market?	

Thank you for sparing your time to provide this information. The results will be documented and shared with all stakeholders. I hope that you will do the same next time to me and others. Good luck.

Appendix 5. Focus Group Discussion Guide

1. Welcome

Introduce yourself and the note taker, and send the Sign-In Sheet with a few quick demographic questions (age, gender, position) around to the group while you are introducing the focus group.

Review the following:

- Who we are and what we're trying to do
- What will be done with this information
- Why we asked you to participate

2. Explanation of the process

Ask the group if anyone has participated in a focus group before. Explain that focus groups are being used more and more often in health and human services research.

About focus groups

- We learn from you (positive and negative)
- Not trying to achieve consensus, we're gathering information
- No virtue in long lists: we're looking for priorities
- In this project, we are doing both questionnaires and focus group discussions. The reason for using both of these tools is that we can get more in-depth information from a smaller group of people in focus groups. This allows us to understand the context behind the answers given in the written survey and helps us explore topics in more detail than we can do in a written survey.

Logistics

- Focus group will last about one hour
- Feel free to move around
- Help yourself to refreshments

3. Ground Rules

Ask the group to suggest some ground rules. After they brainstorm some, make sure the following are on the list.

- Everyone should participate.
- Information provided in the focus group must be kept confidential
- Stay with the group and please don't have side conversations
- Turn off cell phones if possible
- Have fun

4. Turn on Tape Recorder

5. Ask the group if there are any questions before we get started, and address those questions.

6. Introductions

Go around table:

Discussion begins, make sure to give people time to think before answering the questions and don't move too quickly. Use the probes to make sure that all issues are addressed, but move on when you feel you are starting to hear repetitive information.

Consent form for Focus Group Discussion

Facilitator/Moderator: _____ Note taker: _____ Date _____ 2016

Type of Group: Market Committees 1 Village Development Committee 2
 Village Headmen 3

My name is **Laston Kamwana** and my colleagues are From University of Malawi, The Polytechnic. We are conducting a study on the impact of food safety, hygiene and sanitation interventions in food markets here in Chikwawa. We are very interested to hear your valuable opinion on the status of our market in ensuring provision of safe food to consumers.

- We understand how important it is that this information is kept private and confidential, as such I would like to assure you that the information you give is completely confidential, and will not associate your name with your thoughts, opinions, and ideas you give.
- We would like to record our discussions so that we can make sure to capture the thoughts, opinions, and ideas we hear from the group. No names will be attached to the focus groups and the tapes will be destroyed as soon as they are transcribed.
- Feel free to give as much information as possible. You may refuse to answer any question or withdraw from the study at any time.

I therefore ask you to sign below to show that you agree to take part in this discussion

No	Name	Age	Gender	Position	Signature/Thumb Print	Contact Number
1			M F			
2			M F			
3			M F			
4			M F			
5			M F			
6			M F			
7			M F			
8			M F			
9			M F			

10			M	F			
11			M	F			
12			M	F			

NOTE: Make sure that you proceed with the interview only after the respondent has given consent by signing above

Thank you for your time.

Focus Group Discussion Guide

No	Topic	Notes
1	Introductory questions about Healthy Food Markets	
	May you tell more about the genesis of this market	
	Please tell us about the importance of this Healthy Food Markets to the community	
	Can you give the commodities that are sold at our market	
	What kind of foods are sold at our market	
Main Questions		
2	Level of sanitation	
3	What sanitation facilities are available at the market	
4	Are you satisfied with the sanitation facilities available at the market	Number Men & Women segregation Distance Responsibility Management
5	What do you think can be done to the sanitation facilities to ensure food safety?	
6	What are some of the things that aren't good about the sanitation facilities?	
7	What improvements can be done to ensure good that there is enough toilets that are safe and accessible by everybody?	Enough Accessible Safe and clean
Participation of stakeholders in food safety		
8	Which departments, sectors, organisations take part in food safety and hygiene at the market	
9	What are the activities that these institutions/organisations perform in ensuring food safety in markets	
10	What is the role of each of the institutions and organisations mentioned	

Let us now discuss issues of Coordination of Stakeholders in Market FSH activities		
11	How do the different institutions/departments work?	
12	Which activities do they work together	
13	Are there problems that make them fail to work together	
14	What do you think can be done to enable institutions/departments work together in Food safety issues at the market?	
<i>Now we will discuss about Safe food handling practices in our market</i>		
15	Can you explain how ready to eat food items are prepared at home or at the market in relation to food safety	
16	What can you say about the safety of food items considering the containers used for food items	Cleanliness Covering
17	Can you explain about the way food items are stored to ensure food safety	Fresh foods Cereals Milk / meat
18	What can you say on the way food items are stored in markets ready for sale in relation to food safety	Fresh food
		Ready to eat foods
		Cereals
19	What can you say on the way potentially hazardous foods that require to be kept under cold conditions stored (at 5°C or below or 60°C or above) are stored.eg Milk, meat, fresh fish, juices	
20	What is your comment on the way food is displayed for sale in markets in relation to food safety	
21	What do you think can be done to ensure food safety in the following areas	Food preparation Food transportation Food storage Food display
22	What can you say about hand washing among vendors in markets	
We would like now to discuss with you on any knowledge you have on food safety (record all responses)		
23	Which food commodities require strict safety measures	

24	How can food commodities be contaminated at the market.	
25	How can food be protected from contamination at the market	
26	How can we ensure that food handlers do not contaminate food?	
27	Can you explain the critical times a vendor has to wash hands?	
28	Are food handlers medical checks important-Explain	
29	What are the critical times food handlers should wash hands	
30	Who is responsible for ensuring food safety in markets (List all mentioned)	
31	What is the role of the following stakeholders in ensuring FSH	Market committee
		Local Leader
		Councilor
		NGO
		Health:
		Agriculture/veterinary:
		Trade:
		Heads of Departments
32	What do you think can be done to ensure food safety at the market in the following areas	Toilets
		Water
		Stalls
		Waste disposal
		Food display
		Food storage
		Ready to eat foods
33	Finally, What is the most important food safety issue at your market?	

Thank you so much

Appendix 6. Observation Checklist

Name of Market.....Name of Observer..... Date:.....2016

No	Variable to be observed	Variable to be Observed	Remark(s)
	<i>Hygiene and sanitation</i>		
1	Waste bins	Availability Location Covering Emptying	
2	Food covering		
3	Food display and placement		
4	Tap/Borehole condition	Apron Drainage Soak away Sanitation	
5	Drainage system		
6	Pit latrine condition	Roof Floor Door Security Privacy Sanitation	
7	Cleanliness of selling yards		

8	Waste dumping site	Location Condition Management	
9	Personal hygiene of food handlers-	Dressing Body	
10	Smocking, eating or drinking behavior of vendors		
11	Condition of stalls	Roofing Wall Floor Benches	
	<i>Food handling Practices</i>		
12	Hand washing	Source of water Use of soap Utensils used	
13	Cutting meat, fish, and vegetables on the same cutting board surface		
14	Cleaning and sanitizing of equipment and utensils used for handling food		
15	Handling of ready to eat foods i.e. use of hands, tongs, forks, spoons		
16	Food storage rooms	Roof Wall Floor	
17	Food display in shops and stalls	Separation food and nonfood items Covering	

		Shelves cleanliness	
18	Food selling containers	Covering Cleanliness	
19	Food cooking/frying equipment		
20	Food serving containers/materials		
21	Food packaging materials		
22	Benches	Height Cleanliness	
23	Market surrounding		
24	Abattoir	Drainage Walls Roof Floor	
25	Refrigerators	Food lay out Cleanliness Temperature control	