INFLUENCE OF KNOWLEDGE ON HYGIENE PRACTICES OF HANDLERS' OF READY TO EAT FOODS IN MATHARI SLUM, NAIROBI, KENYA.

BY

MURENGA CASTINE DAVE

EL/ESM/00601/2013

THESIS IS SUBMITTED IN PARTIAL FULFILMENT FOR THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS IN PUBLIC HEALTH (EPIDEMIOLOGY AND POPULATION HEALTH).

DEPARTMENT OF PUBLIC HEALTH

SCHOOL OF PUBLIC HEALTH AND COMMUNITY DEVELOPMENT

MASENO UNIVERSITY

August, 2021

DECLARATION

I hereby declare that this thesis work is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Murenga Castine Dave

EL/ESM/00601/2013 Sign……Date:……..

Supervisors

Dr. Agatha Christine Onyango, PhD. Sign……..**.....**Date…….

Department of Nutrition and Health, Maseno University.

Prof. Mohammed Karama. Sign……Date:……...

Deputy Vice Chancellor Academic Research and Student Affairs, Umma University.

ABSTRACT

Urbanization has been on the rise in developing countries, giving rise to slums. Nevertheless, there has been mushrooming of Ready to Eat food joints in the slums and their dependency in Kenya. Additionally, unhygienic handling and trading practices does not assure delivery of safe food to consumers hence these foods pose a major public health hazard as they are associated with foodborne illnesses. While most studies have documented the socio-economic importance and quality of street foods sold in urban centers, there is paucity of information on the knowledge and hygiene practices of the food handlers involved in Ready to Eat (RTE) foods sold in slums of Nairobi. Therefore, the current study objective was to assess the influence of knowledge on hygiene practices among RTE food handlers in Mathari. Specifically assessing food handler's hygiene practices, knowledge and the association of the food handler's knowledge and hygiene practices. A descriptive cross-sectional study was conducted among 180 respondents selected by multistage sampling from a population of 287 in Mathari 14 villages. Data was collected using a semi-structured questionnaire and observation checklist. This study established that the street food business in Mathari is female dominated (76%). Also poor hygienic practices exist among street food vendors in Mathari during food preparation and sale. The food handlers' knowledge was "good" with a mean percentage score of 54%. They also demonstrated knowledge of contamination during preparation at 84%. Most of the vendors were willing to be trained in food safety and hygiene (82%).Chi square test indicated that there was a significant relationship between the levels of knowledge and the food hygiene practices at 0.01 level of significance (P-value <0.01). From the logistic regression analysis, a significant positive relation was observed between knowledge with practices having (OR =3.75, $P < 0.05$) for those who 'always practice', (OR =2.34, $P < 0.05$) for those who 'occasionally practice' depicting that the food handlers' knowledge on food hygiene affects food handler's practices. It can be anticipated that as knowledge will increase, practice will improve accordingly. Street food vendors in Mathari slums generally have "good" knowledge level on food hygiene issues but however do not translate this knowledge into practice, which could result in outbreaks of foodborne illnesses. Therefore, raising food safety knowledge among food handlers should be prioritized. This can be done through training programmes. Additionally, licensing and maintaining supervision should be mandated.

ACKNOWLEDGMENT

At the outset, I would like to express my sincerest appreciation to the Almighty God for the continuous blessings that He provides. The strength and perseverance to be able to carry out this research study positively and complete this study. To Him be all glory, wisdom and honor.

I would like to thank my family for their indispensable role in assisting to make this study a success. My wife Brenda Siganga and son Aviel Mulongo, my parents Mr. and Mrs. Hezron and Emily Mulongo, siblings; Dr. Mike Mulongo, Harriet Wandeyi, Cyrus Festus and Emmanuel Asa.

The completion of this study would not have been possible without the support and assistance of several people. I would like to acknowledge my supervisor Dr. Agatha Christine Onyango for her valuable support, contribution and assistance all the way. You have not only been a great supervisor, but a source of help and encouragement to me. I would like to extend my sincere thanks to my co-supervisor Professor Mohammed Karama, I feel immensely indebted to him for not only showing keen interest in my work and for his meticulous guidance through valuable suggestions and discussions but also being my mentor.

Appreciation is also due to Mr. Edwin Simiyu and Mrs. Nancy Njoki from Muungano wa Wanavijiji and all street food vendors from Mathari involved in the study for their substantial contribution during the data collection for agreeing to participate in this study as without whom, this study would have not have been conceptualized. Finally, I would also like to thank all those who directly or indirectly contributed to my research work including Nairobi City County, Starehe Sub-County Public Health, Mathari community health workers and research assistants.

DEDICATION

This thesis is dedicated to the urban slums RTE Food handlers' and those who strive to improve the health infrastructure and food safety standards in RTE foods in slums.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

DPH	Department of Public Health
FAO	Food and Agriculture Organization
FBD	Food Borne Disease
FERG	Foodborne Disease Burden Epidemiology Reference Group
HACCP	Hazard analysis critical control point
ICMSF	International Commission on Microbiological Specifications for Foods
MOH	Ministry of Health
RTE	Ready to Eat food
SDG	Sustainable Development Goals
WHO	World Health Organization
UA	Urban Agriculture

OPERATIONAL DEFINITION OF TERMS

Food handlers: Anyone who handles packaged or unpackaged food directly as well as the equipment and utensils used to prepare or serve food and/or surfaces that come into contact with food.

Street foods: Are ready-to-eat foods and beverages that are prepared and/or sold by itinerant or stationary vendors, especially on streets and in other public places. Street foods, according to refer to foods and beverages prepared or sold by vendors on the streets and other public places for immediate consumption or consumption at a later time without further processing or preparation. Some local examples of RTE foods include the following: meats (deli meats, sausages, smokies, *mutura*), poultry (chicken pie, deli cuts), dairy products (yogurt, *mala*, pasteurized milk), fruits and vegetables (salads and leafy greens, sukuma wiki, juices), and fish (cold smoked fish, fillet, deep fried fish). Some frozen foods can be included among RTE foods, for example, ice cream and smoothies. Other non-refrigerated RTE foods include products such as breads, *githeri*, chapati, nuts, peanut butter, maize (roasted and boiled), and some snack items.

Ready-to-eat foods: Street foods are foods and beverages that are prepared and/or sold by itinerant or stationary vendors, especially on streets and in other public places.

Slums: An area or settlement of some scale which to varying degrees lacks a combination of the these following conditions; access to improved water, access to improved sanitation, structural quality/durability of dwelling, sufficient living space that is not overcrowded and security of tenure.

Socio-demographic factors: These include gender, age, residence, registration, education level, source of income.

Toilets: This word will be used in this study to refer to any system that promotes proper disposal of human waste, proper use of toilets and avoiding open space defecation

Water availability: Is the availability of clean potable water within a distance of not more than 200m of the vending site and a maximum of water fetching round trip of 15 minutes

Hygiene practices: This word has been used in this document to include handwashing, clean surfaces, cooking, proper separation of raw and cooked foods and proper waste disposal.

Waste disposal facilities: Sanitary disposal bins have been used to refer to containers or pits in which vendors dispose of their refuse.

Knowledge: This word refers to food-handlers who are knowledgeable about hygiene practices and procedures.

Implementation: It refers to the process of putting in place resources and strategies towards achieving the desired level of hygiene.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In recent times in history, more than half the world's population lives in urban areas and over 90% of urbanization is taking place in the developing world (Henderson, Roberts, & Storeygard, 2013). Additionally, the urban population is predicted to double from 3.3 Billion in 2007 to 6.4 billion in 2050. Urbanization "population overload" brings along its strain to the urban populations which include risk of hunger, thirst and growth of slums (UN-Hábitat, 2010). It is believed that currently one-third of urban dwellers, which is about one billion people, live in the slums without access to adequate food, water or sanitation. In sub-Saharan Africa, many cities have slums which account for three-quarters of urban residents (Hoornweg and Munro-Faure, 2008). In Kenya, 56% of urban residents lived in slums, totaling 6.4 million slum-dwellers (United Nations Human Settlements Programme, 2016). Most urban poor have to rely on the informal sector and unstable occasional work jobs for their survival. In developing countries, where food purchases make up 60-80% of total household expenditure, volatile food prices greatly affect the ability of the urban poor to put food on the table (Gustafson, 2013; The Kenya Food Security Steering Group , 2008). Surveys in Mathari, found that food comprised 47% of households' mean monthly expenditures, far exceeding 11% for transport, 11% for school, and 8% for rent (Owuor, Brown, Crush, Frayne, & Wagner, 2017; Support Trust, 2012). This sets the stage for street food which is deemed easily accessible, diverse, cheaper, and instant (Barro et al., 2007; Mensah et al., 2012; Mwamakamba et al., 2012).

In Kenya, street vendors are a sub sector of the Micro and Small Enterprises (MSE) that dominate the Kenyan economy (*Kenya Economic Report 2017 Popular Version*, 2017). A

number of entrepreneurs have entered the trade as an option, especially since the beginning of the Structural Adjustment Programmes (SAPs) that resulted in the retrenchment of civil servants across Africa. In the year 2002 alone, the SME sector employed about 5,086,400 people up from 4,624,400 in 2001. This was an increase of 462,000 persons and consisted of 74.2 percent of total national employment (World Bank Report, 2016).

The street food industry is a million-dollar sector. Street food vending in Nairobi is widespread especially among the urban poor and its growth reflects trends in economic and urban population growth. Its importance is far from being marginalized, since as along with other street vending they contribute approximately 10 - 20% of the country's Gross Domestic Product (GDP) (Mwangi et al., 2010; Schlegel & Racaud, 2016). They provide direct employment for both men and women with low skills and little or no education especially in the urban and peri-urban parts of the country. The sector also provides ready market for both urban and rural food producers as there are purchases of inputs such as vegetables, tubers, fruits, etc., from farmers (FAO, 2009; Odundo, Okemo, & Chege, 2018).

Street food vending in urban areas especially in urban slums has become an integral part of the urban lives and culture, considering its socio-economic importance to the population albeit the associated health risks. Consequently, this poses the foods as a major public health risk (Kuria, 2005; WHO, 2009). Food handlers may struggle to ensure the safety of food, sometimes due to unhygienic practices or other factors beyond their control leading to food contamination.

According to WHO (2010), the food handling personnel play an important role in ensuring food safety throughout the chain of food production and storage. Diarrheal diseases due to

contaminated and unhygienic food are among the leading causes of illness and deaths in low-income countries, and several outbreaks of disease have been attributed to the consumption of street food (P. Mensah, Yeboah-Manu, Owusu-Darko, & Ablordey, 2002; WHO & INFOSAN, 2010). Food borne diseases are an important cause of morbidity and mortality worldwide with significant public health impact. The global burden of food borne diseases in 2010 was 33 million healthy life years lost (disability-adjusted life years or DALYs) with about 600 million food borne illnesses and 420,000 deaths, of which food borne diarrheal diseases, the most frequent cause of food borne illnesses, contributed about 230,000 deaths (WHO,2015).

In 2016, some counties in Kenya including Kisii, Malindi, and Nairobi had to ban selling of street food due to the outbreak of cholera, which was attributed to the street food (Cowman et al., 2017). Ministry of health in Kenya reported 12 counties with active cholera outbreaks, 6 counties Nairobi, Migori, Nakuru, Siaya, Wajir and Busia reported case fatality rates greater than 1%. Nairobi had over 5 waves of cholera outbreak. Community health practitioners in Nairobi had earlier noted that top diseases in Nairobi were hygiene related (Mutonga et al., 2013). Evidently, because of overcrowding and high 'insanitation-concentration', urban-slums could act as reservoirs and fountainheads of infectious outbreaks such as cholera, which will not necessarily be confined to urban slum populations alone. The concentration of microbial contamination could frequently exceed the critical levels needed for epidemic outbreaks, which is consequently a risk to the whole population (World Health Organization & Skovgaard, 2008).

Although many studies have been done to assess the contribution of street foods to food security, past interventions narrowly target food availability and production, especially urban agriculture

(UA), despite only limited evidence of UA's role in enhancing food security (Battersby et al., 2014; Poulsen et al., 2015). Further, studies have also addressed safety of street foods and in comparison to developed countries. While the links between socio-economic benefits of the street foods are well documented, the disproportionate and overlapping foodborne diseases, unhygienic practices and knowledge are rarely captured together for the food handlers living in urban slums including Mathari. There is high child and infant mortality as well as disease prevalence, unemployment and poverty rates exhibited in slums compared to the rest of the other population subgroups, including rural residents in Kenya (Mberu, Mumah, Kabiru, & Brinton, 2013.). Building on the backdrop of the foregoing discussion and in the context of the foodborne diseases being and important cause of morbidity and mortality but the full extent and burden of unsafe food has been unknown (Ombui, Kagiko, & Arimi, 2001; WHO, 2015). Nevertheless, street food handlers in Mathari, knowledge and hygienic practices are not well documented.

1.2 Statement of the Problem

Street food has proven important in many aspects in the lives of the urban population including Mathari. Street food is often considered unhygienic and low in quality partly due to the poor environmental conditions under which it is prepared or sold, and also due to the lack of adequate knowledge on food hygiene practices by people involved in the street food business. Unhygienic street food is associated with the outbreak of serious food borne diseases in most parts of the world.

Studies in Kenya have found street foods to be a source of cholera due to their poor handling and sanitation conditions. In 2016, Nairobi endured a cholera epidemic and the disease became

endemic in the country, spreading to 11 out of the 47 counties, forcing the government to intensify surveillance and public awareness to halt further infections.

Given the above background, there is absence of research on the contribution of food handlers' knowledge and hygiene practices to food safety of RTE foods in urban informal settlements including Mathari slums. Therefore, poor knowledge and unhygienic practices play major roles in the increased burden of communicable diseases within developing countries. This study evaluated the knowledge, practices and their association among street food handlers in Mathari, Kenya.

1.3 Overall Objective

To assess the influence of knowledge on hygiene practices of food handlers' in ready to eat foods in Mathari slums, Nairobi, Kenya.

1.3.1 Specific objectives

1. To assess the food handlers' knowledge on hygiene practices in RTE foods in Mathari slums.
2. To establish the hygiene practices among the food handlers selling RTE foods in Mathari slums.
3. To establish the association between food hygiene knowledge and handling practices.

1.4 Research Questions

1. What is the food handlers' knowledge on hygiene practices in RTE foods in Mathari slums?
2. What are the hygiene practices among the food handlers' selling RTE foods in Mathari slums?
3. What is the association between food hygiene knowledge and handling practices?

1.5 Justification of the Study

Street food vending has demonstrated to be an essential component of the informal sector in developing countries due to its socioeconomic benefits among others. As such its continuous existence and improvement in terms of safety and quality is considered necessary. This important activity is perceived as an urban phenomenon in most developing countries.(Henderson et al., 2013; Odundo et al., 2018).

Food handlers play an important role and can be an entry point to improve food safety (IIED, 2014; World Health Organization, 2009). The food hygiene knowledge and practices of food handlers have always been a cause for concern over the years due to high incidences of foodborne disease outbreaks (van Seventer & Hamer, 2016; World Health Organization & Skovgaard, 2008). Studies have also shown evidence that the food handlers of RTE foods have also contributed to cause outbreaks of foodborne diseases worldwide (World Health Organization & Skovgaard, 2008; Zawide, 2009). It is in this view that this study sought to find the knowledge and the related hygiene practices of the food handlers in Mathari slums. This study will therefore provide information on the RTE food handlers' knowledge associated with hygiene practices in Mathari slums, Nairobi, Kenya. The information obtained can be utilized as

a basis for further research on the level of food safety knowledge and hygiene practices in urban slums. It will also be helpful in informing the interventions and guidelines that will empower food handlers to take greater responsibility for the preparation of safe food in slum populations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Street foods are ready-to-eat foods and beverages prepared and/or sold by vendors or hawkers especially in the streets and other similar places. They represent a significant part of urban food consumption for millions of low-and-middle-income consumers, in urban areas on a daily basis.(FAO, 2009a; Roever & Skinner, 2016). In Africa, the street food phenomenon has burgeoned in the past few decades because of rural outmigration and urban population growth. This is also occasioned by the need for affordable food, unemployment and dwindling economy. (Havelaar et al., 2015; Henderson et al., 2013; Mwangi et al., 2010).

Street food serves the rapidly growing and changing food demands by the urban dwellers needing cheaper food in the face of a harsh economy, also providing outlets for urban and peri-urban agricultural producers and local food processors, thus contributing to nutritional needs and local and national economic growth. Thereby also securing access to food for the residents of low-income settlements in many cities, including Mathari (FAO, 2009; Henderson et al., 2013; J. O. Mensah, Aidoo, & Teye, 2013; Ploeg et al., 2009).

2.2 Emergence of Street Food Vending in Developing Countries

Street foods have become an indispensable component of the socio-economic environment of many cities in developing countries. Their nutritional and economic significance to urban populations is considerable (FAO, 2009; Muinde & Kuria, 2005; Van Staveren et al., 2001). The sector tends to attract people with low skills, training and educational qualification who could otherwise not get formal sector employment in most emerging economies. Low set-up financial

requirements and ease of entry into the sector enable most urban and peri-urban poor to enter into the sector as a coping strategy (FAO, 2009).

Street food vending is prevalent in developing countries, most especially Latin America, Asia and Africa. It belongs to an informal food supply sector characterized with highly unregulated practices (Alimi & Workneh, 2016). In Nairobi, the vending of street foods increased substantially during the 1980s and 1990s, particularly in the low income and in the industrial areas (Oiye & Oyunga-Ogubi, 2009) . More recently, due to the increase in urban populations and food insecurity, the number of street food vendors/hawkers has risen greatly in response to the need to feed larger populations. This has been heightened by the daily movement from residential areas to working places that has created a need among many working people to eat outside the home more often (Oiye & Oyunga-Ogubi, 2009; Schlegel & Racaud, 2016). Further, to address food insecurity, a study in Nairobi by Kimani-Murage et al., (2014) found that most slum dwellers resort to reducing the number of meals, reducing food variety and quality, scavenging and eating street foods as a coping mechanism. Therefore, street food vending and consumption is growing with increasing urban population. The foods, notably, need improvement in terms of variety and nutrient harmonization (Mwangi et al., 2010).

2.3 Regulation of Street Food Vending in Kenya

Street food vending falls in the informal sector category in Kenya. According to a study by ILO and World bank (Ina Pietschmann, Steven Kapsos, 2016) informal sector employs one half to three quarters of non-agricultural employment in developing countries. Regional and country differences are significant but growing importance of informal sector has been registered. WIEGO, 2013 study further posits that street food vending is the world's largest growing sector.

The informal sector, which is often a significant producer and distributor of fresh and processed food products including street foods for direct consumption, is often outside the scope of official control systems and remains the least controlled, except by municipal environmental hygiene authorities(FAO/WHO, 2005).

Due to the informal nature of these businesses, compliance with food laws including registration as well as the enforcement of the same may not always be possible. Thus, the hygiene practices as well as the vending environments may be compromised with the possibility of foodborne diseases posing public health risks to the consumers of these foods (FAO, 2016; Malhotra, 2016).

2.3.1 Food Safety Laws in Kenya

Kenya is deficient of a distinct and published policy for food safety. However, separate laws have been put in place to safeguard the consumers. The primary food safety laws are the Food, Drugs and Chemical Substances Act, Chapter 254; The Public Health Act, Chapter 242 and The Meat Control Act, Cap 356. These laws oversee the activities by the various agencies concerned in food safety management through the Department of Public Health (DPH)(Government of Kenya, 2012).

The Public Health Act Chapter 242 gives authority to the local government to put in force food safety and environmental sanitation guidelines (Government of Kenya, 2012). Proper implementation of food safety laws is vital to reduce the outbreak of food-borne diseases and hence minimize the pressure on healthcare providers. Moreover, it enhances economic growth

and food security by promoting tourism and foreign trade. There is a very strong link between the health of a nation and its economic progress (FAO, 2009a; Havelaar et al., 2015).

2.3.2 Street Foods Legislation and Nairobi County Bylaws

Street food vending is a relatively recent phenomenon. Many African countries including Kenya, have realized that their existing food legislation does not adequately address the new challenges brought about by street food vending (Alimi & Workneh, 2016; Cortese, Veiros, Feldman, & Cavalli, 2016; Kimani-Murage et al., 2014).

Studies have shown that urban policies and regulations are biased against street vending which deter street vendors from efficiently performing their business (Horn & Macleod, 2015; Muiruri, 2010). When starting a food business, there are trade and health regulations to be implemented. These regulations include but not limited to acquisition of trading license and a medical certificate. Further, according to Nairobi City Revenue Act, 2015; all persons carrying or handling food must have medical certificates and permit. These payable to the county and may be revised from time to time after inspection by the Sub County Public Health Officer (Nairobi City County Revenue Act, 2015).

The trading license and permits are a source of revenue for Nairobi County but also served as a formal recognition of existence of the business (The Nairobi City County Revenue Act, 2015). With the advent of liberalization, there were pressures to de-regulate, thus eliminate licensing requirements for the informal economy, and to replace this with a system of permitting, but regulating, all informal trade. The regulation of informal trade is now more often done by authorities in charge of certain locations who issue permits to trade in particular areas (Horn &

Macleod, 2015). The medical certificates were mandatory for food handlers because food processing has a health risk. If food was not well prepared, it could lead to health problems, as unhygienic handling of food served to the public could lead to food related epidemics or mass poisoning. This study sought to determine whether the street food vending businesses in Mathari are registered.

Furthermore, Street food vending activities in most developing countries are mostly outside the regulation and protection of the governments. The economic importance of the activities is not well appreciated due to the informal nature of the enterprise and lack of official data on volume of trade involved (Alimi, 2016). Food control authorities have tried to deal with this issue by forcefully removing vendors from the streets, which has been met with a lot of resistance. Further work must be carried out in African countries under a common action plan. This also should be backed by concrete policy plans at the national government level (FAO/WHO, 2005; Muinde & Kuria, 2005; Mwangi et al., 2010).

2.3.3 Approach to Food Safety

Street foods are considered to be a major public health risk due to the fact that the operations tend to lack basic infrastructure and services, difficulties in monitoring and law enforcement, difficulty in controlling due to not only the large numbers of street food vending operations but also because of their diversity, mobility and temporary nature (Ghosh et al, 2007).

Foodborne diseases continue to be significant causes of morbidity and mortality within the African Region (World Health Organization., 2015). Many cases of foodborne disease occur due to basic errors in food preparation or handling either in food service establishments or at home.

Educating food handlers, therefore, can significantly reduce the chances of contracting food-borne illnesses and the effects of outbreaks, as well as improve public health (Egan et al., 2007). Food safety education programs need to particularly target certain segments of the population who, either directly have a role in food preparation and/or have increased vulnerability to foodborne diseases (Mwangi et al., 2010). Some programs include Hazard Analysis and Critical Control Points (HACCP) and WHO's five keys to safer food.

In response to the increasing need to educate food handlers, including consumers about their responsibilities for assuring the safety of food, the World Health Organization (WHO) initiated a health promotion campaign around five simple rules, "the five keys to safer food" to help ensure food safety during food handling and preparation. The core messages of the WHO five keys to safer food are: keep clean; separate raw and cooked; cook thoroughly; keep food at safe temperatures; and use safe water and raw materials. These messages have been adapted to different target audiences and settings including street vended foods (FAO, 2005b).

On the other hand, Hazard Analysis and Critical Control Points (HACCP) system is recognized by the Codex Alimentarius Commission as the most cost-effective approach for assuring food safety at all stages of the food supply(Codex Alimentarius Commission, 2003). The HACCP system consists of seven principal activities which should be considered during the HACCP process, but in implementing the process, each step should be applied in a manner consistent with the needs and resources of the business. HACCP enables the systematic identification of potential hazards and their control measures and permit a distinction between control measures related to aesthetics and environmental planning and management and those related to critical control points for food safety. HACCP also provides guidance in selection of enforcement and

education priorities, rather than general sanitation and superficial improvements. Additionally, valuable information about food and processes can be obtained, and inspections to verify that the vendors are monitoring the critical control points are more efficient than traditional inspections. Successful HACCP initiatives require the cooperation of all parties involved and the recognition that they each have important roles to play (Cortese et al., 2016; Egan et al., 2007; Nyamari J., 2013). Although the industry is usually given the primary responsibility for the application of HACCP, in the case of street-vended foods the "industry" is comprised of a multitude of individuals who often lack the collective organization and resources to undertake HACCP studies (Mwamakamba et al., 2012; Mwangi et al., 2010). Consequently, governments may need to assume this task, at least until sufficient experience is gained and adequate resources are available for the street vendors to take over. Government authorities at local and municipal levels have the opportunity to provide leadership in improving the safety of street-vended food by assuming this responsibility. Further, a study by Climat, (2013) posited most countries reported that there was insufficient inspection of the personnel, insufficient application of the HACCP concept and noted that registration, training and medical examinations were not part of the management strategies of street vended foods.

2.4 Socio-Demographic Characteristics of the Street Food Vendors

Socio-demographic factors revolve around the life of individuals and characteristics such as gender dimension, age, marital status, educational qualification, occupation, practices of religion, type of family, family size, place of residence and migration status. It is basically a grouping of people by those characteristics (Haorei, 2017). These contexts of people's lives determine their health, and consequently affecting health outcomes (WHO, 2010).

Previous studies of the vendors in developing countries like Ghana, India, Kenya etc. (Ababio & Lovatt, 2015; FAO, 2009a; Muinde & Kuria, 2005; Rane, 2011) have found that in many households both males and females and married and unmarried operate as street food vendors. Their age range is between 25 and 60 years with a majority being in the age group of 30–40 years. Also many street food vendors and their families have their origin in rural backgrounds or have moved to urban centers at a later stage or else live in rural areas and travel daily to the city for their business operations. It was also noted the level of education achieved by the street food vendors is comparatively low and in the case of a majority, education levels varied between grades 5 and 8. Further the studies showed that most street food vendors are constrained by the unstable socioeconomic backgrounds in their families. Employment history of the street food vendors shows their previous involvement in several urban-based, irregular, and low-paid income generating activities, which required hard manual labor, prior to their involvement in the street food business. Their engagement in such activities was not sufficient for their sustenance. The result was that the vendors moved from one work place to another.

2.4.1 Sanitation Concerns of Street Foods

The Street Foods sector is fraught with unwholesome activities which have been reported to pose serious concerns over the safety of the practitioners, especially the health of the consumers (Muyanja *et al*., 2011). These unwholesome activities traversed the whole chain of street food business from agricultural raw materials to the final retail street foods and have been noted in the outbreak of diseases and illnesses (Alimi & Workneh, 2016). The prevention, maintenance and treatment of diseases from street food borne illnesses were reported to result in heavy drain on the purse of individuals and governments in the developing countries due to huge spending

involved. The meager resources that could have been used for infrastructural development are being channeled to treatment of preventable diseases outbreak due to the unwholesome activities.

Previous studies have shown street foods to be a major public health risk due to the fact that the operations tend to lack basic sanitation infrastructure and services, difficulties in monitoring and law enforcement, difficulty in controlling due to not only the large numbers of street food vending operations but also because of their diversity, mobility and temporary nature (Al Mamun & Turin, 2016; Rane, 2011). These aspects were observed with most street food vendors. It probably makes street food the source of most diseases caused by bacteria and other microorganisms (Barro et al., 2002).

2.4.1.1 Availability of Potable Water supply

Water plays a critical role as a raw material in many street-vended operations. Contaminated water can create a public health risk when it is used for drinking, washing, incorporated in the food as an ingredient and used in the processing of food or used for washing equipment, utensils and hands. It is a well-known vehicle for enteropathogens such as *E. coli*, *Salmonella spp*. and *Campylobacter spp*. amongst others (Mensah et al., 2002; Mwamakamba et al., 2012). Most street vendors in urban slums do not have access to potable water and this plays a role in contamination of the RTE foods. The local water supply may not have an acceptable quality, may be in insufficient quantities for drinking, washing, cleaning and other operations. There is also a general scarcity of water in developing countries and tap water is not always available. Some vendors reuse water that has been already used to clean and wash their utensils (Barro et al., 2007; Rane, 2011; Rheinländer et al., 2008).

In recent studies in Ghana, Kenya and South Africa, it was found that most developing countries urban vendors operate in areas with inadequate sanitary amenities no water to wash their hands or their fresh vegetables and no clean place to store their food and their utensils, this further exposes the traders as well as consumers to an endless cycle of risk (Ababio & Lovatt, 2015; Kuria, 2005; Martins, 2016).

2.4.1.2 Availability of Waste disposal

Inadequate waste disposal facilities lead to the accumulation of refuse at food vending sites. This leads to an increased pest population and results in an increased risk of food contamination. Food vending businesses are required to be established where there is efficient waste water and solid disposal. This minimizes chances of contamination of food an or potable water (Codex Alimentarius Commission, 2003; WHO/INFOSAN, 2010).

A study in India, Allahabad city by Gadi, Bala, & Kumar, (2013) shows that inadequate presence or lack of facilities for liquid drainage and wastewater and garbage disposal in slums encourages wastes to be thrown into nearby streets and gutters. Such areas act as habitats for rodents, breeding points for flies and media for growth of microorganisms. All wastes should be properly disposed of. They should not be permitted to accumulate as its presence encourages a further contamination risk for the nearby food vendors as Muinde and Kuria (2005) assert in their study. In many instances, the vending sites are not included within the city or town plans, and therefore amenities such as refuse collection are not available. This contributes to further deterioration of the hygienic condition of the area where the foods are vended (Rane, 2011; Van Staveren et al., 2001).

2.4.1.3 Availability of Toilets

Typically, toilets and lavatory facilities are not readily available which forces the vendors (and sometimes consumers) to use any available nearby area, without washing their hands properly afterwards. These are some of the factors that are responsible for food contamination and rampant outbreaks of faecal-oral bacterial infections in the developing world (Assob et al., 2012). Studies in developing countries have shown, food vending business requires minimum costs to establish (Mensah et al., 2002; Muinde & Kuria, 2005; Rane, 2011). Where, most street food products sold are prepared, handled and processed according to traditional methods with no observance of even minimal sanitary standards (Assob et al., 2012; Kuria, 2005; World Health Organization, 2009).

A study carried out in Abeokuta, Nigeria by Idowu and Rowland, (2006) revealed that 97% of the food vendors were infected with one or more faecal-orally transmissible parasites; parasites observed were: *Entamoeba histolytica* with a prevalence of 72%, *Ascaris lumbricoides* (54%), *Enterobius vermicularis* (27%), *Trichuris trichiura* (24%) and *Giardia duodenalis* (13%). Toilet facilities available to the vendors were mainly pit latrines and other related structures.

2.5 Importance of Street Vended Foods

Street foods plays important roles in securing access to food for low-income consumers, providing income generating activities for poor residents and their overall contribution to the local urban economy and food security (Kimani-Murage et al., 2014; Rheinländer et al., 2008). These foods account for a significant proportion of the daily urban food consumption of millions of low- and middle income consumers. A study in Korogocho and Viwandani slums in Nairobi by Kimani-Murage et al., (2014) found many residents in the slums generally eat for bare survival, with little concern for quality. For many people with limited means and vulnerable to

food insecurity, street foods are often the least expensive and the most accessible way of obtaining a nutritionally balanced meal outside the home, albeit the quality and risks (FAO, 2009a).

In many countries, street foods make an important contribution to employment, household revenue and food security, and help to meet the challenge of feeding urban populations, particularly in developing countries (FAO, 2009; World Bank Report, 2016). Today, local authorities, international organizations and consumer associations are increasingly aware of the socio-economic importance of street food. A study in Ghana, Dhaka by Muzaffar, Huq, & Mallik, (2014) demonstrated how the street vending trade provides employment for the unemployed populations. This scenario is replicated in other developing countries (Grace, 2015b).

In Mathari the informal food web includes food production (urban agriculture and livestock keeping), processing (cooking and packaging of food), retail (selling cooked and uncooked food) and transportation (getting food supplies from markets to the food stalls within the settlement and also positioning stalls so that food is accessible to customers). These entrepreneurial activities provide affordable food, income generating opportunities, autonomy and even security on the streets. (IIED, 2014).

The Street food trade also has its social importance. The food vendors build relationships with regular customers. In Bangkok, this phenomenon was referred to as “clientelization”, the informal relationship that benefits both the food vendors and consumers (Geertz, 1978). In many cases transactions between vendors and consumers emerged out of a relationship of trust, one which assures quality of food and reasonableness of price. Street vendors also offer strong social

networks to ensure security in the settlement community, which further enhances a locally functioning community. This two-way reliance is manifested in strongly ingrained community solidarity (IIED, 2014).

2.5.1 Epidemiology of Street Vended Foods

The numerous advantages offered by street vended foods to food nutrition and security, however, needs to be considered alongside several food safety issues as foods prepared and exposed for sale may become contaminated by pathogenic micro-organisms as well as hazardous chemicals resulting in foodborne diseases. Foodborne disease is caused by consuming contaminated foods or beverages. More than 250 different foodborne hazards have been recognized, including infectious pathogens and noninfectious chemicals and toxins. Most of these diseases are infections, caused by a variety of bacteria, viruses, and parasites that can be foodborne (Hoffmann & Scallan, 2017; van Seventer & Hamer, 2016; WHO & INFOSAN, 2010). Other diseases are poisonings, caused by harmful toxins or chemicals that have contaminated the food. The microbe or toxin enters the body through the gastrointestinal tract, and often causes the first symptoms there, so nausea, vomiting, abdominal cramps and diarrhea are common symptoms in many foodborne diseases. Although majority of the foodborne illness cases are mild and self-limiting, severe cases can occur in high risk groups resulting in high mortality and morbidity in this group. The high risk groups for foodborne diseases include infants, young children, the elderly and the immunocompromised persons (Fleury, Stratton, Tinga, Charron, & Aramini, 2008; van Seventer & Hamer, 2016; World Health Organisation, 2007).

In urban settings, there is need for assessment of a large number of low-level inter-correlated exposures from contaminated street foods, which often occur in complex mixtures (Pekkanen &

Pearce, 2001; Unicomb, 2009; World Health Organisation, 2007). In that respect contaminated street foods exposures usually are involuntary and do not differ significantly among individuals within one area. Contamination of community from foodborne illness, affects all residents more or less equally in the given population and area. A typical example is when a group of people eat together at a restaurant or vendor. For an outbreak to occur, something must have happened to contaminate a batch of food that was eaten by the group of people. Oftentimes, a combination of events contributes to the outbreak. In well-conducted individual-level studies have in many situations been important to establish more firmly the causal associations between specific exposures to contaminated food and specific foodborne diseases (Pekkanen & Pearce, 2001; World Health Organisation, 2007).

Many outbreaks are local in nature. They are recognized when a group of unsuspecting consumers realize that they all became ill after a common meal and outbreak investigation is carried out (S. Hoffmann & Scallan, 2017; Mutonga et al., 2013; World Health Organization & Skovgaard, 2008). This classic local outbreak might follow a catered meal at a reception, a street food vendor, or eating a meal at a restaurant on a particularly busy day. However, outbreaks are increasingly being recognized that are more widespread, that affect persons in many different places, and that are spread out over several weeks. For example, in 2016, some counties in Kenya including Kisii, Malindi, and Nairobi had to ban selling of street food due to the outbreak of cholera, which was attributed to contaminated street foods (Cowman et al., 2017).

Although foodborne illnesses cause substantial morbidity in the developed countries, the main burden is borne by developing countries. In developing countries, foodborne illness causes an

estimated 2.2 million deaths each year, of which 1.9 million are children (FAO/WHO, 2005; Kirk et al., 2015; World Health Organisation, 2007). The population in developing countries is more prone to suffer from foodborne illnesses because of multiple reasons, including lack of access to clean water for food preparation; inappropriate transportation and storage of foods; and lack of awareness regarding safe and hygienic food practices (Havelaar et al., 2015; World Health Organization, 2015). Moreover, majority of the developing countries have limited capacity to implement rules and regulations regarding food safety. Also, there is lack of effective surveillance and monitoring systems for foodborne illness, inspection systems for food safety, and educational programs regarding awareness of food hygiene (Codex Alimentarius Commission, 2003; World Health Organization & Skovgaard, 2008; Young & Waddell, 2016).

2.5.2 Burden of Foodborne diseases in Kenya

The burden of FBD is not equally distributed across the globe. According to the Foodborne Disease Burden Epidemiology Reference Group (FERG) estimates, the risk of foodborne illness is higher in Africa than any other region. The burden of all food-borne diseases is difficult to estimate but is likely to be significant (World Health Organization, 2015, Havelaar et al., 2015). Due to limited availability of data attributing ill-health to specific causes, as well as under-reporting of health complaints to medical systems, estimates of the health and economic costs of food-borne disease in Kenya exist only at the national level. National estimates of the health burden attributable to food-borne disease from WHO with county-level data on diarrhea rates are used to estimate the health and economic burdens of food-borne disease for Nairobi County (V. Hoffmann & Baral, 2019; World Health Organization, 2015).

The incidence of diarrhea diseases caused by consumption of contaminated food and water is estimated at 3.3 to 4.1 episodes per child per year, is indicative of the problem. The total mortality due to diarrhea is around 700,000 for all age groups in Africa. Several devastating outbreaks of food-borne diseases such as cholera, salmonellosis, entero-haemorrhagic Escherichia coli (EHEC), hepatitis A and acute aflatoxicosis have occurred in a number of African countries recently. For example, outbreaks of cholera in 2004 in 28 countries resulted in 85,807 cases and 2,221 deaths. In 2005, reports from 30 countries indicated that so far 33,934 cases and 1,161 deaths have occurred. During the 2004, an outbreak of acute aflatoxicosis, in Kenya reported 317 cases and 125 deaths. Another outbreak reported a further 74 reported cases and 28 deaths in 2005. This shows that the outbreak cases only shows the tip of the iceberg and many more sporadic cases go unrecorded (FAO, 2005a). Notably, in addition to death and ill health, food-borne diseases have profound economic consequences. The economic cost in food replacement during the 2004 outbreak of acute aflatoxicosis in Kenya was 166,000 metric tonnes of safe food for 1.8 million people over six months(FAO, 2005a).

In Kenya, contaminated food is a likely contributor to recent cholera outbreaks. Since December 2014, Kenya has been experiencing continuous large outbreaks of cholera, with a cumulative total of 17 597 cases reported - 10 568 cases reported in 2015 and 6448 in 2016 (Cowman et al., 2017; George et al., 2016; Lee, Abdul Halim, Thong, & Chai, 2017; World Health Organization, 2017).

2.6 Food Hygiene Practices

Food hygiene represents those factors which influence the health and wellbeing of an individual. The factors include observance of simple rules about health behaviors including cleanliness,

exercise, diet, alcohol, smoking and others like educational or literacy level which can also directly impact food health status (Iragunima ,2006). While another researcher conceives food hygiene as a scientific discipline describing the handling, preparation and storage of food in ways that prevent foodborne illness. Food safety consideration is also closely associated, which include practices relating to food labeling, food hygiene, food additives and pesticide residues, as well as policies on biotechnology and food, and guidelines for the management of governmental import and export inspection and certification systems for foods (Codex Alimentarius Commission, 2003; Rane, 2011).

RTE food vending has been found to be a source of a wide range of foods that are nutritionally important for different groups of the urban population. However they are processed in many different ways under unregulated conditions (Muinde & Kuria, 2005; von Holy & Makhoane, 2006). In most countries many hygiene measures in food establishments are controlled and regulated at the local government levels. From previous studies in urban areas in developing countries (Rheinländer et al., 2008; Van Staveren et al., 2001; World Bank Report, 2016) notably most Street vended foods establishments have no access to toilets, running water, washing facilities and inadequate sewage disposal which assist in food hygiene practices. This inadequacy or near absence of basic facilities at the vending sites are mostly attributed for the non-compliance with basic hygiene principles in developing countries (Alimi, 2016).

Although food contamination may occur at any point from production, processing and preparation to distribution, food handlers and other people responsible for food preparation have a critical role in the occurrence and spread of food borne illnesses as their hands and other body

parts may harbor micro-organisms and their practices, as well, may compromise the chain of safety from 'farm-to-fork'(Akonor & Akonor, 2013).

2.6.1 Personal Hygiene

Personal hygienic practices of food handlers rank amongst the major concerns that may potentially lead towards foodborne outbreaks. Studies have shown outbreaks are often associated with poor personal hygiene of people handling foodstuffs. The food handlers with poor hygiene cause contamination of the food, thereby leading to outbreaks (Bhaskar, 2016; Mutonga et al., 2013; Mwamakamba et al., 2012; van Seventer & Hamer, 2016; World Health Organization & Skovgaard, 2008). Each food handler is required to be of good health and free from illness especially communicable diseases which can give rise to food-borne diseases. Mary Mallon 'Typhoid Mary'(Marineli, Tsoucalas, Karamanou, & Androutsos, 2013), infected more than 1300 people with typhoid and caused some deaths in the USA in the early 1900s. This highlights the importance of food handlers' personal hygiene especially the high-risk food handler group. Food handlers therefore have significant role in ensuring food safety

A study by Aklilu et al., (2015) in Ethiopia revealed that low hygiene and safety of food handlers are a potential risk of infection if sanitary conditions of food stuff are not strictly followed. Hence, adherence to good personal hygiene and safe food handling practices remain an effective means of preventing foodborne disease transmission from food handlers to consumers. Studies in Ghana, Nigeria and Kenya have shown most food vendors have poor handwashing practice. Most do not adhere to good personal hygiene practice of washing their hands properly during food preparation and handling, handling money or after visiting the toilet. Very few have been found to be washing after handling garbage, raw materials and after scratching (Chukuezi, 2010;

Muinde & Kuria, 2005; Rheinländer et al., 2008). This has led to transmission of several foodborne diseases.

2.6.2 Cleanliness of Food Contact Surfaces and Equipment

The appropriate use of clean food contact surfaces and equipment is important to prevent cross contamination from raw materials during preparation, handling and display of food (Mwamakamba et al., 2012). Studies by von Holy & Makhoane (2006) and Bryan (1988) established some vending practices and equipment used for dispensing street foods were major contributors to the risk of cross contamination of street foods.

Studies in South Africa (von Holy & Makhoane, 2006), Ghana(P. Mensah et al., 2002), Dominican Republic (Bryan, 1988) and India(Gadi et al., 2013) found that some food handlers washed their hands in the same bucket used for cleaning utensils, which may lead to the contamination of food with fecal matter. Furthermore, washed plates are often stored in an unclean corner, plastic bowl, or cardboard box, leading to recontamination of the plates (Barro et al., 2007). However, the food contact surfaces which should be of food grade quality, clean and sanitized were found to be unsanitary and exposed the food to more dangerous conditions like cross-contamination and transmission of infectious diseases among unsuspecting consumers (von Holy & Makhoane, 2006). It was also observed that the same knife without being clean was used to cut raw meat and poultry as well as gravy and salad (Bryan, 1988). Wherein, color-coding can be utilized to minimize cross-contamination of equipment like chopping boards and knives.

2.6.3 Proper Cooking Time and Temperatures.

Time-temperature exposures during cooking or reheating need to be sufficiently high or long to inactivate large quantities of infectious microorganisms that could develop during the lengthy holding process (Rane, 2011).

Studies in Nigeria (Idowu & Rowland, 2006), Ghana (Paudyal et al., 2017) and Kenya (Muinde & Kuria, 2005) have found that some food vendors often partially or fully cook some products ahead of time, store them and then reheat them when requested by customers. However, this reheating is often inadequate to destroy bacteria that may be present as this would allow the foodborne pathogens that germinate from spores which survived cooking or that contaminate the food after cooking, to survive and proliferate (Rane, 2011).

2.6.4 Clear Separation of Raw and Cooked Foods

Clear separation of raw and cooked foods prevents cross-contamination. Cross-contamination is the transfer of harmful microorganisms from one item of food to another via a non-food surface such as human hands, equipment, or utensils. It may also be a direct transfer from a raw to a cooked food item (WHO, 2017).

A study in Ghana, Kumasi (Rheinländer et al., 2008) found that the street vendors had no consistent separation of raw and cooked foods when using cutlery, fridge facilities, storage space or crockery and on all vending sites knives and chopping boards were observed to be used for meat as well as vegetables, raw as well as cooked. Their common explanation was that crockery is limited and hence vendors continuously shift raw and cooked foods from one pot, basin or board to another. Furthermore, cleaning of boards was often done by wiping it “clean” with cloths, which were often dirty pieces of textile. Two vendors washed crockery and knives with

soap frequently while others were observed to wash crockery only when finishing food preparations. In addition, observing clear separation of raw and cooked can prevent the transmission of pathogens responsible for many foodborne diseases.

2.6.5 Proper Waste Disposal

WHO (1996) stipulates that all waste should be handled and disposed of in such a manner as to avoid contamination of food and water and the environment. In particular, access to food waste by pests (insects and rodents) as well as by animals (dogs and cats) should be avoided. Studies in developing countries have shown few vendors congregate in overcrowded areas where there are high numbers of potential customers, which usually provide limited access to basic sanitary facilities. Hence, the contamination of street foods is often linked to the waste generated by food processing, that is usually dumped near the vending site (Gadi et al., 2013; Mensah et al., 2002; Muinde & Kuria, 2005). The lack of facilities for liquid drainage and wastewater and garbage disposal encourages wastes to be thrown into nearby streets and gutters. Such areas act as habitats for rodents, breeding points for flies and media for growth of microorganisms.

The study by Muinde & Kuria, (2005) in Nairobi further established the street foods are prepared in unhygienic conditions, given that garbage and dirty waste were conspicuously close to the stalls. In these areas large amounts of garbage accumulates which provide harborage for insects and animal pests that are linked to enteric disease transmission (*Shigella*, *Salmonella* and *E. coli*)

2.7 Food Handlers Knowledge

Knowledge is defined as “a complex process of remembering, relating, or judging an idea or abstract phenomenon (cognitive abilities)” (Baxter, Elder, & Glaser, 1996). Knowledge accumulates through learning processes and these may be formal or informal instruction,

personal experience and experiential sharing (Glanz, Rimer, & Viswanath, 2002). It has been traditionally assumed that knowledge is automatically translated into behavior (Glanz et al., 2002).

Knowledge of the street food vendors has a crucial impact on food safety. However as it has been found in previous study in Iran by Ansari-Lari, Soodbakhsh and Lakzadeh, (2010) more knowledge of food safety practices does not always lead to positive changes in food handling behaviors. Knowledge however is not insignificant and it is found to be vital in the cognitive processing of information in the attitude-behavior relationship (Baxter et al., 1996; Byrd-Bredbenner, Maurer, et al., 2007; Schunk, 2012). Most food borne illness is preventable if food hygiene knowledge is practiced from production to consumption to ensure safety but they are neglected in developing countries (Grace, 2015a).

Several studies have linked that the majority of disease outbreaks in street foods were linked to negligence of food handlers (WHO,2001). About 15 cases of foodborne disease outbreaks monitored in Zhapo, a coastal resort of Guangdong, China, from 2008 to 2011 were traced to the negligence of food vendors (liu et al., 2015). Earlier studies conducted on adults have indicated that food safety knowledge tends to increase with age and practice: females have higher scores than males, and younger respondents show the greatest need for additional food safety education (Byrd-Bredbenner, Wheatley, et al., 2007; sanlier, 2009).Williamsons et al.,(1992) suggested that children and adults are usually unaware of basic methods of food handling and preparation, although a substantial proportion of food-borne illnesses can be attributed to improper preparation according to Food and Agriculture Organization (2009).

Knowledge of the consequences of unsafe food hygiene practice can enhance adherence to food safety guidelines. The need for enhanced food safety education started to be recognized in developed countries with the launch of national initiatives to find ways to educate consumers effectively, especially youngsters and adults who prepare food (Mwamakamba et al., 2012). Studies in developing countries have made efforts to establish the depth of food safety knowledge along with disposition to food safety issues and practices of street food vendors (Liu et al., 2015; McKaye al., 2016; Paudyal et al., 2017). It is further noted that most of the food handlers are poorly educated, untrained in food hygiene. Their knowledge and expertise in food handling are often limited and mostly they often engage in street food vending as a survival strategy mainly to escape poverty, especially as little start-up capital is required.

2.7.1 Food Safety Knowledge and Practice

Knowledge has been identified to influence perception and behavior on food safety practices (Çakıroğlu & Uçar, 2008). The study carried out to determine employees' perception of hygiene in the catering industry in Ankara (Turkey) found out that employees' perception of hygiene in the catering industry in Ankara is inadequate and there is a need for training on the subject. Similarly, a study in Owerri, Nigeria by Chukuezi (2010) reported that most food handlers had no formal education and that majority had received training on food hygiene. They identified the need for training of food handlers on the principles of safe food handling. In Edo state, Nigeria it was reported that most food vendors had formal education and good knowledge and practice of food hygiene (Joshua, Musa, Otu, Andrew, & Abubakar, 2009).

Several studies have shown that although, most vendors that reported to have knowledge, they rarely put it into actual practice. Convenience and economic factors were the main reasons cited

why most vendors were not implementing their knowledge of safety practices (Çakıroğlu & Uçar, 2008; Iwu et al., 2017; Muinde & Kuria, 2005). While other studies have further suggested that the lack of knowledge in food safety can lead to poor hygienic practices by food-handlers (Azanza & Zamora-Luna, 2005; Çakıroğlu & Uçar, 2008). However, Clayton et al, (2002) reported that about 63% of food-handlers demonstrating knowledge in food safety did not demonstrate a corresponding positive behavior towards food safety/hygienic practices. This shows that food-handlers might not necessarily be practicing strict food safety procedures during food handling, even when they provide answers to show that they are knowledgeable in a survey. Poor knowledge and improper food handling of street vendors in basic food safety practices and awareness on the potential hazards associated with certain foods could explain the health and safety issues that street foods may pose (Al Mamun & Turin, 2016; FAO, 2009a; Hilario, 2015).

2.7.2 Food Safety Knowledge and Self-Reported Practices

Knowledge is important, however there is a gap between food safety knowledge and self-reported practices (Raab & Woodburn, 2007). Raab and Woodburn,(2007) further found during a telephone survey that 20% of respondents reported unsafe practices in their food preparation even though they had a high awareness of foodborne illnesses. Further confirming, food handlers can be a source of food contamination and facilitators of cross-contamination.

According to Kaiser and Fuhrer (2003) both declarative (knowledge of issues) and procedural knowledge (knowledge of action strategies) are essential for behavior change. However, knowledge was not turned into safe practices, not even by those vendors who had obtained formal training in food safety as Raab and Woodburn (2007) found in their study in Oregon. Despite a self-reported handwashing practiced by food-handlers, many employees' in a study by Stepanovic et al., (2005) had coagulase-positive staphylococci isolated from their hands, and this

could be a source of food contamination. Therefore, it is prudent to combine proper hand washing with the wearing of gloves (food grade gloves) and other hygienic practices in order to minimize the risk of contamination during food handling (Montville, Chen, & Schaffner, 2001). Therefore, lack of knowledge, mishandling and disregard of hygienic measures on the part of the food handlers may enable pathogenic bacteria to come into contact with food and in some cases survive and multiply in sufficient numbers to cause illness in the consumer (Kuria, 2005; Rane, 2011; WHO & INFOSAN, 2010).

2.8 Summary of RTE Foods

Street vended foods are of great importance in the urban community, governments should consider their official recognition especially due to their economic and nutritional contribution. However, the sector is fraught with poor hygiene practices and knowledge which have been reported to pose serious concerns over the safety of the food. These poor hygiene activities and knowledge traversed the whole chain of RTE food business from agricultural raw materials to the final retail street foods and have been fingered in the outbreak of diseases and illnesses. These aspects were observed with most street food vendors. It probably makes street food the source of most diseases caused by bacteria and other microorganisms. The prevention, maintenance and treatment of diseases from street food borne illnesses were reported to result in heavy drain on the purse of individuals and governments in the developing countries due to huge spending involved. The meager resources that could have been used for infrastructural development are being channeled to treatment of preventable diseases outbreak due to the poor hygiene practices and knowledge. This study aims to provide exposition on the hygiene practices and associated knowledge among RTE food handlers in Mathari informal settlement. This could assist to provide holistic intervention baseline improving hygiene of RTE foods, policy

formulation, and develop a plan of action for food handlers and consumers and training on basic safe food handling which will improve their knowledge and can be pertinent for the primary health care system aiming at health for all.

2.9 Operational Conceptual Framework

While the existing literature points to the deep impact that RTE foods have on urban population's lives, there is nonetheless a scarcity of research on the knowledge and hygiene practices of the food handler's in informal settlements (FAO,2009; WHO, 2015). For this reason, the authorities have no known food hygiene and sanitation procedures directed to informal settlement RTE food handlers. To address this gap in the literature, this particular study was conducted in Mathari to specifically explore the hygiene practices and dimensions of knowledge on food hygiene by RTE food handlers to identify relationships between these dimensions in slum areas.

The conceptual framework Figure 2.1 utilized is a modified knowledge to action (KTA) behavioral system framework MacDermid & Graham, (2009) and improved integrated model Adapted from Jeinie, Nor, & Sharif (2015) which captures both the independent variable of knowledge about hygiene practices, and dependent variable which is the actual practice. It is more complete in its causal specifications of determinants of preventive practice and outcomes. Knowledge about hygiene practices are important predictors of adherence and adoption to the prescribed hygiene practices.

The independent variables as shown in the conceptual framework interact with dependent variable and eventually influence outcome of hygienic street foods. The indicators for hygiene

practices include proper hand washing, clean working surfaces, proper cooking, and proper separation of raw and cooked food, proper storage and waste disposal (FAO, 2009a). Independent variable in this study is knowledge of food handlers on hygiene practices which may significantly influence implementation of hygiene practices and the outcome of hygienic street foods.

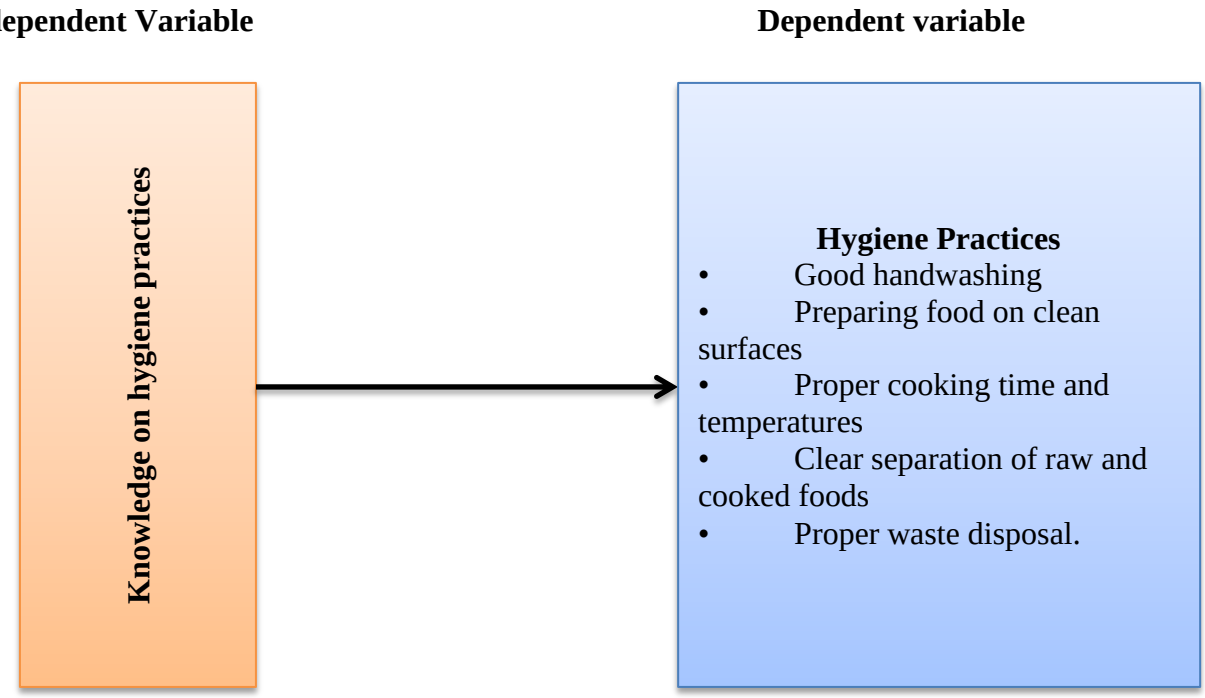


Figure 2.1. Modified Conceptual framework adopted from Jeinie, Nor, & Sharif (2015)

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter gives a description of the study area, it shows the food types distribution profile of Mathari slums. The chapter then shows the research design, sampling procedures and data collection methods that were used in the study. Finally, the data analysis and presentation procedures are laid out.

3.2 Study Area

The study was carried out in Mathari slum area, Nairobi county (Coordinates: 1^{o} 15'41S 36 ^{o}26'E). Nairobi is the largest city in East Africa with 3.1 million people and an annual population growth rate of 4%. Mathari is the second largest urban slum in Kenya, with an estimated population of 193,416 (Kenya National Bureau of Statistics, 2013). It was ideal for the study, since it has a homogenous population that has all the facets to be included in the study including a rich blend of RTE foods and the handlers who are easily accessible. RTE food handlers were selected from the Mathari slum villages namely Kiamutisya, Mlango Kubwa, Village 2, Mathari 3B, Kosovo, Mathari 3A, Mathari 3C, Mathari 4B, Gitathuru, Mathari No.10, Mathari 4A, Mashimoni, Kwa Kariuki and Mabatini [Appendix I, for study area map].

3.3 Study Population

The estimated study population consisted of 287 street food vendors selling RTE foods in Mathari slums [Appendix II]. Data was collected from food handlers (subsequently referred to as the vendors or traders) scattered across Mathari slums.

3.3.1 Inclusion and Exclusion Criteria

a. The study involved the food handlers who consented and sold RTE foods in Mathari informal settlement. The key food handlers sampled in the study included those were involved in preparation, display, serving and selling of the RTE foods.
b. The study excluded vendors who dealt with other foods and non-food items other than RTEs.

3.4 Study Design

This was a descriptive cross-sectional study. This approach combines qualitative and quantitative methods of data collection and analysis (Creswell, 2009). This method was used to objectively evaluate knowledge on food hygiene practices and also observe food-handling practices among participants.

3.5 Sample Design

3.5.1 Sample Size Determination

The minimum size of the study was determined by entering the population size of 287 to the Epi Info™ StatCalc sample size calculator while keeping the parameters adopted from the pilot study as follows; Expected frequency at 50%, acceptable margin of error at 5%, design effect at 1.0, cluster at 1 and confidence level at 97%. The calculated minimum sample size was 178. To operationalize the study involved 180 RTE food handlers from Mathari. This also reduces the standard error of the estimates since larger sample sizes yields better estimates since they have lower standard error.

The Margin of error was calculated using the formula for sample proportion. The pilot study yielded 88% positive response in variables of interest i.e. food handlers' knowledge and hygiene practices. With this background the Margin of error was as follows;

2.17(The critical z-score value for 97% confidence level)

$$2.17\times\sqrt{(0.88(1-0.88))/178} = 0.0528$$

Margin of error ≈ 5%

3.5.2 Sampling Procedure

Multistage sampling adopted from Elder, (2009) was used to sample the food handlers. This method was chosen to enable focus on food handlers who meet the study objectives, which will best enable to answer the research questions. The first step was to identify the 14 villages (stratum) with the population of 287 in the database. The second stage involved simple random sampling to select 180 vendors from the 14 villages. The food handlers involved, voluntarily participated. The sample for each village was distributed to the area proportionate to population size. 18 food handlers were sampled from Mathari 3A and Mathari 3B each, considering their large population and size (IIED, 2014), while 12 food handlers were sampled from each of the rest 12 villages as shown in the Table 3.1.

Table 3.1 Vendors Distribution

Villages	No. of vendors
Kiamutisya,	12
Mlango Kubwa,	12
Village 2,	12
Mathari 3B,	18
Kosovo,	12
Mathari 3A,	18
Mathari 3C,	12
Mathari 4B,	12
Gitathuru,	12
Mathari No.10,	12
Mathari 4A,	12
Mashimoni,	12
Kwa Kariuki	12
Mabatini	12

3.6 Data Collection Instruments

Quantitative data on hygiene practices and knowledge of food handlers on food safety and hygiene were collected by use of semi structured questionnaires administered to the 180 food handlers. Observation checklist was used to collect qualitative data on hygiene practices and sanitary conditions of RTE foods handling environment. Informed consent was obtained from individual respondents and community leaders.

3.6.1 Quantitative

3.6.1.1 Semi-structured Questionnaires

Questionnaires with semi structured questions [Appendix III] were developed from WHO's Five Keys to Safer Food Manual, Nairobi Public Health Food Hygiene inspection checklist (Republic of Kenya, 2012)[Appendix IX] and Food Safety knowledge instrument adopted from Byrd-Bredbenner et al., (2007). The questionnaires were pre-tested for reliability and validity. The questionnaires were administered to the food handlers. The questionnaire was organized into the following three main sections (A) Socio-demographic Profile, (B) Food Handlers' Knowledge on Food Safety and Hygiene, (C) Practices on Food Hygiene.

Section (B) of the questionnaire contained 21 questions concerning food hygiene knowledge of food handlers. The distribution of questions was under the following criteria: hand washing, cross contamination, food storage, food handling and food shelf life. The answers of respondents for the section were scaled from 0 to 1 point, each correct answer was given one point whilst incorrect answer was awarded zero point. For classification, each respondent who obtained score 49% ($n < 10$) points, was considered poor knowledge, the score range 50% ($10 < n \leq 11$) points, was accept level, the score range 51% ($11 < n \leq 12$) points, was awarded a good level of food hygiene knowledge. For Practices Section C, 21 close-ended questions were constructed for matters related to personal hygiene practices. Each question with three possible answers, "Never", "Occasional" and "Always" were asked in order to reduce the possibility of respondents to choose the correct answer by chance. The questions were grouped under the following categories: personal hygiene, hand washing, cross contamination and food handling. The questionnaires were filled in either by the participants themselves or by the researcher for

participants with limited education. A total of 180 questionnaires were administered to the food handlers.

3.6.2 Qualitative

3.6.2.1 Observation Checklist

This method consisted of systematically observing and documenting food handlers' activities in their natural setting. The checklist was used to collect information regarding food hygiene practices and the sanitary conditions. This helped to verify the information given by the respondents and to understand the real situation on the ground. Observation checklist was utilized [Appendix V]. The checklist contained two main components i) Food hygiene practices, ii) Sanitary conditions. The checklist is a combination of different checklists used in previous studies (Chukuezi, 2010; Muinde & Kuria, 2005) and public health inspection checklist(Republic of Kenya, 2012) [Appendix IX] and adopted core food safety information provided in the WHO Five Keys to Safer Food Manual.

3.7 Data Collection Procedures

Data collection was through a semi-structured, standardized questionnaire and an observation checklist. The questionnaire was used to collect data on socio-demographic details, knowledge of the vendors on food hygiene which was based on the core messages of the WHO five keys to safer food which included questions connotations: keep clean; separate raw and cooked; cook thoroughly; keep food at safe temperatures; and use safe water and raw materials as well as practices of respondents.

The confounding effects were controlled through randomization in villages. This ensures that even unknown confounding factors will be equally distributed among the comparison villages. If

all of these other factors are distributed equally among the villages being compared, they will not distort the association between the knowledge being studied and the practice.

3.8 Pre-testing

Pilot study or pretesting of data collection instruments is an important aspect of effective questionnaire design and administration. Pre-testing the questionnaire on a group of people similar to the intended sample provides useful feedback on the questionnaire such as questions phrasing, layout and understanding of particular questions by respondents.

In this study, the preliminary questionnaire was pre-tested using ten (10) food handlers selected through simple random sampling in Mathari 3A. The pretesting highlighted some limitations of the instrument such as difficulty in understanding and answering some questions due to question wording and layout of questionnaire. A discussion was done with respondents focusing on areas of confusion and poor comprehension. These issues were therefore rectified on the final questionnaire before commencement of field work.

3.9 Reliability and Validity

Content and construct validity of the research tool was initiated at the design stage, as instrumentation is a major threat to internal validity. Content validity was measured by expert independent personnel comprising community health volunteers (CHVs) and professionals working in environmental health from Nairobi County. They provided comments on the clarity, difficulty, consistency and the content of the items. Few changes and modifications were made such as rephrasing and moving items to a better domain.

From the pilot study, the reliability analysis suggested that the set of 25 items of the questionnaire demonstrated high internal consistency as the overall Cronbach's alpha value was more than 0.7. The Cronbach alpha value from the pilot study was 0.8759 indicating the questionnaire had good internal consistency amongst a set of grouped questions. The average inter-item covariance was 0.062037.

3.10 Measurement of Variables

3.10.1 Independent Variables

Independent variable in this study was knowledge of food handlers on hygiene practices. These independent variables were evaluated to measure how they influence the dependent variable.

3.10.2 Dependent Variables

Dependent variables in the study included hygiene practices. The indicators for hygiene practices included proper hand washing, clean working surfaces, proper cooking, and proper separation of raw and cooked food, proper storage and waste disposal (FAO, 2009). Scoring was done as indicated in section 3.6.

3.11 Data Analysis

The questionnaires were checked for completeness, cleaned and edited. Complete items were coded and entered onto IBM Statistical Package for the Social Science (SPSS) version 22 software packages for analysis. The results are presented in tables, figures and texts using descriptive statistics such as percentages to describe the study population in relation to relevant variables. Chi-square test was used to test relationships between variables. The data was analyzed using logistic regression to determine the influence of various factors on the outcome variable. Results with p values ≤ 0.05 were considered statistically significant.

A scoring system was used to categorize knowledge as poor, average and good. A total of 21 items in the questionnaire were used to assess respondents' knowledge of food hygiene, while 27 items were used to assess their food hygiene practices. Responses were graded as 'Yes = 1' and 'No = 0'; and the total score of correct responses converted to percentage and used to categorize respondents' knowledge of food hygiene as well as practices as follows: For classification, each respondent who obtained score 49% ($n < 10$) points, was considered poor knowledge, the score range 50% ($10 < n \leq 11$) points, was accept level, the score range 51% ($11 < n \leq 12$) points, was awarded a good level of food hygiene knowledge.

3.12 Ethical Considerations

Before starting the study, the ethical approvals from Maseno University Ethical Research Committee and other relevant public health authorities from Nairobi County were obtained. Informed consent was obtained from individual respondents and community leaders.

The proposal was initially cleared by the School of Graduate Studies, Maseno University and approved by Maseno University Ethical Research Committee and other relevant public health authorities from Nairobi County [Appendix VI and Appendix VII]. Informed written consent [Appendix V] was obtained from each study participant after thorough explanation of the objectives and the procedures of the study. The benefit of this study was explained to the study participants and other concerned parties in terms of how the findings of the study can be utilized in improving safety of RTE foods sold in Mathari slum. Confidentiality was ensured by making sure the questionnaires are anonymous and avoiding personal identifications.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results of analysis of the responses collected by use of questionnaires administered to food handlers and observational checklist. The results are presented in respect to the objectives of the study, that is; results on the hygiene practices among the food handlers selling RTE foods in Mathari slums, the food handlers' knowledge on hygiene practices in RTE foods in Mathari slums and to establish the association between food safety knowledge and handling practices.

The response rate for the study sample was 98%. Total sample of the study was 180 food handlers'. The key respondents were in the study were food handlers involved in preparation, display, serving and selling the RTE foods.

4.2 Socio-demographic Characteristics

The majority of the respondents were females 137 (76%). Males were only 43 (24%). 118 (66%) of the respondents had attained only primary education, while 47 (26%) attained secondary level of education. The study also revealed that 2 (1%) had post-secondary education and 13 (7%) had no form of education. Further, 169 (94%) of the respondents were residents of Mathari and only 11 (6%) had residences outside Mathari as shown in Table 4.1**.**

It was also noted that a higher number 83 (46%) of the food handlers were in the age bracket of 21-30 years. This was followed with those between 31- 40 years at 27% (49). Then those between 41-50 years followed closely at 21% (37). For those below 20 years and those above 50 years were almost similar at 3% (5) and (6) respectively.

Table 4.1 Socio-demographic Characteristics of Vendors

Characteristics	n	%
Gender		
Male	43	24
Female	137	76
Age		
Below 20	5	3
21-30	83	46
31-40	49	27
41-50	37	21
Above 50	6	3
Educational level		
None	13	7
Primary	118	66
Secondary	47	26
Post- secondary	2	1
Food Hygiene Training		
Formal training	13	7
Observation of others	40	22
Self-taught	94	52
Taught by parents	33	19
Residence in Mathari		
Yes	169	94
No	11	6

As shown in the Table 4.1 above, most of the vendors 94 (52%) were self-taught in the food hygiene skills. Twenty-two percent (40) of the vendors learnt their food hygiene skills from observation from others, while (33) 19% were taught the food hygiene skills from guardians including parents. Lastly, (13) 7% of the vendors had formal training on their food hygiene skills.

4.2.1 Food Vending Business Characteristics

The food vending type and registration characteristics in this study are shown in Table 4.2.

This study found the majority 128 (71%) of the businesses were stationary and only 52 (29%) were mobile.

Table 4.2 Food Vending Type and Registration

Type of Business	Mobile		Stationary		n	%
Registration	n	%	n	%		
County trading license	17	9%	40	22%	57	32%
Health license	4	2%	10	6%	14	8%
Other registration	8	4%	18	10%	26	14%
No form of registration	23	13%	60	33%	83	46%
Grand Total	**52**	**29%**	**128**	**71%**		

Generally, with respect to registration 83 (46%) of the vendors had no form of registration. In this pack 60 (33%) were stationary and 23 (13%) were mobile vendors. 57 (32%) of the vendors had County trading license, wherein 40 (22%) were stationary and 17 (9%) were mobile vendors. 14 (8%) had the food handler's health license registration, wherein 10 (6%) were stationary and 4 (2%) were mobile. 26 (14%) had other forms of registration e.g. for waste collection etc. wherein 18 (10%) were stationary and 8 (4%) were mobile vendors.

4.2.2 Source of Income

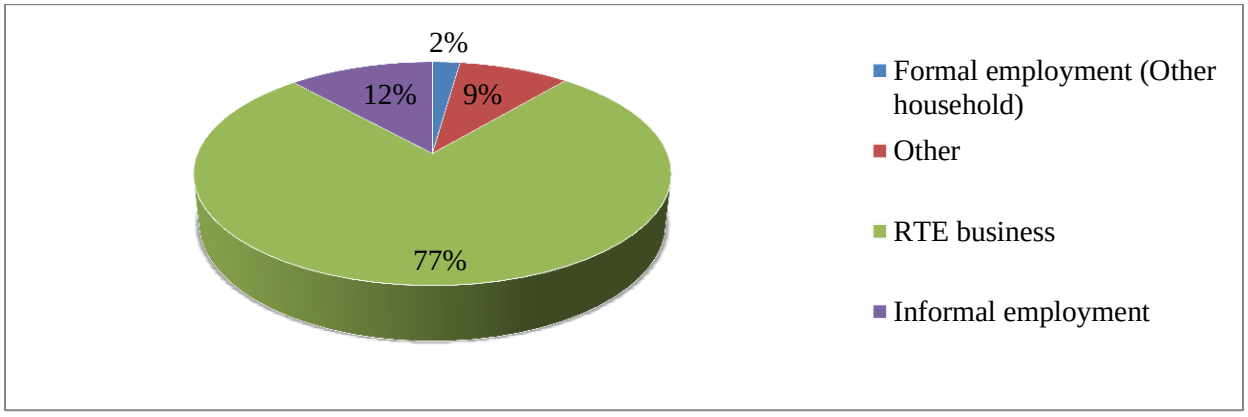


Figure 4.1 Main Source of Income for the Vendors

As shown in Figure 4.1, the study also noted that the RTE business was the main source of income to most households of the vendors at 139 (77%). Although others 21 (12%) had their households employed in the informal sector as the main source of income. Only 16 (9%) had other forms of businesses and 4 (2%) were in formal employment as the main source of income.

4.3 Knowledge of Food Handlers on Food Hygiene Practices

The food handlers were presented with questions that had knowledge in food hygiene practices connotations. The food hygiene knowledge was analyzed using correct responses by the vendors on safe food practices. For evaluation 21 questions were used to measure reported food hygiene knowledge. In order to assess the knowledge of the handlers, for classification, each respondent who obtained score 49% ($n < 10$) points, was considered poor knowledge, the score range 50% ($10 < n \leq 11$) points, was accept level, the score range 51% ($11 < n \leq 12$) points, was awarded a good level of food hygiene knowledge.

4.3.1 Food Handlers Knowledge Scores

Table 4.3 shows the knowledge responses of food handlers to the safe food practices. The correct answers gave the percentage of their knowledge. Generally, the overall performance of the respondents with regard to knowledge was 54% with a standard deviation of 10%, having a maximum score of 81% and a minimum score of 29%. No statistical difference was found between the food hygiene knowledge of the vendors on the basis of gender ($p = 0.182$), age ($p = 0.618$) and educational level attained ($p = 0.441$). Generally, age, gender and the educational level did not affect their scores.

With respect to WHO 5 Keys to safer foods, the vendors had poor responses on some Keys (Key 4. Keep food at safe temperature) activities like refrigeration of leftovers (6%) and leaving food at room temperature for more than 2 hours in covered utensils (25%). Respondents answered satisfactorily with regard to the others. Key 1 (Keep Clean) activities preparing foods in clean environment (98%), Washing hands after using toilet (94%), after handling unsanitary utensils (61%) and before cooking (67%), washing utensils with clean soapy water (69%) and not exposing foods to flies (60%). In Key 2 Separate Raw and Cooked foods, activities like clear separation of raw and cooked foods (49%), Store foods separately by selling foods from the container that they are cooked (43%) and serving foods with spoons (49%). In Key 3 Cooking thoroughly activities like reheating the foods before selling if stored for more than 4 hours (70%) and cooking thoroughly before eating (77%). In Key 5, use of safe water and raw materials activities like source of safe portable water (100%).

Table 4.3 Food Hygiene Knowledge Practices Responses

	Responses (n =180)	
Statement	**Correct**	**n**
Hygienic to use clean soapy water to clean utensils	69%	124
Hygienic to clean working surface while working	59%	106
Cook thoroughly before eating	77%	139
Cover sores and wounds with waterproof dressing	98%	176
Hygienic to handles food with gloves	4%	7
Hygienic to handle food not at ground level	29%	52
Hygienic to close food not expose to flies	60%	108
Reheating before sale if stored for more than 4 hrs.	70%	126
Hygienic to sell food from container used for cooking	43%	77
Have clear separation of raw and cooked food	49%	88
Hygienic to serve food with spoon	49%	88
Safe to prepare food while sick	90%	162
Hygienic to sneeze into your hands	51%	92
Hygienic to cook food in unclean surrounding	98%	176
Hygienic to have uncut fingernails	28%	50
Wash your hands after handling money	34%	61
Wash your hands in between handling raw and RTE foods	35%	63
Wash your hands after handling unsanitary utensils	61%	110
Wash your hands after using the toilet	94%	169
Wash your hands before cooking	67%	121
Hygienic to wear jewelry while cooking	73%	131

4.3.2 Self-Reported Knowledge Responses

Table 4.3 shows most of the food handlers 169 (94%) had correct responses with respect to washing their hands after visiting the toilet, covering sores and wounds with waterproof dressing 177 (98%), Unhygienic to cook food in unclean surrounding 177 (98%), Safe to prepare food while sick 162 (90%).

Other correct responses that many food handlers had good knowledge included hygienic to use clean soapy water to clean utensils 124 (69%), Cook thoroughly before eating 139 (77%), reheating before sale if stored for more than 4 hours 126 (70%), hygienic to close the food and

not exposed to flies 108 (60%), unhygienic to sneeze into your hands 92 (51%), wash your hands after handling unsanitary utensils 109 (61%), wash your hands before cooking 120 (67%), and those who knew it is unhygienic to wear jewelry while cooking 131 (73%). Overall eighty-four percent (152) had knowledge that food can get contaminated during preparation.

4.4 Hygiene Practices of RTE Food Handlers in Mathari Slum

4.4.1 Self-Reported Practices

Table 4.4 Status of the Hygiene Practices

Characteristics	Frequency (n=180)	%
Clothing		
Clean apron	102	57%
Clean hair cover	63	35%
Clean gloves	6	3%
None	9	5%
Frequency of changing clothing		
Daily	99	55%
Twice weekly	63	35%
Weekly	18	10%
Monthly	0	0%
Left over handling Practices		
Consume	47	26%
Discard	25	14%
Leave open in the stall	7	4%
Place in ambient temperature	7	4%
Reheating before selling	38	21%
Store in covered utensils	45	25%
Store in the fridge	11	6%
Waste disposal practices		
Drainage/Culverts/Gutter	51	28%
Street/Pathways	37	21%
Waste bin	75	42%
Other	17	9%
Location of food preparation		
At home	52	29%
At stall	122	68%
Other	6	3%
Handwashing		
Sanitizer	74	41%
Water	23	13%
Water and soap	80	44%
All the above	3	2%

Table 4.4 shows the self-reported responses on the food hygiene practices. Where 171 (95%) of the food handlers reported to have personal protective equipment, which included 102 (57%) who had aprons, 63 (35%) had hair-covers and 6 (3%) had gloves. Only 9 (5%) had none. Among those vendors who had the PPEs, 99 (55%) changed them daily, (63) 35% changed twice in a week, 18 (10%) changed weekly and none changed monthly.

The food handlers reported their leftover handling practices which included 47 (36%) consumed, 25 (14%) discarded, 7 (4%) left open in the stall, 7 (4%) placed in ambient temperature, 38 (21%) reheated before selling, 45 (25%) store covered in utensils and 11 (6%) stored in the fridge.

Further the food handlers reported on where they dispose their wastes which included 51 (28%) in the drainage, culvert, gutter, 37 (21%) on street paths and pathways close by, 75 (42%) in waste bins while 17 (9%) had other unspecified means. On location of food preparation, most 122 (68%) of the handlers prepared the foods at the stall, while 52 (29%) prepared at home. Only 6 (3%) had unspecified areas.

The food handlers also reported on their handwashing practices where 80 (44%) washed their hands with soap and water, 74 (41%) washed using a sanitizer, 23 (13%) reported using only water and only 3 (2%) reported using soap, water and sanitizer as presented in Table 4.4.

4.4.2 Observed Food Hygiene Practices

Table 4.5 Observations of Food Hygiene Practices

Observation of practice	Absent (No)	n	Present (Yes)	n
Use of apron or overall when cooking	39%	70	61%	110
Blows air into polythene bag before use	1%	2	99%	178
Clear separation of raw and cooked foods	57%	102	43%	78
Food heated before serving	39%	70	61%	110
Food prepared on clean surface	17%	30	83%	150
Food washed before cooking	9%	16	91%	164
Hands free from open wounds/covered with waterproof dressing.	43%	77	57%	103
Handle food with bare hands	4%	7	96%	173
Handles money while serving food	6%	11	94%	169
Handwashing after using toilet	12%	21	88%	159
Handwashing before cooking	15%	27	85%	153
Use of head cover at work	78%	140	22%	40
Preparation of food far ahead of service	7%	12	93%	168
Presents food when covered	96%	173	4%	7
Recycle water used for handwashing	89%	160	11%	20
Recycle water used for washing utensils	93%	167	7%	13
Reuse oil for frying	2%	3	98%	177
Serves food with spoon	4%	7	96%	173
Short and clean nails	24%	43	76%	137
Washing of food items	20%	36	80%	144
Washing utensils before and after cooking	22%	40	78%	140

Table 4.5 gives some of the observations made from the food handlers during the study period were as follows 110 (61%) of the food handlers use apron or overall when cooking, 178 (99%) blow air into polythene bag before use, 77 (43%) have clear separation of raw and cooked foods. 110 (61%) heated their food before serving, 149 (83%) prepared food on a clean surface. 164 (91%) washed food before cooking. 103 (57%) had hands free from open wounds and were covered with waterproof dressing.

Most food handlers 173 (96%) were observed to handle food with bare hands, while 169 (94%) handled money while serving food. A significant proportion 158 (88%) washed their hands after using the toilet and 153 (85%) washed their hands before cooking. Slightly fewer food handlers 40 (22%) used head covers at work. A great percentage 167 (93%) prepared their food far ahead of service. Only 7 (4%) presented food when covered. Few 20 (11%) recycled water used for handwashing and 13 (7%) recycled water used for washing utensils. A majority 176 (98%) was observed to reuse oil for frying, 173 (96%) served food with spoon. 137 (76%) had short and clean nails. 144 (80%) washed their food items and 140 (78%) washed their utensils before and after cooking.

4.4.3 Sanitation Conditions

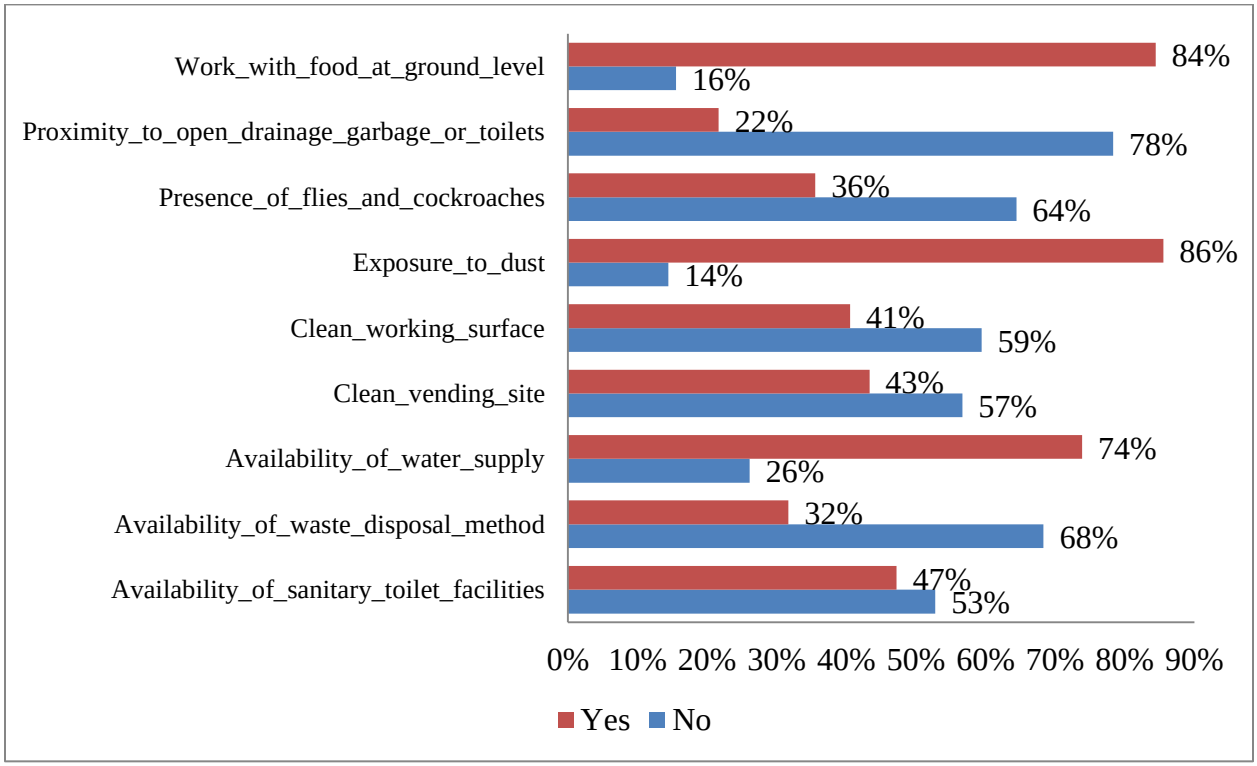


Figure 4.2 Sanitary Conditions Observations

It was observed that most of the vendors 84% (151) worked with food at ground level. A higher percentage 78% (140), were not in close proximity to open drainage or toilets and 36% (65) had a working area with presence of flies and cockroaches. However, 155 (86%) worked in areas exposed to dust, while 41% (74) had clean working surfaces and 43% (77) had clean vending sites. It was further observed a greater majority 133 (74%) had availability of water supply. Only 32% (58) had availability of waste disposal methods and 47% (85) had availability of sanitary toilet facilities.

All the vendors reported to have source of water that they used in the business. Results indicate that 58.7% of the RTE vendors use water from water vendors as their major source of water, while 39.3% of the vendors use water supplied to them by Nairobi County. Others; (1.3%) and (0.7%) depended on protected wells and boreholes, respectively. None sourced from unprotected wells.

4.4.4 Willing to Train in Food Safety and Hygiene

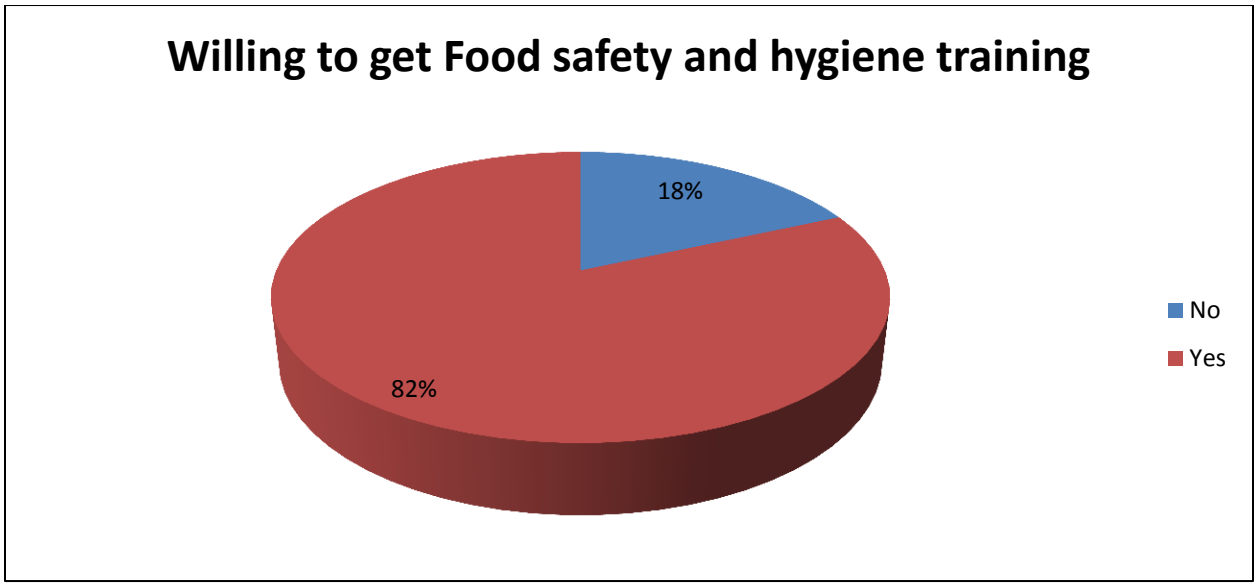


Figure 4.3 Response of those willing to get food safety and hygiene training

Eighty-two percent 82% (148) of the Food handlers reported that they were willing to get food hygiene and safety training. Only 18% (32) did not desire to get the training. It was earlier noted in Table 4.1 only 7% had formal training in food hygiene and safety.

4.5 Association between Food Hygiene Knowledge and Handling Practices

In order to determine whether there was an association between the level of knowledge and handling practices, a chi-square test of association was performed.

Table 4.6 Pearson's Chi-squared Test Output

Chi-square statistics	Degree of freedom	P-value
297.12	2	2.20E-16

The results of the test indicated that there was a significant relationship between the levels of knowledge and the food hygiene practices at 0.01 level of significance since the p-value of the chi-square statistic is less than 0.01. This shows that the level of knowledge of the food handler affects the practices.

Table 4.7 Multinomial Logistic Regression Model Results

Practice (Outcome) Reference level = Never	Knowledge Level Coefficient Estimate	Standard Error	Knowledge Odds Ratio	95% Confidence Interval	P-value
Always	1.3205237	0.07691	3.745382	[3.2236,4.3514]	< 0.01
Occasional	0.8496208	0.09676	2.33876	[1.9347,2.8272]	< 0.01

To further determine the strength of association between food handlers' knowledge on food hygiene and food handler's food hygiene practices a Multinomial logistic regression model was performed. The outcome variable was food handler's food hygiene practices which had 3 levels, 'never', 'occasional' and 'always' and the predictor variable was food handlers' knowledge on

food hygiene which had three levels (Sufficient – knowledgeable, Acceptable- Moderately Knowledgeable and Insufficient- Not knowledgeable). The results of the test indicated that the p-value of the estimated coefficients are both less than 0.05 level of significance, with a residual deviance of 7511.885 and AIC of 7519.885 with those who 'Always' practice having an Odds Ratio of 3.75, while those who 'Occasionally' practice having and Odds Ratio of 2.34. Hence the food handlers' knowledge on food hygiene affects food handler's food hygiene practices.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter gives the discussions of the findings which include the discussion of the findings on the socio-demographic characteristics of Mathari street food vendors and each of the study objectives and their association.

5.2 Socio-Demographic Characteristics of the Respondents

The results of this study revealed that the street food vending business in Mathari is dominated by women (75 %). Generally, the higher proportion of female vendors can be explained by the fact that women are culturally responsible for cooking and childcare and generally underprivileged. Also many aspects of the preparation and sale of street foods are often the domain of women , which result in their greater involvement in informal sector's such as RTE food trade (Cohen, Bhatt, & Horn, 2000). The same findings corresponds with other studies conducted in Accra (Mensah et al., 2002), Brazil (Cortese et al., 2016), South Africa (Martins, 2016), Nigeria (Aluh & Aluh, 2017) and Kenya (Kuria, 2005) where the majority of individual respondents in the studies were female.

The majority (46%) of vendors were between 21 to 30 years. This finding corresponds with the findings of an earlier study by Muinde and Kuria, (2005) in Nairobi, where they found that over thirty-five percent of the vendors belonged to the age category of 20-25 years. This might be due to the youth bulge and soaring unemployment in Kenya, where the significant percentage of the population is young (UNDP, 2017). This study also found most (66%) of the vendors had attained only primary education with only 7% who had no form of education. The high numbers

in primary education arises due to the free primary education enrollment adopted by the Kenyan government since 2003. But the fewer numbers with post-secondary or no education can be attributed to low secondary transition due to space limitation and poor economic situation of the residents (World bank, 2009).

Ninety-four percent of the respondents were from Mathari. Similar to a study in Guwahati, (Choudhur et al., 2011) most vendors were residents of the area. Their proximity to home, proved female traders can more easily care for young children and combine their livelihoods with household chores. Further, unlike various studies done in developing countries India (Choundry *et al.,* 2011), Brazil (Angelillo et *al.,* 2001) and Ghana (Rheinländer et al., 2008) where mobile vendors were the majority, this study differs with their finding with the majority of the businesses being stationary (71%) and only 29% were mobile.

This study found the largest category (46%) of food vendors had no form of registration as per the Nairobi bylaws requirements of the food vendors to trade in Nairobi. Notably, low numbers of food handlers were noted to have health registration (8%), and are outside the regulation and protection of government in comparison to 46% in Ghana (FAO, 2016). Vendors prefer not to incur costs such as rent, registration and utility payments. The finding shows that this low registration can weaken implementation of relevant environmental and public health regulations, since there would be poor monitoring and inspection of the vendors' activities in Mathari by the relevant authorities.

In this study, 77% of the respondents' household had the RTE business as their main source of income and only 2% had other sources of income. This finding is consistent with the study of Carol and Ongori (2013) in Gaborone where most respondents were engaged in street food vending as a way of promoting self-reliance. Further, confirming that many populations in African, Asian and Latin countries who cannot find work in the formal sector are constrained by the unstable socioeconomic backgrounds in their families and the RTE business creates employment and their main source of income. This is also in conformity to ILO report by Kusakabe, (2006.) in Thailand, Cambodia and Mongolia where street vending was found to contribute to the national economy, create employment, act as a buffer for unemployment, and offer conveniences to customers. This further reinforces the notion that street vending contributes to a large part of the vendors household income, and for those people in the middle working age group, it is a core means of livelihood.

This study found that most of the vendors (54%) were self-taught in their food hygiene and vending skills like other informal businesses. This confirms the ILO Working Paper (2002) and Mwangi et al.,(2010) studies that many of the informal sector workers do manage to acquire most of the basic skills and competencies that are necessary to carry out their activities. In this study, the majority (93%) of the vendors had no formal training in food preparation and handling. Apart from being self-taught, they either learnt it through observation (22%) or from their parents (19%). This was consistent with findings of Nurudeen, et al.,(2014) and Buted and Ylagan,(2014) where only 2.7% and 12% had formal training on food hygiene respectively. This finding is also in conformity with earlier studies including those of Kuria, (2005) and Rheinländer et al., (2008), which found that most people involved in street food vending had no

formal knowledge on food hygiene, a situation they observed to negatively affect the level of proper hygiene practices among food vendors. This lack of formal knowledge and training may contribute to neglect of very important hygienic practices. This finding further implies that most of the food vendors need training on food hygiene practices.

Generally, 82% of respondents indicated that they are willing to get food hygiene training. Education and training of food handlers can contribute to a marked improvement of their food handling practices, which may be the most cost-effective way to reduce the incidence of food-borne diseases by contaminated street vended foods (WHO & INFOSAN, 2010). According to IFOSAN, (2009) and FAO, (2009b), food vendors are required to undergo basic training in food hygiene before licensing. This is because inadequate or non-compliance to hygiene practices could pose a potential threat to the safety of food and its suitability for consumption.

5.3 Knowledge of Food Handlers on Food Safety Practices

The food handlers demonstrated an overall "good knowledge on food safety and hygiene" with a score of 54%. This is in contrast to previous studies in Ethiopia (Tessema et al., 2014), Malaysia (Mizanur et al.,2012) and Iran (Pirsaheb et al., 2010) where the majority of street food vendors had poor knowledge of food safety and hygiene. Of the 21 questions on food safety and hygiene knowledge in the questionnaire, the respondents correctly scored highest in the questions of hygienic cooking environment (98%), sores and wounds dressing (98%), food preparation while sick (90%) and handwashing after using the toilet (94%). The awareness of such important hygienic procedures by the majority of the food-handlers in this study is very appropriate. This may be due to the hygiene awareness campaigns. 100 vendors received food safety trainings led by local nurses, as well as by staff at the International Livestock Research Institute (ILRI) and

African Population and Health Research Centre (APHRC). The participants later taught other members of their groups. Utilizing a 'train-the-trainer' model which helped reach additional vendors, who took several steps to promote food safety (Zoo, et al., 2017)

Although these efforts have led to an increase in awareness and knowledge levels of food safety and hygiene practices, this knowledge is however not always translated in to actual practice (Akabanda, Hlortsi, & Owusu-Kwarteng, 2017). This is evidenced by the low numbers (22%) of observed food handlers using head covers as compared with the higher self-reported numbers (35%). This is consistent with previous studies in Ghana by Rheinländer et al., (2008), South Africa by Campbell et al., (2011) and Kenya by Zoo, et al., (2017) who further posit that some of the chief reasons for non-compliance among a large section of street food vendors include their poor knowledge on personal hygiene, insufficient training, illiteracy or uneducated background and perhaps lack of knowledge and/ or appreciation of hygienic and safe food handling, low skills levels, and poverty.

Manning & Snider, (1993) reported that 81% of their respondents are aware of the importance of hand washing, but only 2% observed washing their hands thoroughly. More than half of the respondents (73.9%) answered with the correct option which indicates that they realized food prepared without proper handling may contribute to the risk of food-borne illnesses. A similar study was done in small and micro enterprises, to assess food handlers' knowledge on food hygiene in South Africa and found that the average correct answers were lower at 46% compared to this study that found an average of 54% to be knowledgeable in food hygiene practices. The

improved results can be attributed to the recent food hygiene awareness campaigns (Zoo et al., 2017) done to the food handlers in Mathari.

In this study 90% of the food handlers' respondents had good knowledge of keeping away persons suffering from potential pathogenic illnesses from food preparation which is in contrast to studies in Sri Lanka 61.8% (Galgamuwa et al., 2016) and Bangladesh 38.5% (Md Shafiqul Islam, et al., 2018) where the food handlers continued with food handling duties. In a study in Bloemfontein, South Africa, all of the street food vendors interviewed by Lues, et al., (2006), confessed that they had prepared food for public consumption at some point while sick probably because their sustenance depended on daily returns from the trade. This clearly demonstrates how pathogenic organisms from infected food handlers can be transmitted to food via contaminated hands, infected skin lesions, nasopharyngeal secretions or fomites (Hedberg, 2017; Rane, 2011; Sabbithi et al., 2017). Food handlers' need to fully understand the importance of taking a sick off from food preparation and vending duties. The employee could instead be temporarily assigned to other work not involving direct contact with food. For some food handlers, it is difficult to report health problems if they think they will be penalized [loss of wages, etc.](FAO, 2009b).

In this study respondents had good knowledge on sores dressing while handling food (98%). This finding intimated there is awareness regarding personal and food hygiene among the vendors. This is in contrast with a study in Sri Lanka (Galgamuwa et al., 2016) which found 52.4% of the food handlers had good knowledge of skin dressing. A study in the Federal Capital Territory of Nigeria by Nnebue, et al.,(2014), 57 (33.9%) of the food handlers were observed with an open wound or cut. *Streptococci* and *Staphylococci* are commonly transmitted via infected skin lesions

on exposed body parts. In addition, aerosolisation has been identified as a mode of transmission of some vital outbreaks such as Norovirus (Aron J et al., 2011; Havelaar et al., 2015). Therefore, adequate covering of these infected lesions by colored waterproof dressings is important to ensure the reduction of cross contamination of foods. In addition, food handlers with purulent discharges should not have contact with food because they are also a potential source of food contamination (World Health Organization & Skovgaard, 2008).

Majority of food-handlers in this study reported awareness of the importance of general sanitary environments such as preparing food in a clean environment (98% correct answers). However, it was observed only 43% operated in clean vending sites. This discrepancy has been noted. These unsanitary conditions have been necessitated by the poor infrastructure and hazardous environmental conditions in informal settlements. This finding reinforces a previous study in Nairobi informal settlements by Ahmed et al., (2015) which showed some of these interrelated sanitation concerns were beyond the vendors control. This study also found 29% respondents who knew it was unhygienic to cook at ground level. This finding is similar to previous studies in Uganda, Masaka District by Muyanja et al., (2011) and Ghana, Accra P. Mensah et al., (2002) where 74.3 % and 17.1% respectively of the food handlers were observed to handle food at ground level. Holding of foods at ground level and incessant uncovering of foods for dispensing exposed street foods to dust contamination and flies which has been linked to food borne diseases such as cholera and diarrhea (Levine & Levine, 1991; Muinde & Kuria, 2005).

In this study, it was found that few respondents were aware of the requirement of well-trimmed and clean fingernails (28%) in food handling. This low finding shows noncompliance of personal

hygiene of the vendors. These low findings are similar to a study in Sari City, Iran by (Nasrolahei, et al., (2017) where of the 220 food handlers examined, 62.2% (137) were carriers of some pathogenic bacteria in their fingernails. As evidenced in the study by Nasrolahei et al., (2017), several pathogenic microorganisms can survive beneath fingernails and therefore always fingernails should be kept clean and short to prevent the pathogens transmission to foods (Ferron, Morgan, & O'Reilly, 2000; Lues et al., 2006).

Food-handlers in this study knew the importance of general sanitary practices such as hand washing after visiting the toilet (94% correct answers) and not wearing jewelry while handling food (73% correct answers). However, this study also found very low respondents who used gloves (4%) when handling food. Despite a self-reported good hand washing practiced by food-handlers, others had low correct answers on handwashing after handling money (34%) and handwashing in between handling raw and cooked foods (35%). This finding is similar to Brazil study (Cortese et al., 2016). Further, many employees' in a study by Stepanovic et al., (2005) had coagulase-positive staphylococci isolated from their hands, and this could be a source of food contamination. A comparative study on the risks involved in the use of hands and cutleries to serve street foods in Ghana by Mensah et al.,(2002), showed that the use of bare hands to serve increased the level of contamination. Alimi, (2016) further reported food can be recontaminated by the hands of the vendors. Therefore, it is prudent to combine proper hand washing with the wearing of gloves and other hygienic practices in order to minimize the risk of contamination during food handling.

In 70% of the self-reported knowledge vendors reheated their food before sale if stored for more than 4 hours. While 77% thoroughly cooked before eating. Although it was observed 61% heated their foods before serving and 93% of the vendors prepared food far ahead of service. These findings are contrary to those earlier reported by Muinde & Kuria, (2005) in Kenya, Bryan FL et al., (1997) in Zambia and by Redzwan Habib,(2016) in Bangladesh. This is an important finding as it has been shown that inadequate cooling is among the key factors that contribute to the occurrence of food poisoning outbreaks (Barro et al., 2007; WHO, 1996; Rane, 2011; Rheinländer et al., 2008). Foods are often held for several hours after cooking and this includes overnight holding at ambient temperatures, until sold, and thus can harbor high microbial populations. Besides, some of the foods are held in the pans in which they are cooked, until sold or reheated, which results in longer holding time, hence creating favorable conditions for the growth of foodborne pathogens. In such foods, the counts of *Escherichia coli, Staphylococcus aureus, Bacillus cereus* and *Clostridium perfringens* are reported to be high (Barro et al., 2007; Bryan FL et al., 1997).

However, the ways the street foods are being prepared, handled and vended predispose them to recontamination, cross contamination and transmission of pathogens and food borne illnesses. Overall eighty-four percent of the food handlers had knowledge that food can get contaminated during preparation. This finding is similar to the Chidambaram study by Prabakaran et al.,(2017). The study found 97.33±9.13 of the food handlers was aware of food contamination. Bryan, (1988) reported contamination can occur at any stage from the initial contamination of raw foods with pathogenic bacteria to subsequent contamination by vendors during preparation. A study by Barro et al., (2007) found that the common potential sources of contamination of

street food comprised of the food vendors' hands, the utensils used to serve the food and in cases where the dish was made of raw vegetables, the hygienic quality of the water used to wash them.

5.4 Hygiene Practices in RTE Food Premises in Mathari

Fifty seven percent of the street vendors reported using aprons during handling, preparation and serving of food which is similar to a study in Ghana by Rheinländer et al., (2008). However, there is a slight increase in use of aprons as compared to earlier studies by Muinde & Kuria (2005) and Mensah et al., (2002). This may be due to more food handlers being aware of the hygiene practices recently.

Vendors reported it was hygienic to use clean soapy water to clean utensils (69%), but it was observed 7% of the vendors used recycled water for washing utensils and 78% washed their utensils before and after cooking. Majority of street vendors, as reported in a study by Muyanja et al., (2011) in Uganda, Kampala, used non-disposable plates, cups and cutleries for serving foods at 87.1%. These utensils were usually washed with soap solution and rinsed in cold water, while in some other instances washed with cold water and scouring towels. While some vendors changed the washing and rinsing liquids twice in a day, others used the same liquids unchanged for the whole day. These practices, observed by the authors, create favorable environments for recontamination of street vended foods. The use of the same set of cutleries (not properly cleaned after each use by different consumers) led to cross contamination and transmission of infectious diseases among unsuspecting consumers (Mosupye & von Holy, 2000). These practices highlight the challenges experienced by the vendors, although this study found most vendors had access to water sources, a further challenge as vendors may struggle to prepare and adequately clean their

foods since the water provision comes at a cost. Due to the cost attached on water the vendors use the water sparingly to save money and there is tendency of recycling wash water many times.

Contrary to our study where 68% of the food was prepared on site, only 10% and 14% of the food was prepared on site in South Africa (Lues et al., 2006) and Mauritius (Subratty et al., 2004), respectively. This may be attributed to many of Mathari food vendors having stationary vending sites and the types of foods they are selling that only need reheating before reselling. Most of the foods for street vending are usually prepared in bulk at different times ahead of retailing. The long holding period of more than 6 h, sometimes at ambient temperature, were reported by Muyanja et al., (2011) to be a common factor contributing to food borne illness through multiplication of microorganisms favored by holding temperature in the range of 5 and 60 ◦C (described as danger zone). Mosupye & von Holy, (2000) suggested that holding conditions which favored the survival and germination of *Bacillus* spores may be responsible for the high load of *Bacillus spp*. isolated in ready to eat street foods. Storage and handling of left-over food was found to be mostly by consumption. Others covered them in utensils and others reheated them before selling. However, very few reported to have any form of refrigeration for their products. Vendors utilized these range of strategies to avoid unsold leftovers, which reflect vendors' poverty and lack of refrigeration for perishable foods. This study is consistent with many other studies in developing countries like Nigeria (Nkiruka, 2013), India (Choudhury et al., 2011) and South Africa (von Holy & Makhoane, 2006) where storage was done in ambient temperature. This situation of time-temperature abuse is potentially hazardous due to prolonged exposure to the generally high ambient temperatures typical of the local climate (Alves da Silva et al., 2014).

Many vendors reported to have access to waste disposal, mostly through waste bins private or provided by the municipality. However, twenty-eight percent disposed of in drainages, culvert or gutters close to their vending sites. This is in similar with the findings of vendors of Nsawam and Adoagyiri in Ghana study by Wuliyeng, (2013). Where 42% of the respondents had no waste bins at their vending sites but relied on public bins at central collection points located far away from their sites. Because of the lack of adequate waste disposal facilities, street vendors have a tendency to dispose of their garbage in the street. This in turn attracts more flies and insects which are potential vectors of pathogens.

In the present study, majority of respondents 44% practiced washing hands with soap and water during the food handling process. However, lower results have been reported in Owerri, Nigeria (Iwu et al., 2017) which was only 21% of subjects that had a practice of proper hand washing with soap and water. Further this study found 13% of Mathari vendors' used water only. This may be attributed to the challenges of toilets and washing facilities not readily available in the vending sites and also additional costs incurred in purchasing the soap and sanitizers. Although hand washing only with water can reduce the burden of normal flora, it cannot remove all types of pathogenic microorganisms. Therefore, improper hand washing could be a major reason for high prevalence of food borne diseases present in the street food vending sector (Rane, 2011).

In agreement to the findings that have been made in other studies (Ngoc et al., 2011; Odeyemi et al., 2019; Rane, 2011; Samapundo et al., 2015), 96 % of the vendors in Mathari were observed to handle food with bare hands, 94% handled money while serving the food and only 85% washed

their hands thereafter. Further, it was observed 76% had short and clean nails. These findings are a concern since the hands are vectors for pathogens such as *S.aureus* (Rane, 2011). Consequently, it is advised that food handlers should avoid handling food with bare hands and handling money at the same time (Michaels, 2002). Handling money and ready-to-eat food with the same gloved hands or without hygiene intervention between these activities can introduce the risk of cross-contamination to foods provided in food service establishments. Accumulated data obtained over the last 20 years on the microbial status and survival of pathogens on coins and currency notes indicates that this could represent a potential cause of sporadic cases of food borne illness. Survival of various microorganisms of concern on money is such that it could serve as a vehicle for transmission of disease and represents an often overlooked enteric disease reservoir. With low infectious doses capable of causing illness noted for a number of different infectious intestinal diseases, failure to adequately sanitize hands, or use food handling tools (tongs, spoons, utensils or bakery/serving papers) between handling money and serving food, could put patrons at risk (Girma, 2015; Michaels, 2002).

With 98% reusing frying oil, many consumers of RTE foods are exposed to the adverse effects of saturated and trans fats that are suspected to be carcinogenic (Cam et al., 2019). Separation between raw foods from cooked food was also poor with 43% of the vendors who participated. This finding is higher than a study in Ghana by Akuu et al., (2016.), who found 29%. Mosupye & von Holy, (2000) observed that raw meat and poultry as well as gravy and salad being sold by a vendor in Johannesburg, South Africa were cut and chopped with the same knife on the same surface without cleaning in-between. Clear separation of cooked and raw foods prevents cross-contamination (World Health Organization & International Food Safety Authorities Network,

2010). Generally, most of the stationary and mobile structures had very small working areas which made the place look too crowded and disorderly with storage facilities for cooking and serving utensils, raw materials and cooking place all in one stall.

Most of the vendors pack the food in polythene bags for their customers. When packing these foods, 99% of the vendors were observed blowing air into the polythene bags to open them, in this process a number of pathogens can be passed on to the consumer. A study by Barro et al.,(2007) found that pathogens can invade the interior surfaces of the polyethylene bags during packaging because of this poor handling. This result showed marked increase in this practice being followed in Mathari as compared to the study in Owerri, Nigeria by Chukuezi, (2010) which had 28.7%. This high number of polythene bags use can be attributed to lack of affordable alternative packaging materials.

In addition, it is important to highlight that some of the food handlers' knowledge and self-reported practices are inconsistent with the observations carried out. Although almost all (98%) food handlers correctly answered that it was unhygienic to prepare food in an unhygienic environment, the observations showed that the sanitation conditions were unhygienic with only 43% working in clean vending sites and 41% with clean working surfaces. While 60% of the handlers were aware that it was hygienic not to expose the food to flies. Nonetheless, the observations revealed that only a paltry 4% presented their foods while covered, 86% their food was exposed to dust and further 36% their work place had flies and cockroaches. The occurrence of a social desirability bias may also have contributed to the divergence between self-reported and observed practices of handlers. Social desirability bias is described as the tendency of respondents to give socially desirable responses in such a way as to be viewed favorably by

others (Jespersen, MacLaurin, & Vlerick, 2017). As previously mentioned, handlers were aware of the hygiene practices and the importance of complying with them, but they were not willing to admit their noncompliance. This further highlight that the hygiene knowledge is not entirely translated into practice other factors such as attitude may also play a role (Rheinländer et al., 2008).

5.4.1 Sanitation Conditions of RTE Food Environment in Mathari

Food safety is also dependent on personal and environmental hygiene. Due to the nature of street foods literally being prepared, displayed and served on the street, the physical conditions/preparation area are exposed to the natural elements. Dust has potential to carry many microbes that may be pathogenic if left to settle on prepared foods. Hence it is important that food is covered to protect it from dust exposure and flies (Muinde & Kuria, 2005; Sukontason et al., 2000). Based on observations, the current study found that 84% of street food vendors worked with food at ground level, 36% of the vendors worked in places exposed to flies and cockroaches and 86% were exposed to dust. Muinde & Kuria, (2005) reported similar findings. Vendors in Mathari struggle to ensure hygiene practices, as their vending spaces are small and the ground is the area utilized for display of their food products and sometimes due to limited infrastructure access or other factors beyond their control.

Bryan et al., (1997) observed accumulation of large heaps of garbage around street food vending sites in Zambia which harbored insects and animal pests (known vectors of diseases). Vendors in Uganda, Masaka (64.3%) and Jinja (38.9%) disposed of waste at their vending site. Muyanja et al., (2011) reported this was a common practice at the vending sites. These findings are consistent with this study, where 32% were observed to have availability of waste disposal. 78%

were far from open drainage, garbage and toilets. Further, Mathari vendors (43%) were observed to have clean vending sites whereas Kampala (75.9%) and Jinja (65.3%) indicated hygiene regulations were enforced onsite management by local government (Muyanja et al., 2011). A high proportion of 90.5% of the vending sites in Nigeria (Okojie & Isah, 2014) appeared clean. In Mathari, most vendors are unregistered and thus unregulated, therefore most of the basic services offered by the local authority cannot be offered to them.

Inadequacy or near absence of basic facilities at the vending sites can mostly be attributed for non-compliance with basic hygiene principles. In the study on the hygienic practices by street food vendors in Trinidad, West Indies, Benny-Ollivierra & Badrie, (2007) reported that most of the vending sites observed did not have pipe borne water, 97.5% did not have drain to channel wastewater and toilet facilities. This is in contrast with this study finding where 74% of vendors were observed to have availability of water and 47% had availability of toilets. The observation of good sanitary condition in the majority of the food vending sites is similar to findings of studies conducted in Owerri, Nigeria(Chukuezi, 2010), and Accra, Ghana (Mensah et al., 2002), where the majority of the food premises were observed to be tidy, with the use of waste bin and the presence of on-site water source for sanitary purposes. This phenomenon is in line with requirements of standard guidelines and recommendations for street food vending practice and is thus commendable (Codex Alimentarius Commission, 2003; World Health Organization, 1996.-b). Most vendors in Mathari are unregistered and remain unnoticed by the local authorities, therefore most of the basic amenities offered by the local authority are limited or inaccessible.

Forty-one percent of the vendors in Mathari were observed to have clean working surfaces. This finding is slightly higher than those found in a study done by Walker et al., (2003), which confirmed that a majority of food handlers (97%) know the reason of separating cooked and raw foods but their knowledge of keeping work surfaces hygienically clean to avoid cross-contamination is poor (20%). The importance of effective cleaning and disinfection of food surfaces for reducing the potential of cross-contamination is well recognized and is an important universally accepted component of food safety management systems (Sagoo, Little, Griffith, & Mitchell, 2003). Generally, these higher numbers can be attributed to the training and coupled with the need of the vendors to "appear clean".

5.5 Association between Food Hygiene Knowledge and Handling Practices

According to the result of multinomial logistic regression analysis, vendors who "always practice" are 95% more likely (AOR=3.745, 95% CI (3.224, 4.351) to implement hygienic practices as compared to those who "never practices". Vendors who "occasionally practice" are 95% more likely (AOR=2.339, 95% CI (1.935, 2.827) to implement hygienic practices as compared to those who "never practices". The findings suggested that there were positive relationships between both knowledge and practice. It can be anticipated that as knowledge will increase, practice will improve accordingly. Different studies found a similar result which states that hygiene practice is directly related to the status of food safety knowledge (Akabanda et al., 2017; Chukuezi, 2010). However, even though good knowledge and hygiene practice is associated, knowledge is not always translated to practice. This means other factors such as attitude may play a role.

Several factors were identified to contribute to these improper hygienic and safety practices. Among these factors were; most vendors (93%) had no formal knowledge or training on vending skills before starting the business, poor infrastructural and social amenities such as lack of potable water, waste disposal and toilet facilities for vendors to work with, and poor/ ineffective monitoring, control and enforcement of rules and regulations on street food vending by regulatory authorities evidenced by registration and acquisition of food handlers' certificates. Thus poor institutional monitoring and regulation of vendors contributed to improper hygienic practices among vendors in Mathari.

In spite of the food handlers being aware of food safety and hygiene practices, the reported lack of safe practices highlights a gap between knowledge and actual food safety practice. Other studies (Azanza & Zamora-Luna, 2005) have shown similar findings; Azanza and Zamora-Luna, (2005) found a significant discrepancy between reported food safety knowledge and actual food safety practice. As previously mentioned, handlers were aware of the hygiene practices and the importance of complying with them, but they were not willing to admit their noncompliance.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter gives the conclusions and recommendations of the study. It is divided into three parts, the first part gives the summary of findings, the second part gives the conclusions of the study, and the third part gives the recommendations for the study and future research.

6.2 Summary of Findings

The socio-demographic characteristics of the food handlers sampled for the study, revealed that more females than males availed themselves for the purpose of the study. It was also discovered that the population of Mathari was dominantly youthful (21-30 years) in nature and thus constituted the active labour force of the study area. Additionally, as revealed by the study, most respondents were prominently primary school graduates. It was also noted that the ready to eat business was the main source of income for the majority of the respondents.

The first objective of the study sought to assess the food handlers' knowledge on hygiene practices in RTE foods in Mathari slums. It was revealed that a significant number of respondents had "good knowledge" of food hygiene practices. Respondents were aware of important hygienic procedures and correctly scored highest in the questions of hygienic cooking environment, sores and wounds dressing, food preparation while sick and handwashing after using the toilet. The study in addition revealed that vendors were aware of good hygiene practices like handwashing after visiting the toilet and before handling food. Furthermore, the study disclosed that many vendors were not aware of good hygiene practices of handwashing

after handling money and handwashing in between handling raw and cooked foods which increases risk of cross-contamination.

The second objective sought to assess the vendors' hygiene practices, many respondents wore clean aprons, and hair covers and also changed frequently. Very few reported storing left-over food in the fridge, ambient temperature and leaving it in an open stall. Most respondents reported to throw their waste in the waste bin. Others disposed their wastes in drainage, culvert and gutter nearby also along the street path. Other reported hygiene practices included washing hands after toilet visits, reheating food before selling and covering food during storage, the majority greatly adhered to the good practices. Nevertheless, some of the responses were contrary to the actual practices as from the observation which indicates that vendors use head covers at work, preparing foods far ahead of service, presenting food when covered and clear separation of raw and cooked foods was exercised by only a few of the respondents which contradicts their responses. Furthermore, the findings indicate that the handling of food with bare hands was practiced by a great majority of the respondents.

The last objective of the study examined the relationship between Food Safety Knowledge and Handling Practices. The study in this context performed a chi square test and multinomial logistic regression model analysis to test the association and strength of association respectively between the knowledge and practice. The findings suggested that there were positive relationships between both knowledge and practice. It can be anticipated that as knowledge will increase, practice will improve accordingly.

6.3 Conclusions

This study found that the food handlers surveyed had average "good knowledge" on food hygiene practices. However, a considerable percentage had very low scores in some important practices highlighting the need for food hygiene training.

The actual food handling practices by street vendors in Mathari also raise some serious concerns as some of the responses were not actually implemented. Although vendors reported practicing the hygiene practices some of the food handlers' knowledge and self-reported practices were inconsistent with the observations carried out.

With regards to association between food hygiene knowledge and handling practices, findings in this study indicated that increase in food hygiene knowledge of food handlers will influence the food handlers' practices. This study shows that increasing hygiene knowledge could lead to having good practice in food hygiene among the respective food handlers, consequently improving the hygiene of the street foods.

6.4 Recommendations

6.4.1 Recommendations for Study

- The study suggests that even though the knowledge on hygiene practice level of food handlers was average, some aspects related to handwashing, use of aprons and gloves, storage and leftovers handling (time-temperature control) and clear separation of cooked and raw need to be stressed. Use of universally adopted HACCP based systems or World Health Organization, (2006) Five Keys to Safer Foods Manual can assist. Continuous food safety training for food handlers in Mathari should become mandatory to strengthen

food handlers' knowledge in the areas which seem to be lacking. Training should not only focus on theoretical aspects of knowledge, but also be practical and to promote good food safety practices. This would raise the level of awareness and implementation.

- The county health sector and other related stakeholders should be regular in providing training on food hygiene to street food vendors and should maintain regular inspection and supervision to ensure implementation of the hygiene practices.

- Local governments can also facilitate subsidized medical examinations and affordable issuance of food handlers' health certificates. This can help vendors become more likely to register and acquire trading license. The licensing of vendors will ensure that they are not harassed, arrested or have their trading items confiscated by council officers. Excessive regulation of the sector carries the risk of fewer certified vendors and the problem of an informal sector consisting of those dodging the regulation, but with this certain minimum standard, especially related to food quality and food handler's health certificate, can be enforced. It will also assist with recognition, inspection and enforce implementation of food hygiene by the vendors.

6.4.2 Recommendation for Future Research

- Assess the microbial risk of food poisoning associated with ready to eat foods in order to determine the magnitude of the problem, risk factors, monitoring and surveillance, and measures of control.
- Assess the antimicrobial resistance of the microbes found in ready to eat foods sold in the urban slums.

- Further research in intervention study by providing food hygiene practices and assessing the nature and extent of its impact on food hygiene practices after vendors are well informed and educated on the same.

REFERENCES

Ababio, P. F., & Lovatt, P. (2015). A review on food safety and food hygiene studies in Ghana. *Food Control*. https://doi.org/10.1016/j.foodcont.2014.06.041

Ahmed, S., Simiyu, E., Githiri, G., Sverdlik, A., & Mbaka, S. (2015). Cooking up a storm Community-led mapping and advocacy with food vendors in Nairobi's informal settlements. Retrieved from www.iied.org@iiedwww.facebook.com/theIIED

Akabanda, F., Hlortsi, E. H., & Owusu-Kwarteng, J. (2017). Food safety knowledge, attitudes and practices of institutional food-handlers in Ghana. *BMC Public Health*, *17*(1), 40. https://doi.org/10.1186/s12889-016-3986-9

Aklilu, A., Kahase, D., Dessalegn, M., Tarekegn, N., Gebremichael, S., Zenebe, S., … Mama, M. (2015). Prevalence of intestinal parasites, salmonella and shigella among apparently health food handlers of Addis Ababa University student's cafeteria, Addis Ababa, Ethiopia. *BMC Research Notes*, *8*(1), 4–9. https://doi.org/10.1186/s13104-014-0967-x

Akonor, P. T., & Akonor, M. A. (2013). Food Safety Knowledge: The Case of Domestic Food Handlers in Accra. *European Journal of Nutrition & Food Safety*, *3*(3), 99–111. https://doi.org/10.9734/EJNFS/2013/3227

Akuu Joshua Amaami, Danyi Dominic, & Dapaah Collins. (n.d.). Factors associated with poor food safety compliance among street food vendors in the Techiman Municipality of Ghana. Retrieved from https://academicjournals.org/journal/AJFS/article-full-text-pdf/766D58462887

Al Mamun, M., & Turin, T. C. (2016). Safety of street foods. In *Food Hygiene and Toxicology in Ready-to-Eat Foods*. https://doi.org/10.1016/B978-0-12-801916-0.00002-9

Alimi, B. A. (2016). Risk factors in street food practices in developing countries: A review. *Food*

Science and Human Wellness, *5*(3), 141–148. Retrieved from https://www.sciencedirect.com/science/article/pii/S2213453016300441#bib0540

Alimi, B. A., & Workneh, T. S. (2016). Consumer awareness and willingness to pay for safety of street foods in developing countries: A review. *International Journal of Consumer Studies*, *40*(2), 242–248. https://doi.org/10.1111/ijcs.12248

Aluh, F. O., & Aluh, D. O. (2017). Knowledge, attitudes and practices of food hygiene among mobile food vendors in a Nigerian rural settlement. *International Journal Of Community Medicine And Public Health*, *4*(11), 4025. https://doi.org/10.18203/2394-6040.ijcmph20174812

Alves da Silva, S., Cardoso, R. de C. V., Góes, J. Â. W., Santos, J. N., Ramos, F. P., Bispo de Jesus, R., … Teles da Silva, P. S. (2014). Street food on the coast of Salvador, Bahia, Brazil: A study from the socioeconomic and food safety perspectives. *Food Control*, *40*, 78–84. https://doi.org/10.1016/J.FOODCONT.2013.11.022

Ansari-Lari, M., Soodbakhsh, S., & Lakzadeh, L. (2010). Knowledge, attitudes and practices of workers on food hygienic practices in meat processing plants in Fars, Iran. *Food Control*, *21*(3), 260–263. https://doi.org/10.1016/J.FOODCONT.2009.06.003

Aron J, H., Jan, V., Benjamin, L., Geun, W. P., Catherine, Y., Nicole, G., & Umesh, P. (2011). Updated Norovirus Outbreak Management and Disease Prevention Guidelines. Retrieved September 10, 2019, from https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6003a1.htm

Assob, J., Nde, P., Nsagha, D., Njimoh, D., Nfor, O., Njunda, A., … Hlf, K. (2012). The incidence of feco-oral parasites in street-food vendors in Buea, south-west region Cameroon. *African Health Sciences*, *12*(3), 376. https://doi.org/10.4314/ahs.v12i3.20

Azanza, M. P. V., & Zamora-Luna, M. B. V. (2005). Barriers of HACCP team members to

guideline adherence. *Food Control*, *16*(1), 15–22. https://doi.org/10.1016/j.foodcont.2003.10.009

B, P., AJW, F., & PK, G. (2017). Assessment of Level of Knowledge on Food Hygiene among Street Food Vendors in Urban Chidambaram: A Cross Sectional Study. *Saudi Journal of Medicine*. Retrieved from https://pdfs.semanticscholar.org/f70d/387114bcee67b2b178fceaa4938aef8adb3b.pdf

Barro, N., Bello, A. R., Itsiembou, Y., Savadogo, A., Ouattara, C. A. T., Nikiéma, A. P., … Traoré, A. S. (2007). Street-vended foods improvement: Contamination mechanisms and application of food safety objective strategy: Critical review. *Pakistan Journal of Nutrition*, *6*(1), 1–10. https://doi.org/10.3897/zookeys.765.23157

Barro, N., Ouattara, C. A. T., Nikiema, P. A., Ouattara, A. S., & Traoré, A. S. (n.d.). [Microbial quality assessment of some street food widely consumed in Ouagadougou, Burkina Faso]. *Sante (Montrouge, France)*, *12*(4), 369–374. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12626290

Battersby, J., Crush, J., Battersby, J., & Crush, J. (2014). Africa's Urban Food Deserts. *Urban Forum*, *25*, 143–151. https://doi.org/10.1007/s12132-014-9225-5

Baxter, G. P., Elder, A. D., & Glaser, R. (1996). Knowledge-based cognition and performance assessment in the science classroom. *Educational Psychologist*, *31*(2), 133–140. https://doi.org/10.1207/s15326985ep3102_5

BENNY-OLLIVIERRA, C., & BADRIE, N. (2007). HYGIENIC PRACTICES BY VENDORS OF THE STREET FOOD DOUBLES AND PUBLIC PERCEPTION OF VENDING PRACTICES IN TRINIDAD, WEST INDIES. *Journal of Food Safety*, *27*(1), 66–81. https://doi.org/10.1111/j.1745-4565.2007.00061.x

Bhaskar, S. V. (2016). Foodborne diseases-disease burden. In *Food Safety in the 21st Century: Public Health Perspective* (pp. 1–10). https://doi.org/10.1016/B978-0-12-801773-9.00001-7

Bryan, F. L. (1988). Hazard analysis critical control point: what the system is and what it is not. *Journal of Environmental Health*.

Buted, D. R., & Ylagan, A. P. (2014). Street Food Preparation Practices. *Asia Pacific Journal of Education, Arts and Sciences* , *1*(2). Retrieved from http://apjeas.apjmr.com/wp-content/uploads/2014/05/APJEAS-2014-1-031.pdf

Byrd-Bredbenner, C., Maurer, J., Wheatley, V., Schaffner, D., Bruhn, C., & Blalock, L. (2007). *Food Safety Self-Reported Behaviors and Cognitions of Young Adults: Results of a National Study*. *Journal of Food Protection* (Vol. 70). Retrieved from https://pdfs.semanticscholar.org/0e76/633e4c4b0575d5f8645c8677b430e6f34a42.pdf

Byrd-Bredbenner, C., Wheatley, V., Schaffner, D., Bruhn, C., Blalock, L., & Maurer, J. (2007). Development and Implementation of a Food Safety Knowledge Instrument. *Journal of Food Science Education*, *6*(3), 46–55. https://doi.org/10.1111/j.1541-4329.2007.00029.x

Çakıroğlu, F. P., & Uçar, A. (2008). Employees' perception of hygiene in the catering industry in Ankara (Turkey). *Food Control*, *19*(1), 9–15. https://doi.org/10.1016/J.FOODCONT.2007.01.001

Cam, A., Oyirifi, A. B., Liu, Y., Haschek, W. M., Iwaniec, U. T., Turner, R. T., … Helferich, W. G. (2019). Thermally Abused Frying Oil Potentiates Metastasis to Lung in a Murine Model of Late-Stage Breast Cancer. *Cancer Prevention Research*, *12*(4), 201–210. https://doi.org/10.1158/1940-6207.CAPR-18-0220

Campbell, P. T., Ngoc, T., Thanh, C., Reviewers, P., Iwu, A. C., Uwakwe, K. A., … Kosatsky, T. (2011). Assessing the Knowledge , Attitudes and Practices of Street Food Vendors in the

City of Johannesburg regarding Food Hygiene and Safety. *Food Control*, *30*(May), 150–156. https://doi.org/10.1016/j.foodcont.2012.06.034

Choudhury, M., Mahanta, L., Goswami, J., Mazumder, M., & Pegoo, B. (2011). Socio-economic profile and food safety knowledge and practice of street food vendors in the city of Guwahati, Assam, India. *Food Control*, *22*(2), 196–203. https://doi.org/10.1016/J.FOODCONT.2010.06.020

Chukuezi, C. O. (2010). Food Safety and Hygienic Practices of Street Food Vendors in Owerri, Nigeria. *Studies in Sociology of Science*, *1*(1), 50–57. https://doi.org/10.3968/j.sss.1923018420100101.005

Climat, R. (2013). Faculty of Bioscience Engineering Academic year 2012-2013 Microbial safety aspects of street foods in Haiti Major : Public health.

Codex Alimentarius Commission. (2003). General Principles of Food Hygiene - CAC/RCP 1-1969. *Codex Alimentarius - Basic Texts Food Hygiene*.

Cohen, M., Bhatt, B., & Horn, P. (2000). *Women Street Vendors: The Road to Recognition*. Retrieved from www.popcouncil.org

Constituency Population by Sex, Number of Households, Area and Density - Kenya National Bureau of Statistics. (n.d.). Retrieved August 5, 2019, from https://www.knbs.or.ke/constituency-population-by-sex-number-of-households-area-and-density/

Cortese, R. D. M., Veiros, M. B., Feldman, C., & Cavalli, S. B. (2016). Food safety and hygiene practices of vendors during the chain of street food production in Florianopolis, Brazil: A cross-sectional study. *Food Control*, *62*, 178–186. https://doi.org/10.1016/j.foodcont.2015.10.027

Cowman, G., Otipo, S., Njeru, I., Achia, T., Thirumurthy, H., Bartram, J., & Kioko, J. (2017). Factors associated with cholera in Kenya, 2008-2013. *Pan African Medical Journal*. https://doi.org/10.11604/pamj.2017.28.101.12806

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches, 3rd ed. Research design: Qualitative, quantitative, and mixed methods approaches, 3rd ed.* Thousand Oaks, CA, US: Sage Publications, Inc.

Da, C., CJ, G., P, P., & AC, P. (2002). Food handlers' beliefs and self-reported practices. *International Journal of Environmental Health Research*, *12*(1), 25–39. https://doi.org/10.1080/09603120120110031

Egan, M. B., Raats, M. M., Grubb, S. M., Eves, A., Lumbers, M. L., Dean, M. S., & Adams, M. R. (2007). A review of food safety and food hygiene training studies in the commercial sector. *Food Control*, *18*(10), 1180–1190. https://doi.org/10.1016/j.foodcont.2006.08.001

Elder, S. (2009). *Youth Employment Programme International Labour Office ILO school-to-work transition survey: A methodological guide Sampling methodology Module 3*. Retrieved from www.ilo.org/publns

Elizabeth Walker, Catherine Pritchard, Stephen Forsythe, Walker, E., Pritchard, C., & Forsythe, S. (n.d.). Food handlers hygiene knowledge in small food businesses, *14*, 339–343. Retrieved from http://ssu.ac.ir/cms/fileadmin/user_upload/Mtahghighat/tfood/asil-article/amuzesh-Behdasht-Ghaza/Food_handlers_hygiene_knowledge_in_small_food_businesses.pdf

Essential safety requirements for street-vended foods *(Revised Edition) Food Safety Unit Division of Food and Nutrition World Health Organization*. (1996.). Retrieved from https://apps.who.int/iris/bitstream/handle/10665/63265/WHO_FNU_FOS_96.7.pdf;jsessioni

d=07B13E1C67A314AB8D9336FD75BE49C0?sequence=1

FAO/WHO Regional Conference on Food Safety for Africa assuring food safety and quality in small and medium size food enterprises *(Paper prepared by Botswana)*. (2005). Retrieved from http://www.fao.org/prods/GAP/gapindex_en.htm

Fao. (2016). *Street Food Vending in Accra, Ghana Field Survey Report*. Retrieved from http://www.fao.org/3/a-i6369e.pdf

FAO. (2005a). FAO/WHO Regional Conference on Food Safety for Africa. In *The Joint Secretariat of the Regional Conference on Food Safety for Africa* (p. 41). Retrieved from http://www.fao.org/3/a0215e/A0215E20.htm

FAO. (2005b). National food safety systems in Africa-a situation analysis. *FAO/WHO Regional Conference on Food Safety for Africa*. Retrieved from http://www.fao.org/tempref/docrep/fao/Meeting/010/a0215e/a0215e00.pdf

FAO. (2009a). Ensuring quality and safety of street foods. *Food for the Cities*. Retrieved from www.fao.org/ag/agn/food/food_en.stm

FAO. (2009b). Good hygienic practices in the preparation and sale of street food in Africa: Tools for Training. Retrieved from http://www.fao.org/3/a-a0740e.pdf

FAO, & Food and Agriculture Organization of the United Nations – FAO. (2009). *Good hygienic practices in the preparation and sale of street food in África*. Retrieved from http://www.fao.org/3/a0740e/a0740e00.pdf

Fleury, M. D., Stratton, J., Tinga, C., Charron, D. F., & Aramini, J. (2008). A descriptive analysis of hospitalization due to acute gastrointestinal illness in Canada, 1995-2004. *Canadian Journal of Public Health*, *99*(6), 489–493. https://doi.org/10.1007/bf03403783

Food and Agriculture Organisation. (2009). *How to Feed the World in 2050. Insights from an*

expert meeting at FAO. https://doi.org/10.1111/j.1728-4457.2009.00312.x

Frank L. Bryan, Marco, J., Rudolf, S., Esnart N, C., Mwanza, M., Abel, M., … H, Ch. (1997). Hazards Associated with Holding and Reheating Foods at Vending Sites in a Small Town in Zambia. *Journal of Food Protection* , *60*(4), 391–398. Retrieved from https://jfoodprotection.org/doi/pdf/10.4315/0362-028X-60.4.391

Gadi, C., Bala, K. L., & Kumar, A. (2013). Study of Hygienic practices of street food vendors in Allahabad city , India and Determination of Critical control points for safe street food. *The Allahabad Farmer Vol.*, *LXVIII*(2), 1–133.

Galgamuwa, L. S., Iddawela, D., & Dharmaratne, S. D. (2016). Knowledge and practices of food hygiene among food handlers in plantation sector, Sri Lanka. *International Journal of Scientific Reports*, *2*(12), 304. https://doi.org/10.18203/issn.2454-2156.intjscirep20164307

Geertz, C. (1978). 市场经济 - 农民营销中的信息与搜索---Bazaar Economy - Information and Search in Peasant Marketing. *American Economic Review*, *68*(2), 28–32. Retrieved from http://www.asia-europe.uni-heidelberg.de/fileadmin/Documents/Summer_School/Summer_School_2013/Frank_Gruener_text_I.pdf

Geneva. (2002.). *Global surveillance of foodborne disease: Developing a strategy and its interaction with risk analysis Report of a WHO consultation*. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/68882/WHO_CDS_CSR_EPH_2002.21.pdf?sequence=1&isAllowed=y

George, G., Rotich, J., Kigen, H., Catherine, K., Waweru, B., Boru, W., Muraguri, N. (2016). *Notes from the Field* : Ongoing Cholera Outbreak — Kenya, 2014–2016. *MMWR. Morbidity and Mortality Weekly Report*. https://doi.org/10.15585/mmwr.mm6503a7

Girma, G. (2015). Health Risk Associated with Handling of Paper Currencies. *International Journal of Food and Nutritional Science*, *2*(2), 1–6. https://doi.org/10.15436/2377-0619.15.014

Glanz, K., Rimer, B. k., & Viswanath, K. (2002). Health behavior and health education *Theory, Research, and Practice*. (K. GLANZ, B. K. RIMER, & K. Viswanath, Eds.) (4th ed.). San Francisco,CA: Jossey-Bass.

Government of Kenya. (2012). Public Health Act Chapter 242 2012(1986). *Revised Edition*. Retrieved from www.kenyalaw.org

Grace, D. (2015a). Food safety in developing countries: an overview, (October). https://doi.org/10.12774/eod_er.oct2015.graced

Grace, D. (2015b). Food safety in low and middle income countries. *International Journal of Environmental Research and Public Health*. https://doi.org/10.3390/ijerph120910490

Gustafson, D. J. (2013). Rising food costs & global food security: Key issues & relevance for India. *The Indian Journal of Medical Research*, *138*(3), 398–410. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24135190

Haorei, W. (2017). *EPRA International Journal of Economic and Business Review SOCIO-DEMOGRAPHIC CHARACTERISTICS OF STREET VENDORS IN MADURAI CITY-A STUDY*. *ISI Impact Factor* (Vol. 5). Retrieved from www.eprawisdom.comwww.eprawisdom.com

Havelaar, A. H., Kirk, M. D., Torgerson, P. R., Gibb, H. J., Hald, T., Lake, R. J., … Zeilmaker, M. (2015). World Health Organization Global Estimates and Regional Comparisons of the Burden of Foodborne Disease in 2010. *PLoS Medicine*. https://doi.org/10.1371/journal.pmed.1001923

Hedberg, C. W. Food safety, Occupational and Environmental Health § (2017). https://doi.org/10.1093/oso/9780190662677.003.0020

Henderson, J. V., Roberts, M., & Storeygard, A. (2013). Is Urbanization in Sub-Saharan Africa Different? *The World Bank Research Observer*. https://doi.org/doi:10.1596/1813-9450-6481

Hilario, J. S. (2015). An Evaluation of the Hygiene and Sanitation Practices Among Street Food Vendors Along Far Eastern University (FEU). *International Journal of Advanced Research Journalwww.Journalijar.Com INTERNATIONAL JOURNAL OF ADVANCED RESEARCH*.

Hoffmann, S., & Scallan, E. (2017). Epidemiology, Cost, and Risk Analysis of Foodborne Disease. In *Foodborne Diseases: Third Edition* (pp. 31–63). Elsevier Inc. https://doi.org/10.1016/B978-0-12-385007-2.00002-4

Hoffmann, V., & Baral, S. (2019). Foodborne disease in Kenya: County-level cost estimates and the case for greater public investment. https://doi.org/10.2499/P15738COLL2.133525

Horn, P., & Macleod, M. (2015). Street Vendor Licensing and Permits-Reflections from StreetNet International WIEGO Resource Documents. Retrieved from www.wiego.org

Idowu, O. A., & Rowland, S. A. (2006). Oral fecal parasites and personal hygiene of food handlers in Abeokuta, Nigeria. *African Health Sciences*, *6*(3), 160–164. https://doi.org/10.5555/afhs.2006.6.3.160

IIED. (2014). Dining with less danger: Mathare, Nairobi environmental hazards in mapping food and, *6*(5), 4. https://doi.org/10.1088/1751-8113/44/8/085201

Ina Pietschmann, Steven Kapsos, E. B. (2016). *Key Labor Market Indicators*.

Institute of Food Technologists., D. M., Gravani, R. B., & Lawless, H. T. (1992). *Food technology. Food technology (USA).* Institute of Food Technologists. Retrieved from

http://agris.fao.org/agris-search/search.do?recordID=US9418242

International Food Safety Authorities Network (INFOSAN) of the WHO Global Strategy for Food Safety Implementation of the WHO Global Strategy for Food Safety SUMMARY NOTES. (2009). Retrieved from www.who.int/foodsafety/fs_management/infosan_events/en

Iwu, A. C., Uwakwe, K. A., Duru, C. B., Diwe, K. C., Chineke, H. N., Merenu, I. A., … Ohale, I. (2017). Knowledge, Attitude and Practices of Food Hygiene among Food Vendors in Owerri, Imo State, Nigeria. *Occupational Diseases and Environmental Medicine*, *5*, 11–25. https://doi.org/10.4236/odem.2017.51002

Jespersen, L., MacLaurin, T., & Vlerick, P. (2017). Development and validation of a scale to capture social desirability in food safety culture. *Food Control*, *82*, 42–47. https://doi.org/10.1016/j.foodcont.2017.06.010

Joshua, I. A., Musa, S. K., Otu, A., Andrew, M., & Abubakar, M. S. (2009). Profile and knowledge of food hygiene and safety of food handlers in a University Campus. *Journal of Pure and Applied Microbiology*.

Kaiser, F. G., & Fuhrer, U. (2003). *Ecological Behavior's Dependency on Different Forms of Knowledge*. *APPLIED PSYCHOLOGY: AN INTERNATIONAL REVIEW* (Vol. 52). Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.455.4780&rep=rep1&type=pdf

Kenya Economic Report 2017 Popular Version. (2017). Retrieved from http://www.kippra.org

Key Debates about Street Vending | WIEGO. (n.d.). Retrieved August 30, 2019, from https://www.wiego.org/informal-economy/key-debates-about-street-vending

Kimani-Murage, E. W., Schofield, L., Wekesah, F., Mohamed, S., Mberu, B., Ettarh, R., …

Ezeh, A. (2014). Vulnerability to Food Insecurity in Urban Slums: Experiences from Nairobi, Kenya. *Journal of Urban Health*, *91*(6), 1098–1113. https://doi.org/10.1007/s11524-014-9894-3

Kirk, M. D., Pires, S. M., Black, R. E., Caipo, M., Crump, J. A., Devleesschauwer, B., … Angulo, F. J. (2015). World Health Organization Estimates of the Global and Regional Disease Burden of 22 Foodborne Bacterial, Protozoal, and Viral Diseases, 2010: A Data Synthesis. *PLoS Medicine*, *12*(12). https://doi.org/10.1371/journal.pmed.1001921

Kuria, M. O. and E. (2005). Hygienic and sanitary practises of vendors of street food. *African Journal of Food Agriculture and Nutritional Development (AJFAND)*, *5*(7), 1–15. https://doi.org/ISSN 1684-5378

Kusakabe, K. (2006.). *Policy Issues on Street Vending: An Overview of Studies in Thailand, Cambodia and Mongolia*. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_bk_pb_119_en.pdf

Lee, H. K., Abdul Halim, H., Thong, K. L., & Chai, L. C. (2017). Assessment of food safety knowledge, attitude, self-reported practices, and microbiological hand hygiene of food handlers. *International Journal of Environmental Research and Public Health*, *14*(1), 55. https://doi.org/10.3390/ijerph14010055

Levine, O. S., & Levine, M. M. (1991). Houseflies (Musca domestica) as Mechanical Vectors of Shigellosis. *Clinical Infectious Diseases*, *13*(4), 688–696. https://doi.org/10.1093/clinids/13.4.688

liu, S., liu, Z., Zhang, H., Lu, L., Liang, J., & Huang, Q. (2015). Knowledge, attitude and practices of food safety amongst food handlers in the coastal resort of Guangdong, China. *Food Control*, *47*, 457–461. https://doi.org/10.1016/J.FOODCONT.2014.07.048

Lues, J. F. R., Rasephei, M. R., Venter, P., & Theron, M. M. (2006). Assessing food safety and associated food handling practices in street food vending. *International Journal of Environmental Health Research*, *16*(5), 319–328. https://doi.org/10.1080/09603120600869141

M, G., S, W., M, K., & A, G. (2007). Prevalence of enterotoxigenic Staphylococcus aureus and Shigella spp. in some raw street vended Indian foods. *International Journal of Environmental Health Research*, *17*(2), 151–156. https://doi.org/10.1080/09603120701219204

MacDermid, J. C., & Graham, I. D. (2009, February). Knowledge Translation: Putting the "Practice" in Evidence-Based Practice. *Hand Clinics*. Hand Clin. https://doi.org/10.1016/j.hcl.2008.10.003

Malhotra, S. (2016). Food safety issues related to street vendors. In *Food Safety in the 21st Century: Public Health Perspective*. https://doi.org/10.1016/B978-0-12-801773-9.00031-5

Manning, C. K., & Snider, O. S. (1993). Temporary public eating places: Food safety knowledge, attitudes and practices. *Journal of Environmental Health*, *56*(1), 24–28. Retrieved from http://www.jstor.org/stable/44534541

Marineli, F., Tsoucalas, G., Karamanou, M., & Androutsos, G. (2013). *Mary Mallon (1869-1938) and the history of typhoid fever*. *Ann Gastroenterol* (Vol. 26). Retrieved from www.annalsgastro.gr

Martins, J. H. (2016). Socio-economic and hygiene features of street food vending in Gauteng. *South African Journal of Clinical Nutrition*, *19*(1), 18–25. https://doi.org/10.1080/16070658.2006.11734085

Matenge, N. C. C.-, Ongori, H., Carol, N., & Ongori Senior Lecturer, H. (2013). An Assessment

of Challenges faced by Microenterprises in Botswana: A case of Street Food Vendors in Gaborone. *International Journal of Learning & Development*, *3*(5), 56. https://doi.org/10.5296/ijld.v3i5.4470

Mberu, B., Mumah, J., Kabiru, C., & Brinton, J. (2013). Bringing Sexual and Reproductive Health in the Urban Contexts to the Forefront of the Development Agenda: The Case for Prioritizing the Urban Poor. https://doi.org/10.1007/s10995-013-1414-7

McKay, F. H., Singh, A., Singh, S., Good, S., & Osborne, R. H. (2016). Street vendors in Patna, India: Understanding the socio-economic profile, livelihood and hygiene practices. *Food Control*, *70*. https://doi.org/10.1016/j.foodcont.2016.05.061

Md Mizanur, R., Mohd. Taha, A., Kamaluddin, B., & Zainab bt, T. (2012). Food safety knowledge, attitude and hygiene practices among the street food vendors in Northern Kuching City, Sarawak. *BORNEO SCIENCE, 31*. Retrieved from http://borneoscience.ums.edu.my/wp-content/uploads/2012/09/FOOD-SAFETY-KNOWLEDGE-ATTITUDE-AND-HYGIENE-PRACTICES-AMONG-THE-STREET-FOOD-VENDORS-IN-NORTHERN-KUCHING-CITY-SARAWAK.pdf

Md Shafiqul Islam, K., Abu, S., Achia, A., Md Azharul, I., & Sharmin, A. (2018). Food safety and hygiene practices of vendors during chain of street food production in Barisal city. *Journal of the Bangladesh Society for Safe Food*, *1*(1), 57–65. Retrieved from https://www.researchgate.net/publication/330618330_Food_safety_and_hygiene_practices_of_vendors_during_chain_of_street_food_production_in_Barisal_city

Mensah, J. O., Aidoo, R., & Teye, A. N. (2013). Analysis of Street Food Consumption Across Various Income Groups in the Kumasi Metropolis of Ghana. *International Review of Management and Business Research*.

Mensah, P., Yeboah-Manu, D., Owusu-Darko, K., & Ablordey, A. (2002). Street foods in Accra, Ghana: How safe are they? *Bulletin of the World Health Organization*, *80*(7), 546–554. https://doi.org/10.1590/S0042-96862002000700006

Michaels, B. (2002). Handling money and serving ready-to-eat food. *Food Service Technology*, *2*(1), 1–3. https://doi.org/10.1046/j.1471-5740.2002.00030.x

Montville, R., Chen, Y., & Schaffner, D. W. (2001). Glove barriers to bacterial cross-contamination between hands to food. *Journal of Food Protection*, *64*(6), 845–849. https://doi.org/10.4315/0362-028X-64.6.845

Mosupye, F. M., & von Holy, A. (2000). Microbiological hazard identification and exposure assessment of street food vending in Johannesburg, South Africa. *International Journal of Food Microbiology*, *61*(2–3), 137—145. https://doi.org/10.1016/s0168-1605(00)00264-6

Muinde, O. K. O. O. K., & Kuria, E. (2005). Hygienic and sanitary practices of vendors of street foods in Nairobi, Kenya. *African Journal of Food Agriculture Nutrition and Development*. https://doi.org/ISSN 1684-5378

Muiruri, P. (2010). Women street vendors in Nairobi, Kenya : a situational and policy analysis within a human rights framework, 125.

Mutonga, D., Langat, D., Mwangi, D., Tonui, J., Njeru, M., Abade, A., … Dahlke, M. (2013). National surveillance data on the epidemiology of cholera in Kenya, 1997-2010. *Journal of Infectious Diseases*. https://doi.org/10.1093/infdis/jit201

Muyanja, C., Nayiga, L., Brenda, N., & Nasinyama, G. (2011). Practices, knowledge and risk factors of street food vendors in Uganda. *Food Control*, *22*(10), 1551–1558. https://doi.org/10.1016/j.foodcont.2011.01.016

Muzaffar, A. T., Huq, I., & Mallik, B. A. (2014). Entrepreneurs of the Streets: an Analytical

Work on the Street Food Vendors of Dhaka City. *International Journal of Business and Management*. https://doi.org/10.5539/ijbm.v4n2p80

Mwamakamba, L., Mensah, P., Fontannaz-Aujoulat, F., Hlabana, M., Maiga, F., Bangoura, F., … Ingenbleek, L. (2012). The who five keys to safer food: a tool for food safety health promotion. *African Journal of Food, Agriculture, Nutrition and Development*.

Mwangi, A. M., van't Riet, H., Van Staveren, W. A., Mwadime, R. K. N., Foeken, D. W. J., & den Hartog, A. P. (2010). The ecology of street foods in Nairobi. *Ecology of Food and Nutrition*. https://doi.org/10.1080/03670244.2001.9991664

Nairobi City County Assembly. (2015). Nairobi-City-County-Finance-Act-2015.

Nasrolahei, M., Mirshafiee, S., Kholdi, S., Salehian, M., & Nasrolahei, M. (2017). Bacterial assessment of food handlers in Sari City, Mazandaran Province, north of Iran. *Journal of Infection and Public Health*, *10*(2), 171–176. https://doi.org/https://doi.org/10.1016/j.jiph.2016.03.006

Nkiruka, A. (2013). *Strategies for enhancing the hygiene practices needed by food vendors in Public primary Schools in Nsukka Education zone*. Nigeria. Retrieved from http://www.unn.edu.ng/publications/files/images/OZIOKO ANGELA NKIRUKA.pdf

Nnebue, C., Adogu, P. U., Ifeadike, C., & Ironkwe, O. (2014). Assessment of the food hygiene practices of food handlers in the Federal Capital Territory of Nigeria. *Tropical Journal of Medical Research*, *17*(1), 10. https://doi.org/10.4103/1119-0388.130175

Nurudeen, A. A., Lawal, A. O., & Ajayi, S. A. (2014). A survey of hygiene and sanitary practices of street food vendors in the Central State of Northern Nigeria. *Journal of Public Health and Epidemiology* , *6*(5), 174–181. https://doi.org/10.5897/JPHE2013.0607

Nyamari J. (2013). *Evaluation of compliance to food saftey standards amongst food handlers in*

selected Hospitals in Kenya. Retrieved from http://etd-library.ku.ac.ke/bitstream/handle/123456789/7042/Nyamari Jackim.pdf?sequence=1&isAllowed=y%0Afile:///C:/Users/MBIRIRI/Desktop/Food safety/Nyamari Jackim-1 Kenya.pdf

Odeyemi, O. A., Sani, N. A., Obadina, A. O., Saba, C. K. S., Bamidele, F. A., Abughoush, M., … Aberoumand, A. (2019). Food safety knowledge, attitudes and practices among consumers in developing countries: An international survey. *Food Research International*, *116*. https://doi.org/10.1016/j.foodres.2018.10.030

Odundo, A., Okemo, P., & Chege, P. (2018). An Assessment of Food Safety Practices among Street Vendors in Mombasa, Kenya. *International Journal of Health Sciences & Research*, *8*, 235. Retrieved from www.ijhsr.org

Oiye, S., & Oyunga-Ogubi, M. (2009). Street foods in Nairobi, Kenya: their role as a source of micronutrients in low income groups. Retrieved from http://www.fao.org/fileadmin/user_upload/fsn/docs/Street_Foods/Street_Foods_Kenya_Oyunga-Ogubi.pdf

Okojie, P. W., & Isah, E. C. (2014). Sanitary conditions of food vending sites and food handling practices of street food vendors in Benin city, Nigeria: Implication for food hygiene and safety. *Journal of Environmental and Public Health*, *2014*. https://doi.org/10.1155/2014/701316

Ombui, J. N., Kagiko, M. M., & Arimi, S. M. (2001). Foodborne diseases in Kenya. *East African Medical Journal*, *78*(1), 40–44. https://doi.org/10.4314/eamj.v78i1.9111

Owuor, S., Brown, A., Crush, J., Frayne, B., & Wagner, J. (2017). *The Urban Food System of Nairobi, Kenya HUNGRY CITIES REPORT NO. 6 HUNGRY CITIES PARTNERSHIP THE*

URBAN FOOD SYSTEM OF NAIROBI, KENYA.

P, M., Nsue-Milang, L, M., C, M., & D, M. P. M. L. M. C. N.-M. (2012). Public health and food safety in the WHO African Region. TT -. *African Journal of Food, Agriculture, Nutrition and Development*.

Paudyal, N., Anihouvi, V., Hounhouigan, J., Matsheka, M. I., Sekwati-Monang, B., Amoa-Awua, W., … Fang, W. (2017). Prevalence of foodborne pathogens in food from selected African countries – A meta-analysis. *International Journal of Food Microbiology*. https://doi.org/10.1016/j.ijfoodmicro.2017.03.002

Pekkanen, J., & Pearce, N. (2001). *Environmental Epidemiology: Challenges and Opportunities*. *Environmental Health Perspectives* • (Vol. 109). Retrieved from http://ehpnet1.niehs.nih.gov/docs/2001/109p1-5pekkanen/abstract.html

Pirsaheb, M., Almasi, A., & Rezaee, M. (2010). The Special Health Education Course Effects on Knowledge, Attitude and Practice of Preparation, Distribution and Sale Centers Food Staff in Kermanshah. *Iranian Journal of Health and Environment*, *3*(3), 299–308. Retrieved from http://ijhe.tums.ac.ir/browse.php?a_id=111&sid=1&slc_lang=en

Ploeg, M. Ver, Breneman, V., Farrigan, T., Hamrick, K., Hopkins, D., Kaufman, P., … Kim, S. (2009). *Access to Affordable and Nutritious Food : Measuring and Understanding Food Deserts and Their Consequences Report to Congress*. *USDA*.

Poulsen, M. N., McNab, P. R., Clayton, M. L., & Neff, R. A. (2015, August 1). A systematic review of urban agriculture and food security impacts in low-income countries. *Food Policy*. Elsevier Ltd. https://doi.org/10.1016/j.foodpol.2015.07.002

Raab, C. A., & Woodburn, M. J. (2007). Changing risk perceptions and food-handling practices of Oregon household food preparers. *Journal of Consumer Studies and Home Economics*.

https://doi.org/10.1111/j.1470-6431.1997.tb00274.x

Rane, S. (2011, January 26). Street Vended Food in Developing World: Hazard Analyses. *Indian Journal of Microbiology*. https://doi.org/10.1007/s12088-011-0154-x

Redzwan Habib, K. (2016). Understanding Challenges Faced By Street Food Vendors to Maintain Street Food Hygiene in Dhaka City. *Journal of Food and Nutrition Sciences*, *4*(4), 78. https://doi.org/10.11648/j.jfns.20160404.11

Republic of Kenya. (2012). Food, Drugs and Chemical Substances Act Chapter 254: Act no. 2 of 2002. *Revised Edition*.

Rheinländer, T., Olsen, M., Bakang, J. A., Takyi, H., Konradsen, F., & Samuelsen, H. (2008). Keeping up appearances: Perceptions of street food safety in urban Kumasi, Ghana. *Journal of Urban Health*, *85*(6), 952–964. https://doi.org/10.1007/s11524-008-9318-3

Roever, S., & Skinner, C. (2016). Street vendors and cities. *Environment and Urbanization*, *28*(2). https://doi.org/10.1177/0956247816653898

Sabbithi, A., Reddi, S. G. D. N. L., Naveen Kumar, R., Bhaskar, V., Subba Rao, G. M., & Rao V, S. (2017). Identifying critical risk practices among street food handlers. *British Food Journal*, *119*(2). https://doi.org/10.1108/BFJ-04-2016-0174

Sagoo, S. K., Little, C. L., Griffith, C. J., & Mitchell, R. T. (2003). Study of cleaning standards and practices in food premises in the United Kingdom. *Communicable Disease and Public Health*, *6*(1), 6–17. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12736965

Samapundo, S., Climat, R., Xhaferi, R., & Devlieghere, F. (2015). Food safety knowledge, attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti. *Food Control*, *50*. https://doi.org/10.1016/j.foodcont.2014.09.010

sanlier, N. (2009). The knowledge and practice of food safety by young and adult consumers.

Food Control, *20*(6), 538–542. https://doi.org/10.1016/j.foodcont.2008.08.006

Schlegel, P., & Racaud, S. (2016). *Urbanization and Street Vending How street vending, an individual and a collective resource, can be integrated into the urban governance?* Retrieved from www.ifra-nairobi.net

Schunk, D. H. (2012). *Learning theories : an educational perspective*. Pearson.

Special Issue Republic Of Kenya Nairobi City County Gazette Supplement Acts, 2013 Nairobi, 6th September, 2013 Content. (n.d.).

Stepanovic, S., Dakic, I., Morrison, D., Hauschild, T., Jezek, P., Petras, P., … Devriese, L. A. (2005). Identification and Characterization of Clinical Isolates of Members of the Staphylococcus sciuri Group. *Journal of Clinical Microbiology*, *43*(2), 956–958. https://doi.org/10.1128/JCM.43.2.956-958.2005

Sukontason, K., Bunchoo, M., Khantawa, B., Sukontason, K., Piangjai, S., & Choochote, W. (2000). Musca domestica as a mechanical carrier of bacteria in Chiang Mai, north Thailand. *Journal of Vector Ecology : Journal of the Society for Vector Ecology*, *25*(1), 114–117. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10925804

Support Trust, M. (2012). *Mathare Zonal Plan | Nairobi, Kenya Collaborative Plan for Informal Settlement Upgrading a collaboration between*.

Tessema, A. G., Gelaye, K. A., & Chercos, D. H. (2014). Factors affecting food handling Practices among food handlers of Dangila town food and drink establishments, North West Ethiopia. *BMC Public Health*, *14*(1), 571. https://doi.org/10.1186/1471-2458-14-571

The Kenya Food Security Steering Group (KFSSG). (2008). The impact of rising food prices on disparate livelihoods groups in Kenya. Retrieved from https://documents.wfp.org/stellent/groups/public/documents/ena/wfp182903.pdf

The situation faced by young people in Kenya. (n.d.). Retrieved from http://siteresources.worldbank.org/INTUNITFESSD/Resources/Chapter3_Edited_MCMay30_.pdf

UN-Hábitat. (2010). *State of the world's cities 2010/2011-cities for all: bridging the urban divide*. *Cities*. https://doi.org/10.4324/9780203756171

Unicomb, L. E. (2009). Food safety: Pathogen transmission routes, hygiene practices and prevention. *Journal of Health, Population and Nutrition*. International Center for Diarrhoeal Disease Research. https://doi.org/10.3329/jhpn.v27i5.3635

United Nations Human Settlements Programme. (2012). *The Challenge of Slums*. *The Challenge of Slums*. https://doi.org/10.4324/9781849772907

United Nations Human Settlements Programme. (2016). *Urbanization and Development: Emerging Futures*. *UN Habitat World Cities Report 2016*. https://doi.org/10.1016/S0264-2751(03)00010-6

van Seventer, J. M., & Hamer, D. H. (2016). Foodborne Diseases. In *International Encyclopedia of Public Health*. https://doi.org/10.1016/B978-0-12-803678-5.00162-4

Van Staveren, W. A., Mwangi, A. M., van't Riet, H., den Hartog, A. P., Foeken, D. W. J., Mwadime, R. K. N., … Mwadime, R. K. N. (2001). The ecology of street foods in Nairobi. *Ecology of Food and Nutrition*, *40*(SEPTEMBER), 497–523. https://doi.org/10.1080/03670244.2001.9991664

von Holy, A., & Makhoane, F. M. (2006). Improving street food vending in South Africa: Achievements and lessons learned. *International Journal of Food Microbiology*. https://doi.org/10.1016/j.ijfoodmicro.2006.06.012

WHO | The determinants of health. (2010). *WHO*. Retrieved from

https://www.who.int/hia/evidence/doh/en/

Why Kenya must create a million new jobs annually | UNDP in Kenya. (n.d.). Retrieved August 30, 2019, from http://www.ke.undp.org/content/kenya/en/home/blog/2017/2/1/Why-Kenya-must-create-a-million-new-jobs-annually.html

Working Paper No. InFocus Programme on Skills, Knowledge and Employability Informal Economy Series Training and Skills Acquisition in the Informal Sector: A Literature Review Marjo-Riitta Liimatainen INTERNATIONAL LABOUR OFFICE-GENEVA. (n.d.). Retrieved from https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_104010.pdf

World Bank Report, W. B. R. J. World Bank Report (2016). Retrieved from http://documents.worldbank.org/curated/en/463151481129266828/pdf/103433-SCD-ARABIC-Jordan-PUBLIC.pdf%0Ahttp://www.worldbank.org/en/country/jordan/overview#2

World Health Organisation. (2007). WHO estimates of the global burden of foodborne diseases. Retrieved from http://apps.who.int/iris/bitstream/handle/10665/199350/9789241565165_eng.pdf;jsessionid=3CF77EECAC0E54193B292B37FB282475?sequence=1

World Health Organization, Food Safety: What you should know. (2017). *SEARO*. Retrieved from http://www.searo.who.int/entity/world_health_day/2015/whd-what-you-should-know/en/

World Health Organization. (2006). Five keys to safer food manual. Geneva: WHO Press. Retrieved from https://www.who.int/foodsafety/publications/consumer/manual_keys.pdf

World Health Organization. (2009). Five keys to safer food manual safer food manual.

International Journal of Environmental Research and Public Health, *6*(11), 2833–2842. https://doi.org/10.3390/ijerph6112833

World Health Organization (WHO). (2017). Disease outbreak - Cholera - Kenya - 21 July 2017 | WHO | Regional Office for Africa. Retrieved July 22, 2021, from https://www.afro.who.int/health-topics/cholera/outbreak/21-july-2017-kenya

World Health Organization (WHO)., & Organization, W. H. (2015). *WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015*. *WHO Library*. Geneva PP - Geneva: World Health Organization. Retrieved from https://apps.who.int/iris/handle/10665/199350

World Health Organization, & International Food Safety Authorities Network. (2010). *Basic steps to improve safety of street-vended food*. *WHO INFOSAN*.

World Health Organization, & Skovgaard, N. (2008). *Foodborne disease outbreaks: Guidelines for investigation and control*. *World Health Organization* (Vol. 135). Elsevier BV. https://doi.org/10.4324/9780203889770

Wuliyeng, G. T. (2013). Examining the Hygiene Practices Among Street Food Vendors in Nsawam and Adoagyiri By Legon in Partial Fulfillment of the Requirement for the Award of Ma Development Studies Degree, (10172516).

Young, I., & Waddell, L. (2016). Barriers and facilitators to safe food handling among consumers: A systematic review and thematic synthesis of qualitative research studies. *PLoS ONE*, *11*(12). https://doi.org/10.1371/journal.pone.0167695

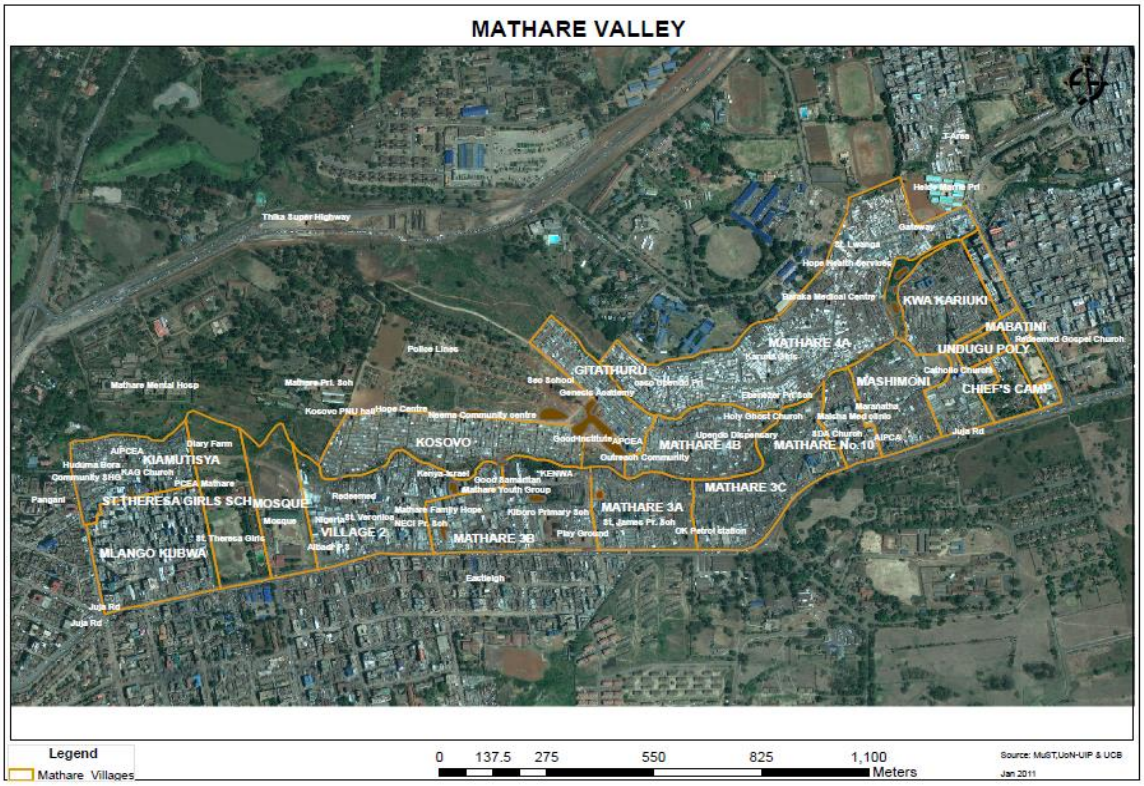
Zawide, F. (2009). Strengthening the Role of Street Food Vendors to Reduce the Burden of Foodborne Diseases in Developing Countries. *Epidemiology*, *20*(6). Retrieved from https://journals.lww.com/epidem/Fulltext/2009/11001/Strengthening_the_Role_of_Street_F

ood_Vendors_to.304.aspx

Zoo, U., Brief, P., South, G., & Food, T. (2017). Promoting Food Security , Safe Food Trading , and Vendors ’ Livelihoods in Informal Settlements : Lessons from Nairobi, (June), 1–12. https://doi.org/10.13140/RG.2.2.36082.94400

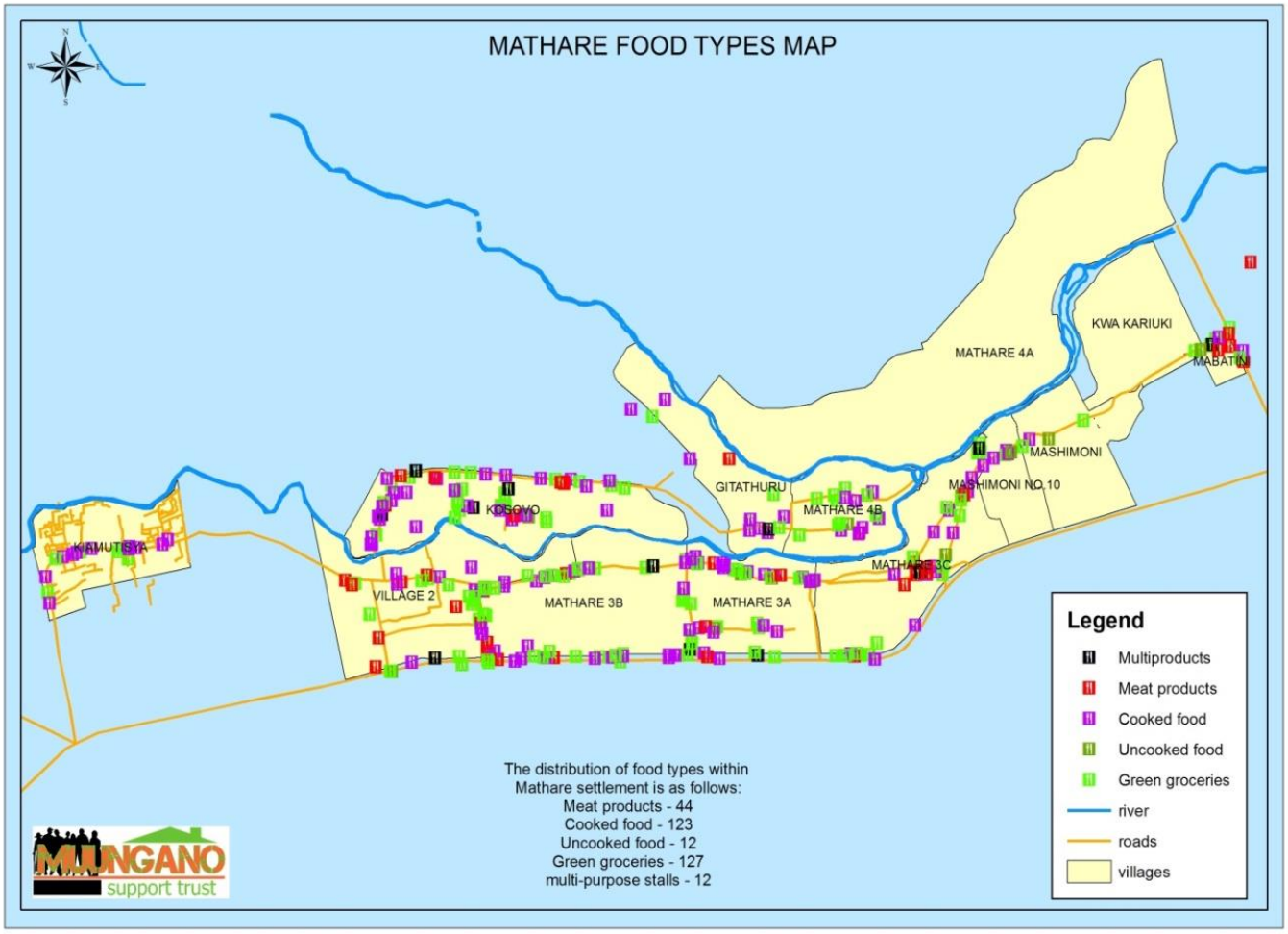
APPENDICES

Appendix I: Mathari Map



Source: MuST,UoN-UIP & UCB

Appendix II: Mathari Food Types Map



Source: Muungano support trust

Appendix III : Questionnaire

Questionnaire

Section A: Socio-demograhic Factors

Food handler's code

1. Gender [Male/Female]
2. Age group [Tick where appropriate] Residence in Mathari [Yes/No]

< 20	
21-30	
31-40	
41-50	
> 50	

3. Education level [Tick where appropriate]

None	
Primary	
Secondary	
Post-secondary	

4. What is the vending type of your business [Mobile/ Stationary]

i. Does the business have any form of registration [Ask to be shown any and tick as appropriate]

- Health license
- County trading license
- Other registrations
- No form of registration

ii. I would like to know the main source of income for your household.

This business(RTE)	
Formal employment (Other household)	
Informal employment (Other household)	
Other business	

iii. I am interested to know how you acquired your food vending skills

Self-taught	
Taught by parents	
Observation of others	
Formal training	

Section B: Food Handlers' Knowledge on Food Safety and Hygiene

1. Is it / necessary to [Tick where appropriate]

1. Cook thoroughly before eating	
2. Wash your hands before cooking	
3. Wash your hands after using the toilet	
4. Wash your hands after handling money	
5. Wash your hands in between handling raw and RTE foods	
6. Wash your hands after handling unsanitary utensils	
7. Hygienic to clean working surface while working	
8. Reheating before sale if stored for more than 4 hrs.	
9. Hygienic to serve food with spoon	
10. Hygienic to use clean soapy water to clean utensils	
11. Hygienic to sell food from container used for cooking	
12. Hygienic to close food not expose to flies	
13. Hygienic to handle food not at ground level	
14. Hygienic to handles food with gloves	
15. Cover sores and wounds with waterproof dressing	
16. Hygienic to have uncut fingernails	
17. Hygienic to sneeze into your hands	
18. Hygienic to wear jewelry while cooking	
19. Have clear separation of raw and cooked food	
20. Safe to prepare food while sick	
21. Hygienic to cook food in unclean surrounding	

2. Can food get contamination during preparation? [Yes/No]

Section C: Practices on Food Hygiene

i. Which type of clothing do you have [Tick as appropriate]

Clean apron	
Clean hair cover	
Clean gloves	
None	

Frequency of change if ticked on any above (Daily, twice in a week, weekly, monthly)

ii. What do you wash your hands with [Tick as appropriate]

Water	
Water and soap	
Sanitizer	
All the above	

iii. I would like to know where you prepare your food. [Tick as appropriate]

At stall	
At home	
Other	

iv. How do you store and handle leftovers?

Place in ambient temperature	
Consume	
Discard	
Leave open in the stall	
Store in covered utensils	
Store in the fridge	
Reheating before selling	

v. How often do you observe the following practices [Tick as appropriate]

Practices	**Never**	**Occasional**	**Always**
1. Cook thoroughly before eating			
2. Wash your hands before cooking			
3. Wash your hands after using the toilet			
4. Wash your hands after handling money			
5. Wash your hands in between handling raw and RTE foods			
6. Wash your hands after handling unsanitary utensils			
7. Hygienic to clean working surface while working			
8. Reheating before sale if stored for more than 4 hrs.			
9. Hygienic to serve food with spoon			
10. Hygienic to use clean soapy water to clean utensils			
11. Hygienic to sell food from container used for cooking			
12. Hygienic to close food not expose to flies			
13. Hygienic to handle food not at ground level			
14. Hygienic to handles food with gloves			
15. Cover sores and wounds with waterproof dressing			
16. Hygienic to have uncut fingernails			
17. Hygienic to sneeze into your hands			
18. Hygienic to wear jewelry while cooking			
19. Have clear separation of raw and cooked food			
20. Safe to prepare food while sick			
21. Hygienic to cook food in unclean surrounding			

vi. Do have any source of water supply (Yes/ No)

If yes tick as appropriate

Municipal Tap water	
Borehole	
Water vendor	
Protected well	
Unprotected well	

vii. Where do you dispose your waste

Street/Pathways	
Drainage/Culverts/Gutter	
Bush	
Waste bin	
Other	

viii. Are you willing to get food safety and hygiene practices training? [Yes /No]

Thank you.

Appendix IV: Observation Checklist

Tick (√) when YES and (×) when NO

Food Handler's Code

1. Food hygiene practices [Tick as observed]

Short and clean nails	
Hands free from open wounds/covered with waterproof dressing.	
Use of head cover at work	
Use of apron or overall when cooking	
Handwashing before cooking	
Handwashing after using toilet	
Washing utensils before and after cooking	
Food washed before cooking	
Food heated before serving	
Recycle water used for handwashing	
Recycle water used for washing utensils	
Food prepared on clean surface	
Reuse oil for frying	
Handle food with bare hands	
Blows air into polythene bag before use	
Handles money while serving food	
Serves food with spoon	
Presents food when covered	
Clear separation of raw and cooked foods	
Washing of food items	
Preparation of food far ahead of service	

2. Sanitary conditions [Tick as observed]

Presence of rodents	
Presence of flies and cockroaches	
Exposure to dust	
Proximity to open drainage, garbage or toilets	
Clean vending site	
Clean working surface	
Work with food at ground level	
Availability of water supply	
Availability of sanitary toilet facilities	
Availability of waste disposal method	

Appendix V: Consent Form

MASENO
UNIVERSITY

TEL: (057) 51622/51267/51110
FAX: (057) 51221/51153/51011

School of Public Health and Community Development
Siriba Campus

Private Bag, **MASENO,**
07-03-2016

This informed consent form is for Food Handlers in Mathari and who we are inviting to participate in the study, titled "ASSESSMENT OF KNOWLEDGE AND HYGIENE PRACTICES OF HANDLERS' OF READY TO EAT FOODS IN MATHARI SLUM, NAIROBI, KENYA."

Name of Investigator:

Part I: Information Sheet

Introduction

I am ……., a public health student at Maseno University. I am doing research on food safety in ready to eat foods which is very common in this area. I am going to give you information and invite you to be part of this research.

This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them to me or another researcher.

Purpose of the research

There has been mushrooming of Ready to Eat food joints in the slums of Kenya. Additionally their handling and trading practices does not permit delivery of safe food to consumers hence these foods pose as a major public health hazard as they are associated with foodborne illnesses. While most studies have elucidated the microbiological quality of street foods sold in urban centers there is paucity of information on RTE foods sold in the slums of Nairobi especially Mathari slum where previous studies have reported that most of the population is dependent on RTE street foods. Therefore the current study will assess the food handlers' knowledge associated with hygiene practices in different ready to eat foods in Mathari slums, Kenya. Specifically the study will determine the socio-demographic characteristics of the food handlers', the knowledge of the food handlers on hygiene practices and establish the food handlers food hygiene practices utilized.

Type of Research Intervention

This research will involve your participation in filling a questionnaire that will take about ten minutes.

Participant Selection

You are being invited to take part in this study because we feel that your experience as a food handler and a resident in Mathari can contribute much to our understanding and knowledge of local food safety practices in Ready to eat food business.

Voluntary Participation

The choice that you make will have no bearing on your job or on any work-related evaluations or reports. You may change your mind later and stop participating even if you agreed earlier.

Procedures

We are asking you to help us learn more about food safety and hygiene in your community. We are inviting you to take part in this research project. If you accept, you will be asked to answer the questionnaire.

You may answer the questionnaire yourself, or it can be read to you and you can say out loud the answer you want me to write down.

If you do not wish to answer any of the questions included in the survey, you may skip them and move on to the next question.

Then we will ask you questions about food hygiene and sanitation and give you time to share your knowledge. The questions will be about food safety knowledge in your community, how is it recognized, what people do about it, where people get training if there is.

We will also talk about food safety practices more generally because this will give us a chance to understand more about food safety but in a different way.

The information recorded is confidential, and no one else except [name of person(s)] will have access to the tapes.

Duration

The study will take place over one month which will include participants' questionnaire filling, investigator observation and other days for data collation.

Risks

"There is a risk that you may share some personal or confidential information by chance, or that you may feel uncomfortable talking about some of the topics. However, we do not wish for this to happen. You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable."

Benefits

There will be no direct benefit to you, but your participation is likely to help us find out more about the gaps and how to incorporate training on food safety to the food handlers in your community.

Reimbursements

You will not be provided any incentive to take part in the study. However, we will give you [Ksh 100/= per premise] for your time, and travel expense (if applicable).

Confidentiality

The research being done in the community may draw attention and if you participate you may be asked questions by other people in the community. We will not be sharing information about you to anyone outside of the research team. The information that we collect from this research project will be kept private. Any information about you will have a number on it instead of your name.

Only the researchers will know what your number is and we will lock that information up with a lock and key. It will not be shared with or given to anyone except research sponsors and muungano wa wanvijiji.

Sharing the Results

Nothing that you tell us today will be shared with anybody outside the research team, and nothing will be attributed to you by name. The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Each participant will receive a summary of the results through the research sponsors and muungano wa wanavijiji.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so, and choosing to participate will not affect your job or job-related evaluations in any way. You may stop participating in the [discussion/interview] at any time that you wish without your job being affected. I will give you an opportunity at the end of the interview/discussion to review your remarks, and you can ask to modify or remove portions of those, if you do not agree with my notes or if I did not understand you correctly.

Contact

I. If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact any of the following: Murenga Castine , 0723781893, murengacastine@yahoo.com or Muungano wa wanavijiji ; Edwin Simiyu , esimiyu@mustkenya.or.ke

II. For any questions pertaining to rights as a research participant, contact person is: **The Secretary, Maseno University Ethics Review Committee, Private Bag, Maseno; Telephone numbers: 057-51622, 0722203411, 0721543976, 0733230878; Email address:** muerc-secretariate@maseno.ac.ke; muerc-secretariate@gmail.com.

Part II: Certificate of Consent

(This section is mandatory)
I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant_____
Signature of Participant _____
Date _____
Day/month/year

If illiterate [1]

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness_____ **Thumb print of part**
Signature of witness _____
Date _____
Day/month/year

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:
1.
2.
3.
I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.
Print Name of Researcher/person taking the consent_____

Signature of Researcher /person taking the consent_____
Date _____
Day/month/year

[1] A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

Appendix VI: Data Collection Request: KEMRI

KENYA MEDICAL RESEARCH INSTITUTE

Centre for Public Health Research. P.O. Box 20752 – 00202, NAIROBI, Kenya.
Tel (254) (0202) 2725016/7/8. Fax (020) 2725012. Nairobi. E-mail: cphrdirector@kemri-nuitm.or.ke Website: www.kemri.org

25th July 2016

The Public Health Officer
Starehe Sub-County
NAIROBI

Dear Sir

RE: STUDENT RESEARCH – MURENGA CASTINE

The bearer of this letter is an MPH student from Maseno University which has approved his research.

I will highly appreciate if he will be assisted to administer a questionnaire among food handlers in your area as part of his research.

Prof. Mohamed Karama
Supervisor
Head, Public Health &Health System Research Programme.
Centre for Health Research
Kenya Medical Research Institute
Nairobi.
Mobile 0722885366
Email: mhmdkarama@gmail.com

Appendix VII: Data Collection Request Approval: Nairobi City County

NAIROBI CITY COUNTY

Telephone 020 344194

Web: www.nairobi.go.ke

City Hall,
P. O. Box 30075-00100,
Nairobi,
KENYA.

COUNTY HEALTH SERVICES

PHD/5/3/RESEARCH/018/016 9th August 2016

SUB-COUNTY COMMUNITY STRATEGY COORDINATOR
STAREHE

RE: DATA COLLECTION FOR RESEARCH

Reference is made to the above subject matter.

Please allow the following Masters student from Maseno Universty to collect data in your Sub-County for research work.

S/N	Name	Sub-County
1.	Murenga Castine	Starehe

Period of data collection will be one (1) week starting from 11th August 2016. They are expected to adhere to the rules and regulations pertaining to research.

WILSON LANGAT
FOR: COUNTY CHIEF PUBLIC HEALTH OFFICER

C.c. Chief Administrative Officer
SCCSC Starehe
Murenga Castine

Appendix VIII: MUERC Approval

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 15th July, 2016

TO: Castine Dave Murenga
EL/ESM/00601/2013
Department of Public Health
School of Public Health and Community Development
Maseno University.

REF: MSU/DRPI/MUERC/00295/16

RE: Assessment of Hygiene Practices, Knowledge and Environmental Factors among Ready-to-Eat Food Handlers in Mathare Slums. Proposal Reference Number: MSU/DRPC/MUERC/00295/16

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 15th day of July, 2016 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 14th July, 2017. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 15th June, 2017.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 15th June, 2017.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

DIRECTORATE OF RESEARCH PUBLICATION & CONSULTANCIES 15 JUL 2016 MASENO UNIVERSITY

Yours faithfully,

Dr. Bonuke Anyona,
Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

Appendix IX: Nairobi City County Food Hygiene License Application Form

NAIROBI CITY COUNTY

Telephone 020 344194

Web: www.nairobi.go.ke

City Hall,
P. O. Box 30075-00100,
Nairobi,
KENYA.

THE FOOD, DRUGS AND CHEMICAL SUBSTANCES (FOOD HYGIENE) REGULATIONS

APPLICATION FOR A LICENCE

To Public Health Department
NAIROBI CITY COUNTY

I hereby apply for a license under the above regulations.
Name of Applicant …….
Name of the person, Firm or Company to be issued with the license……...
Full name of partners and/or Directors ……..….
Nature of occupation for which a license is required ……..
Owner of premises ……..…….
Plot No …….…….
Fronting on ……...……
Contacts of the Owner/Proprietor ……..……..

Food hygiene for Financial Year ……

In respect of this application in accordance with regulation 3 (2) of the Food, Drugs and Chemical Substances (Food Hygiene) Regulations.

Name of inspecting Officer: ……..…….

NAIROBI CITY COUNTY

Telephone 020 344194

Web: www.nairobi.go.ke

City Hall,
P. O. Box 30075-00100,
Nairobi,
KENYA.

COUNTY HEALTH SERVICES

INSPECTION REPORT

REF…….

TO:

THE CPHO

THRO'

SUB COUNTY PUBLIC HEALTH OFFICER

APPLICATION BY: ……

T/A: ……..……

PLOT NO....…….

LOCALITY/ROAD……..

LICENCE APPLIED ……..……..

DATE OF INSPECTION……...……..

INSPECTING OFFICERS REPORT

1. Locality – (residential/commercial/agricultural)…… ……..
2. Physical condition of the building……....

   ……..
3. Facilities provided e.g.
   - Dinning floor area (size)…….
   - Drinking/dinning floor space (size)……
   - Kitchen ……...
   - Scullery sink ……..……..
   - Stores (dry) …….
   - Changing Room (No. and State) …….
   - Sanitary facilities (No. and state) ……

- Dancing floor ……..
- The above facilities will depend on type of license.

4. Firefighting equipment ……..……..
5. First aid kit ……..
6. Solid/liquid waste management ……..
7. Medical certificates for workers (No.)… ……
8. Sound proofing NEMA cert.) ……..……..
9. Wholesome water supply …….
10. Means of extracting fumes ……..
11. Lighting and ventilation (through) ….....
12. Secondary means of access …….
13. Smoking area provision ……..

INSPECTING OFFICER ……..…….……

REMARKS

……....
……
RECOMMENDATION BY SCPHO
……
……

Name ……... Date …….……