ANALYSIS OF THE FACTORS INFLUENCING OBSERVATION OF THE WORLD HEALTH ORGANISATION SAFE FOOD KEYS THROUGH MONITORING PREVALENCE OF DIARRHOEAL DISEASES IN MBEYA CITY

PETER LUDOVIKI MELEKI

A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY OF THE OPEN UNIVERSITY OF TANZANIA

2019

CERTIFICATION

The undersigned confirm that they have read and hereby recommend for acceptance by the Open University of Tanzania, a thesis entitled; "Analysis of Factors Influencing Observation of the World Health Organisation Five Keys to Safe Food through Monitoring of Prevalence of Diarrhoeal Diseases in Mbeya City". A thesis submitted to the Department of Environmental Studies, in fulfilment of the requirements for the award of the degree of Doctor of Philosophy of the Open University of Tanzania.

……………………………… .

Prof. Tolly S. A. Mbwette

(Supervisor)

…………………………

Date

………………… .……………..

Doctor Judicate Peter Ndengerio-Ndossi

(Supervisor)

…………………..

Date

COPYRIGHT

No part of this dissertation may be reproduced, stored in any retrieval system or transmitted in any form by any means, electronic, mechanical, photocopying, recording or otherwise without prior written permission of the author or the Open University of Tanzania on behalf.

DECLARATION

I, Peter Ludoviki Meleki, do hereby declare that this thesis is my own original work.
It has not been submitted to any other institution for the purpose of award of any
kind of degree.

í í í í í í í í í í í

Signature

í í í í í í í í í í .í í

Date

DEDICATION

I dedicate this thesis to God, the source of my strength and inspiration, for endowed knowledge, understanding, and wisdom, to my wife Sophia who took care of our family while endlessly praying for us and so encouraged, and enabled me to accomplish this work. To my daughter Rest and to my son Albin who gave us family happiness and purpose in life to worship our God.

ACKNOWLEDGMENTS

ABSTRACT

The prevalence of diarrhoeal diseases has been a universal challenge that poses a public health problem. It threatens many lives and demands huge health care resources to redress it. Unhealthy food handling practices by food vendors have remained a major cause of diarrhoeal diseases. This study is time-honoured for establishing the factors responsible for the intermittent occurrence of diarrhoeal diseases centred on the food vendorsø food handling practices in Mbeya City, in Tanzania. The study instituted a cross-sectional design comprising both quantitative and qualitative methods for which a stratified simple random sampling technique was used. Data were collected from 96 street food vendors by using an interviewer-administered questionnaire and an observation checklist. Data were collected from Jun. to Dec. 2014. The data was processed, organised and analysed using SPSS with which binary and multiple logistic regression analyses were conducted and extracted. The study results showed that 20% of stool specimens and 27 % of the food samples from the study area were found to have microbial pathogens that are capable of spreading diarrhoeal diseases. These determined the health carrier status among the street food vendors. The pre and post-test training indicated that food vendors had adequate information about the five WHO keys to food safety. The study results suggest that improvement in education, safety training of food vendors, casual helpers, social health services and maintenance of food stalls and related infrastructure, toilet facilities need to be planned and imposed by the government including provision of befitting water and sanitation infrastructure for food vendors as well as monitoring equipment, and constant communication through various social media to redress the problem that can lead to major benefits in Mbeya City.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS ACRONYMS AND SYMBOLS

AIDS   Acquired Immuno-Defiency Syndrome

AN   Author's Note

a_w Water Activity

BBL   Bobbed Lethal

BD^{TM} Becton, Dickinson and Company

CFIA   Canadian Food Inspection Agency

CI   Confidence Interval

DOI   Digital Object Identifier: Serial Code for Electronic Documents,

E.g.   For example

Ed.   Edited by

Eds.   Editors

et al.   et cetera, and others

FAO   Food and Agriculture Organization

FDA   Food and Drug Administration

FSA   Food standard Agency

HACCP   Hazard Analysis Critical Control Point

HAM   Health Action Model

HIV   Human Immunodeficiency Virus

http   Hypertext Transfer Protocol

i.e.   That means

Ibid   Reference is the same as the previous reference; Ditto mark

IBM   Integrated Behavioural Model

IOM   International Organization for Migration

ISSN   International Standard Serial Number Journal, articles

Ltd   Limited

MDGs   Millennium Development Goals

MoHCDGEC   Ministry of Health Community Development, Gender, Elderly and

                Children

n.d.   Not dated

NIMR   National Institute of Medical Research

^{o}C   Degree Centigrade

OR   Odd Ratio

OUT   Open University of Tanzania

pdf   Portable Document File

pH   Hydrogen Concentration (ion)

PhD   Doctor of Philosophy

PLoS   Public Library of Science

pp.   Pages

ppt/ppm/ppb   Parts per thousand or Ÿ /parts per million/parts per billion

PRB   Population Reference Bureau

Rs   Indian Rupee

SDGs   Sustainable Development Goals

SN   Serial Number

spp.   Species

SPSS   Statistical Package for Social Science

taxa   A taxonomic category, as a species or genus.

TBS   Tanzania Bureau of Standards

TEA	Texas Education Agency
TFDA	Tanzania Food and Drugs Agency
TPB	Theory of Planned behaviour
TRA	Theory of Reasoned Action
Î	Trademark
UN	United Nations
UNAIDS	Joint United Nations Programme on AIDS
UNICEF	United Nations International Childrenøs Emergency Fund
USD	United States Dollar
WHO	World Health Organisation
WHO-AFRO	World Health Organisation-Regional Office for Africa
WIEGO	Women in Informal Employment: Globalizing and Organising
WWW	World Wide Web
@	At sign, each
°	Degree
#	Number sign/hash tag/octothorpe
%	A notation of percent/parts per hundred
Ÿ	A notation of parts per thousand
	Epsilon: represents a very small number, near zero (0)
<	Less than
>	Greater than
Ö	Less than or equal to
≥	Greater than or equal to
é/~	Tilde/approximation/weak approximation (11~10)

=	equals sign
( )/[ ]	Round brackets/square brackets (Parentheses)
	Seconds/arc second
'	Minute/arc minute
ø	Apostrophe
/	Stroke/slash/ division slash
÷ø̃ö	Single quotation marks the UK and double quotation marks the US
&	Ampersand/and
*	Asterisk
.	Period US and full stop the UK
-	Dash
¶	Paragraph sign/pilcrow
-	Dash
_	Underscore/understrike
ô	Em dash it can be used instead of commas, colon to enhance readability
:and;	Colon and semicolon

Note that: The abbreviations, acronyms Greek Letters and other symbols used are for this thesis and do not necessarily mean the same in or for other documents. Some abbreviations that are found on a single page are not included in this list.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Street food includes ready-to-eat meals and beverages sold in the streets by vendors including mobile and stationary ones. They operate in public places including roadside stalls, markets, bus stands, roadsides, and pavements. The diversity and types of food traded vary according to eating lifestyles and socio-economics of the surroundings (FAO, 2007). Street foods are common features of urban centres in many developing countries including Tanzania. They are important since they give a source of income for low-income persons and provide a ready and cheap source of nutritious food (Dipeolu *et al.*, 2007 & Khairuzzaman *et al.*, 2014). For example, street vended food is popular in India because it can serve almost 1000 calories in exchange for only one Indian Rupee (Rs) (Boegh-Petersen & Tøstesen, 2010).

Street food offers employment to the deprived in cities and elsewhere (Campbell, 2011; Muhonja & Kimathi, 2014; Roever, 2014 &Khairuzzaman *et al.*, 2014). The proximity and easy access to choice dishes add to the convenience of purchasing street food instead of cooking at home (Boegh-Petersen & Tøstesen, 2010). Published literature, suggests that very little is known about street food vendors that pose more health risks than the services they offer (Donkor *et al.*, 2009 & Odonkor, 2011).

Discussion on street food and street food vendors in urban centres of Tanzania and/or elsewhere reflects much about health risks. According to the Mayo Clinic

(2014), all food may have a few microorganisms, which may multiply into harmful levels due to the poor hygienic management of food, reprehensible cooking or poor storage conditions. Parasites, viruses, toxins, and chemicals can also contaminate food and perhaps because of foodborne diseases.

World Health Organisation reports show that diarrhoeal diseases caused by food or waterborne pathogens remain one of the leading sources of diseases and deaths in the world. Ifeadike *et al.* (2014) suggest that many of the minor cases go unreported, as diarrhoeal illness resolves within 24 to 48 hours without any remedial attention. In the case of cholera, Ali *et al.* (2012), Ali *et al.* (2015) & Chowdhury *et al.* (2017) pointed out that on the record of cholera cases reported stand for only 5ᶨ10% of the actual case numbers occurring yearly, worldwide. Therefore, except in severe cases, many food-related illnesses may not make a diagnosis and the relationship of foodborne illness occurrence is repeatedly not documented or reported (Department of Health, 2009).

1.1 Diarrhoeal Disease Outbreaks in Tanzania

As far back in history to 1950, there have been outbreaks of cholera in Tanzania. Cholera cases were initially recorded to have occurred in 1974. This was one year after the first 10 cases of cholera were reported in Malawi in 1973 during the seventh pandemic, which hit East Africa (Khoje *et al.*, 2012). The first 10 cases of cholera occurred during the outbreak of 1974 and lasted for one month, in Kyela and along the shores of Lake Nyasa bordering Malawi (MoHCDGEC, 2015).
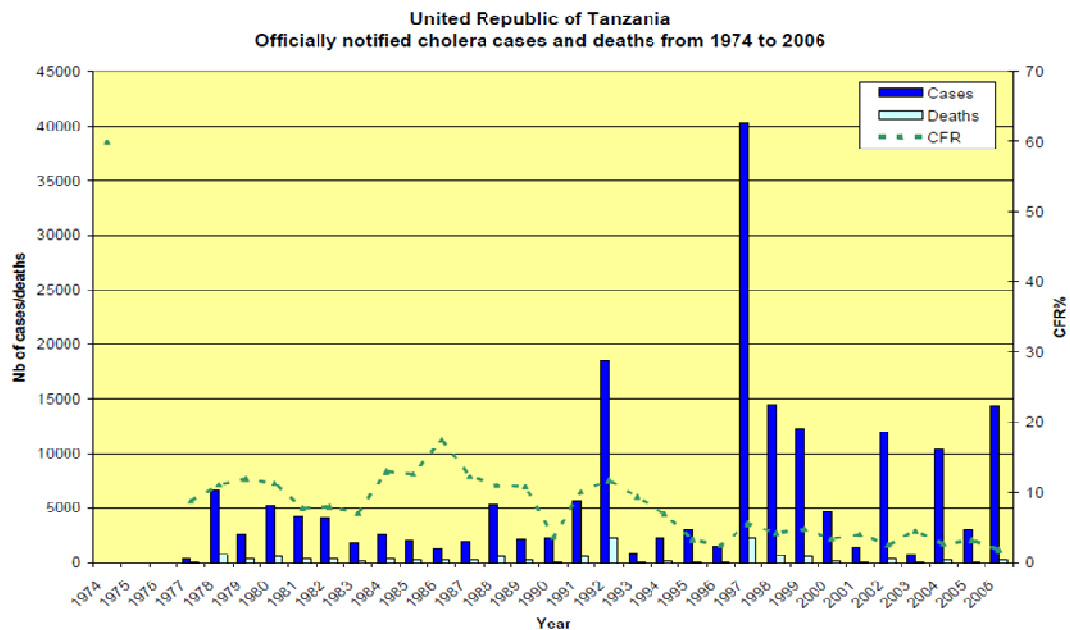
Source: (WHO, 2008)
Figure 1.1: Cholera Epidemics in Tanzania

Several large epidemics that have occurred were as observed in Figure 1.1 above but are not limited to those of 1992, 1997 and 2006 in Tanzania. During the last five years, the prevalence of the diseases drastically dropped while it increased in other cases as observed in Table 1.1. Malaria cases have dropped from being the leading top ten killers, but it is now in the seventh position with a prevalence of 30 people per 1000 due to various interventions compared to typhoid cases that were not previously in the top ten diseases but now has entered the list of top ten killers in the country.

As shown in Table 1.1, diarrhoeal diseases account for 11% of all diagnosed cases reported in health facilities and with the prevalence of 95 per 1000 in Mbeya City. Many studies, including by Girma (2015) recommend adherence and compliance with the WHO five keys to safe food as one effective means of reducing the occurrence of diarrhoeal diseases. The five keys can also control other diseases of

public health importance. These include intestinal worms, eye diseases, typhoid, and other diarrhoeal diseases.

Diarrhoeal diseases in children less than five years old have attack rates ranging from two to three illnesses per child per year in developed countries too as high as 10 to 18 illnesses per child per year in developing countries (Zeru & Kumie, 2007&Girma, 2015).The top ten diseases according to Zeru & Kumie (2007) & Girma, (2015) presented a major dominance and constrain the services up to 69% of all other diseases in health facilities in terms of cost-effectiveness of sanitation and hygiene promotion actions when compared with other health interventions as indicated in Table 1.1 (Water Aid, 2008; Khijjah & Rozga, 2010).On average, every year or two to three years, there is an outbreak of cholera as displayed in Table 1.2.

Cholera in one way or another has become the standard term used to describe any case of diarrhoeal in panic distressed districts (Said, 2006).

Table 1.1: Top Ten Diseases as Reported in Mbeya City Health Facilities in 2017

SN	Diseases	Facility diagnosed cases	%	Prevalence rate per 1000 Population
1	Acute Respiratory Infection	60,106	17.0	137
2	Urinary Tract Infection	41,700	12.0	88
3	Diarrhoeal diseases	38,614	11.0	95
4	Skin infections	25,966	7.3	59
5	Pneumonia	16,178	4.6	37
6	Sexually Transmitted Diseases	15,230	4.3	35
7	Malaria	13,101	3.6	30
8	Hypertension	11,897	3.4	27
9	Intestinal worms	11,613	3.2	27
10	Typhoid	9,272	2.6	21
★All total diagnosed diseases		351,547	69	Population 438,767

Source: Data sourced in District Health Information System (DHIS)-Mbeya City (2018)

★Note: i) All total diagnosed diseases mean the count of all diseases reported in a health facility per year and not top ten diseases as in table so % is only ten top diseases overall total diseases diagnosed and cannot be 100%

ii) The population represented Mbeya City. Projected from 2012 census, the prevalence rate is total single diagnosed disease cases per total population

It was suggested at one time, that there is a case of cholera somewhere or there is a diarrhoeal related case reported in District Councilsø health facilities. All districts continued to be at risk for almost three decades with exception of 1997 and 1998 during the El Nino rains when cases rose to more than 5000 cases and 500 deaths.

Since 1990,the Mbeya Region and its Councils had experienced several epidemics that include those of 1992, 1997ó1999, the highest epidemic, due to El Nino, followed by 2003, 2004, 2005, 2006, 2010, 2011 2013, 2015, 2016 and 2017 as observed in Table 1.2. Many reports have already made elaborations about cholera. Kyela District Council has always been hit by cholera epidemics more than any other district, not only due to being along the shores of Lake Nyasa with its warm temperatures but historically, the first 10 cases of cholera in Tanzania in 1974 occurred in the Kyela District Council area of Mbeya Region (WHO, 2008b).

The trend was probably pinpointing that cholera had become endemic in Mbeya Region, suggesting that some *Vibrio cholerae*strains capable of causing the epidemics had become resident microorganisms within the environs of Mbeya region. The Mbeya City Council, where this study was conducted, has not been an exception, because of its business centrality, social interaction and mixed cultural traditions and norms. However, cholera outbreaks in 2017 showed 133 cases with 3

deaths reported in Mbeya City; 69 cases and 1 death in Kyela; 134 cases and 2 deaths in Chunya and about 704 probable cases with 12 deaths reported in Mbarali District Council as shown in Table 1.2.This is in line with the observation made in the study area, which is potentially prone to diarrhoeal disease outbreaks at any moment in time.

Table 1.2: Cholera Outbreaks as Reported for Three Decades in Mbeya Region

Councils Years	Mbeya		Kyela		Rungwe		Chunya		Mbarali		Total	
	C	D	C	D	C	D	C	D	C	D	C	D
1990	67	8	0	0	3	0	0	0	0	0	70	8
1991	21	9	6	0	1	0	1	0	0	0	29	9
1992	655	49	11	0	32	8	332	65	0	0	1030	122
1993	0	0	0	0	0	0	41	10	0	0	41	10
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	182	20	187	16	0	0	100	10	469	46
1998	1340	96	800	41	304	30	1136	104	1478	102	4,058	373
1999	339	17	150	10	90	4	126	7	619	36	1,324	74
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	1	0	0	0	0	0	1	0
2002	18	0	171	10	94	7	0	0	0	0	283	17
2003	67	4	88	2	19	1	203	8	90	1	4467	16
2004	132	10	98	2	81	1	663	27	528	3	1,502	43
2005	14	7	172	9	56	1	64	4	65	2	371	23
2006	14	2	75	1	15	0	218	7	40	0	362	10
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	90	1	90	1
2009	0	0	0	0	0	0	32	1	0	0	32	1
2010	134	3	0	0	0	0	1054	29	0	0	1188	32
2011	0	0	0	0	0	0	224	2	0	0	224	2
2012	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	193	8	0	0	0	0	0	0	193	8
2014	0	0	0	0	0	0	0	0	0	0	0	0
2015	0	0	187	6	0	0	0	0	0	0	187	6
2016	0	0	339	9	25	1	0	0	0	0	364	10
2017	134	5	69	1	0	0	134	2	704	12	1041	20

Note: C=cases D=deaths
Source: DHIS-Mbeya (2018)

The assertion that street food and diarrhoeal diseases results are related from the fact that infrequently the food is prepared and sold under filthy conditions such as unsafe water sources and use of poor waste disposal facilities (WHO, 2006; Rheinländer *et al.,* 2008; Rijswijk & Donkor *et al.,* 2009). The majority of disease outbreaks related to street food are connected to the negligence of food handlers to health conditions (Alimi, 2016a). A study of 15 cases related to foodborne disease outbreaks and monitored from 2008 to 2011 in Zhapo, a coastal resort of Guangdong, China, were traced to culpable negligence of food vendors (Liu *et al.*, 2015).

A study by Nicolas *et al.* (2007) observed that cooked and uncooked foods held at warm temperatures for 6 hours or longer without ensuring the right holding temperature are bound to lead to disease illnesses to consumers. Cross-contamination and infections from various sources include unclean cutleries, uncooked foodstuff, the influx of flies that sporadically land on the foodstuffs and unclean bare hands in food handling for consumers (Kok & Balkaran, 2014).

Street food vendors prefer selling their products by the roadsides, instead of at designated places with adequate safety facilities supported with essential amenities like electricity and safe water. The vendors prefer roadsides for their proximity to potential consumers (Alimi, 2016a). Most of the street food vendors interviewed in Bloemfontein, South Africa, admitted that at some point they had prepared food for public consumption while they were sick. They felt forced to do this since they depended on daily returns from the business for their normal livelihoods (Alimi, 2016a).

These poor environment conditions expose street food consumers to foodborne illnesses, which more often than not cause disease epidemics (Todd *et al.*, 2007a; AMREF, 2007; Zeru & Kumie, 2007). While globally, foodborne diseases remain a major public health problem, it is more severe in developing countries due to difficulties in securing optimal sanitary food handling practices. Evidently, in developing countries, up to an estimated 70% of cases of the diarrhoeal diseaseare associated with the consumption of contaminated food (Zeru & Kumie, 2007 & Girma, 2015).

It is unfortunate that even with observable unhygienic conditions; consumers would still opt to have a meal at the street food points because of the low price of the food. The study conducted in India pointed out that 80% of the population is more concerned about the price of food than surrounding health conditions Sneh Lata *et al.*, (2016) while consumers are more concerned with the convenience and affordability of the food than their risks to health (Kok & Balkaran, 2014).

Donkor *et al.* (2009) suggested that a focal intervention is necessary for the form of education on how best is the protection of ready-to-eat meals through a tailored training of street food sellers. In addition, food and sanitation educational tools offered for use by the sellers could be used effectively to mitigate the potential of the occurrences of food-borne illnesses (Todd *et al.*, 2007a; (Ghosh *et al.*, 2007; Christison, 2008; Park, Kwak, & Chang, 2010; Pajot & Aubin, 2011; Gaungoo & Jeewon, 2013). Other schools of thought express doubt about the usefulness of food safety training of street food sellers.

The authors point to their low educational background of food handlers as the main cause of the inability to translate into action, information gained during training. Besides, some claim that consumers should bear responsibility for the potential risks of consuming food that is prepared in an unhygienic environment.

In support of the above assertion by Campbell (2011) it is of the view that low education of the street food consumers is related to high prevalence of Human Immunodeficiency Virus (HIV) and Acquired Immuno-Deficiency Syndrome (AIDS) conditions of the victims which, in turn, shows that health risks are more significant in persons with less immunity, for whom a simple foodborne illness can perhaps prove to be lethal. On the contrary, the onus to protect the consumer lies with the food provider. With this duty in mind, various solutions provisions to save consumers have been designed. One such solution is the insurance of the WHO Global tool of Five Keys to Safe Food (WHO, 2007b).

The package of the WHO five keys each assessed under the Knowledge, Attitude, and Practice. Its features are reflected in appendixes 2.1 & 2.2. The description of the five WHO keys is stipulated as follows:

1) **Keep clean**: Emphasises a food handler's health and hygienic behaviour, clean food contact surfaces, and an operating environment.

2) **Use safe raw materials and water**: Raw food materials and contaminated water contribute heavily to the introduction of health risks to food.

3) **Cook food thoroughly**: This key aims at ensuring that pathogens are reduced to a safe minimum if not eliminated.

4) **Avoid cross-contamination**: The key intends to make sure that ready to eat food is not contaminated with pathogens from uncooked food through vendorsø hands, dirty surfaces exposed to food or raw food exposed to ready to eat food.

5) **Keep food at safe temperatures**: The emphasis of this key is to limit the multiplication of pathogens possibly present in the food. Cooked food should be served while hot and leftovers refrigerated or discarded. Cold food should be refrigerated and never allowed to reach ambient temperatures.

The Tanzania Food and Drugs Authority (TFDA) has not only adopted and adapted the WHO five keys to safe food and customized them to suit the Tanzanian environment (TFDA, 2016), but it has also extensively supported their observance by all street food vendors. Despite this move, foodborne disease outbreaks continue to occur and some of these incidents have been associated with street food outlets whose operators had already been trained in the application of the WHO food safety tool.

1.2 Statement of the Research Problem

There is a high prevalence of diarrhoeal diseases in Mbeya City. This may be related to poor food vending practices and particularly by way of the street food businesses. Worldwide, deaths among children under five years of age are due to diarrhoeal diseases and account for up to 19% (Black *et al.*, 2010).

In Tanzania, mortality due to diarrhoeal diseases in under-fives is estimated at 12% (TDHS-MIS, 2016) and for the Southern Zone regions of Tanzania, including the

Mbeya Region, the prevalence of diarrhoeal diseases stands at 16%. A lot of effort and resources are spent yearly to alleviating the outbreaks of diarrhoeal diseases such as cholera the efforts include the application of WHO Five Keys to Safe Food by TFDA. Studies on foodborne disease risk factors have indicated that most such outbreaks are linked to food service establishments that can be attributed to food handlersø improper food handling and preparation practices (Nyamari, 2013). Additionally, observational studies have shown that food handlers frequently engage in unsafe food preparation practices according to Nyamari (2013).

These findings indicate that the improvement of health conditions of food handlers, especially in food preparation and practices are urgently needed to reduce the incidences of foodborne diseases. Intervention programmes are needed to effect these improvements. Furthermore, the twenty yearsø trend of diarrhoeal diseases especially cholera outbreaks in the Mbeya Region is the first outbreak of diarrhoeal disease including cholera that of 1974 in Tanzania shown in Figure1.1. To date, diarrhoeal disease outbreaks are still prevailing in almost every year in the Mbeya Region as per the detailed trends presented in Table 1.2. This study aimed to establish a level of understanding and to identify the leading factors that are contributing to the prevalence of diarrhoeal diseases in Mbeya City.

It was, therefore, imperative to establish what information street food vendors knew, about food and food safety. Such information was expected to provide a means to determine areas that require attention in planning for the training programmes about food safety. This study was thus, aimed at assessing the Knowledge, Attitudes, and Practices of street food vendors in response to WHO keys to safe food in Mbeya City

and to recommend necessary corrective measures to be instituted to control the continued prevalence of diarrhoeal diseases.

1.3 Rationale of the Study

The study was conducted to prove the assertions that street food has a role in the prevalence of diarrhoeal disease outbreaks in Mbeya City and to identify possible causative factors including how best to eliminate the factors.

1.4 Research Objectives

1.4.1 General Objective

The study aimed to identify and establish the main factors contributing to the prevalence of diarrhoeal disease outbreaks in the areas of engagement by street food vendors and their food handling practises for purposes of ultimately improving human health and safety in Mbeya City.

1.4.2 Specific Objectives

The specific objectives of the study were:

i)   To establish street food vendors Knowledge, Attitude and Practices by using the World Health Organisation five keys to safe food tool.

ii) To establish the health carrier status of foodborne disease pathogens in stools of selected street food vendors.

iii) To establish the extent of microbial contamination in street vended food in Mbeya City.

1.5 Hypotheses

i)   The prevalence of diarrhoeal disease outbreaks is influenced by street food

vendorsøhandling practices in the study area.

ii)   Street vended food causes microbial contamination and contributes to the transmission of diarrhoeal disease outbreaks in Mbeya city.

1.6 Significance of the Study

This study aimed to examine the factors that lead to non-compliance with the WHO Global Keys to Safe Food. The Government and other health stakeholders involved in decision-making and health planning will be expected to use the knowledge gained from the study to take corrective and effective measures to improve the conditions under which street food business is conducted in Mbeya City and elsewhere in urban Tanzania.

1.7 Scope of the Study

The study was confined to selected street food vendors as representative of ready to eat food outlets in Mbeya City. It was conducted in only four wards, namely, Ruanda, Sisimba, Uyole, and Igawilo wards under the Mbeya City Council.

1.8 Limitations

This study was limited to by the following:

i) Only microbiological pollutants in the food were targeted for monitoring in the study.

ii) The study respondents to questionnaire comprised of only those food vendors who, on their own will and without force of any sort, volunteered to be involved and were available during the study.

iii) The quality and sources of raw materials and other ingredients used by street food vendors were not studied.

iv) Casual helpers and/or next of kinsøknowledge in hygiene and their health carrier status was not checked.

CHAPTER TWO

LITERATURE REVIEW

2.1 A Literature Review on Food Vending as a Major Source of Diarrhoea Diseases

Food consumers are at high risk of infection with food or waterborne diarrhoeal disease microorganisms that remain one of the leading causes of illnesses and deaths in many countries. Often the word food-based diarrhoeal disease, food poisoning, and foodborne diseases are used interchangeably. Parasites, viruses, fungi, toxins, and chemicals may contaminate food and cause foodborne diseases. Foodborne diseases have many adverse social and economic consequences.

For example, the 1998 outbreak of cholera in Tanzania cost the United States Dollar (USD) 36 million for the supply of urgently needed medication alone. The World Health Organisation has documented many food quality problems that have affected food exports and imports in African countries including Tanzania (WHO, 2007a & Chukuezi, 2010). The safety of street food is occasionally compromised in some settings. Food is prepared and sold under filthy conditions with little or no use of safe water, germ-free services or waste disposal facilities (WHO, 2006). In some circumstances, consumers of higher-income consider street food unhygienic; while public opinion considers the same food as only less hygienic served formal street food outlets.

Consumersø attitudes and perceptions of health risks in relation to street food are determined through the customersø knowledge of food safety, demographic and socio-economic factors including age, gender, education and economic status (Alimi,

2016c). The World Health Organisation (2007) Public health definition, unfortunately, does not include the risks caused by food handlers or persons who handle fruits and vegetables. Probably, this error omission was due to the general belief that fruits and vegetables are washed and/or peeled before being eaten and so, the level of health risk that may go with such food was assumed minimal.

This assumption is not always correct. Persons in some circumstances do not always wash or peel fruits and or vegetables before eating them. Therefore, the exclusion of such terms in the WHO definitions becomes significant, especially whereas wild and domestic animals may also contaminate the grain, tubers, leafy vegetables and fruits herbs in the farms (WHO, 2007a).

2.2 Relationship between Food Vending and Food Safety

According to (Zeru & Kumie (2007); Donkor *et al.* (2009); Khairuzzaman *et al.* (2014); Kok & Balkaran (2014); Girma (2015) & Alimi (2016aóc); the reasons why street food vendors in deliberately selling unsafe food to consumers can be described as follows: i) Street food settings locations are based on convenience of both vendors and clients and are cheap in terms of rent and taxes paid to the relevant authorities. In such cases, hygiene of the operating surroundings for the businesses is not of primary concern of the vendors or the consumers. ii) Street food vendors have a low financial capacity to purchase appropriate food safety facilities to ensure due health services. The facilities may include protective clothing and readiness to undergo a regular medical examination.

iii) Street food vending sites are threatened and sometimes exposed to the hostile climate, temperatures, unsafe water supplies, poor sanitary services, and pests. iv)Street food businesses target low-income persons that are conveniently located nearby and are easily reached, by food vendors. Such customers are usually have limited knowledge of food hygiene and this situation does not allow them to make informed choices. v) The sector Ministries responsible for public health and sanitation give little if any formal recognition and support for infrastructural support to street food vending businesses. vi) Street food is ready and easily easy to run lucrative business for persons with low formal education and poor knowledge on food safety, hence minimum capital to investment and little or no professional training in food safety vi) Urban Management Authorities collect revenue from street food vendors to improve the working environments to sell food but nothing ploughs back to them by ways of improving vendors operating environments.

2.3 Knowledge, Attitude, and Practice of Food Vendors and Their Compliance with Safe Food Practices

Information collated through studies including from WHO, (2009); Samapundo, (2012); Bhowmik (2010); Taché & Carpentier, (2014); Girma (2015) & Alimi (2016aóc) suggests that among the underlying factors impeding street vendorsø compliance with food safety practices including complying with the World Health Organisation five keys include: i) Low education levels of the vendors and food consumers limiting their awareness of the risks posed by unsafe food handling practices. Such knowledge would have otherwise enabled them to make informed choices such as not handling food in filthy areas. ii) Convenience and economic

factors attract clients to street food vending outlets with low food hygiene. iii) Inadequate training and poor legal enforcement of prerequisite training of food handlers by food safety control institutions. This shortfall leads to the vendorsø negligence of hygienic food handling practices.

2.4 Observed Gaps in The literature on Street Food Vending

The numerous works have been done on street food vending in gifted economies, in the developing countries, many studies already undertaken and have illuminated big cities and related urban centres leaving medium-sized towns in the dark about food safety. In addition: i) Few studies have been conducted to evaluate the effectiveness of the roles of Government institutions in the promotion of food safety and hygienic practices among street vendors. ii) The effects of high turnover of street food vendors in a short period and their temporariness in a given location have not been evaluated. iii) There has been a lack of appropriate food handling equipment, safe water, and lack of formal recognition of the businesses by Local Government Authorities. iv) Practical approaches, appropriate, cheap and robust technologies for food vendors, consumers, and regulatory bodies or institutions requires are lacking and a need to be studied and documented.

2.5 Empirical analysis of Global Food Safety Management

The joint FAO and WHO Codex Alimentarius, in (2008), established the General Principles of Food Hygiene and the Hazard Analysis Critical Control Point (HACCP) system. These have identified the essential principles of food hygiene considered suitable throughout the food chain (Tiisekwa, 2013). The application of

HACCP has been a major challenge in developing countries due to relaxed food market places that have minimal attentiveness and application of basic hygiene practices among food handlers and consumers (Jeo, 2010 & Tiisekwa, 2013).

The Codex Regional Coordinating Committees have elaborated respective codes of hygienic practices for street vendorsø food taking into account local conditions and the special nature of street food. FAO has further developed guidelines for nutrition education and most recently, a detailed programme for nutrition education in schools (Tiisekwa, 2013). Successful nutrition education programmes for schoolchildren and other key community groups are an essential means of equipping street food customers with the knowledge necessary for them to make healthy food choices and preferences.

Several projects across the world have been implemented by FAO in collaboration with member state to i) Improve conditions under which street foods are prepared and sold; ii)Strengthen food quality control capabilities of the local authorities for overall improvement of the quality of both raw food materials and processed foods; iii) Undertake further research on the street food sector: socio-economic impact, legislative framework, hygienic and nutritional improvement requirements; iv) Improve of food vendorsøknowledge about sanitation and food hygiene including nutritional value of food through education and training; v) Share experiences and promote networking among local and national authorities at the regional level to spread good food practices and promote common strategies; vi) Raise awareness among consumers about food and hygiene conditions of street food.

2.6 Street Vendors and Non-Agricultural Informal Employment

Women in the street food business in Senegal account for 53% while in Burkina Faso the figure stands at 75 % (Njaya 2014). In Sub-African countries employment of women in street food vending accounts for 51% of the total non-agricultural informal employment (Roever & Skinner, 2016).

The overview of employment data for 11 Cities in 10 developing countries ranges from 34% in Hanoi Vietnam to 65% in Bamako, Mali, (Herrera, *et al.*, 2012). In the Indian cities, the share of street food vending is low from 4% in Mumbai to 7% in Ahmedabad. In total, urban informal employment is 6% and is higher among employed men than employed women in the total of the non-agricultural informal sector. Although the trade is still an important branch of economic activity in Indian cities, non-trade services and manufacturing account for higher shares of total urban employment. Food-vending business is an imperative source of employment, especially for women.

The ratio of women in informal service and street vending business is altogether higher than that of men in most cities (Roever & Skinner, 2016). In the West African cities, less than 10% of women in the labour force have formal paid occupation (*Ibid*: 2016). Street vendorsø contributions to urban life go beyond their self-employment. Women create demand for a broad range of services that provide for and other informal workers including transport workers, tea sellers, market porters, security guards, recyclers, and others (Bromley *et al.*, 2009). The women also generate demand for services provided by formal sector public and private actors, including transportation, and formal shops and suppliers from whom they source

their goods (Bromley & Mackie, 2009).

The Supreme Court of India has noted that street vendors õconsiderably add to the comfort and convenience of the general public, by making available ordinary articles of everyday use for a comparatively low priceö (Brown *et al.*, 2015). This is a particularly important role for the urban poor who cannot afford to shop at supermarkets.

2.7 The Framework for Street Food Vending and Safety Controls in Tanzania

The Tanzania Food and Drug Authority (TFDA), the regulatory organ for food safety in Tanzania, enacted by Act No.1 of 2003 (TFDA, 2016), works in collaboration with the Tanzania Bureau of Standards (TBS) establishment under the Act No. 2 of 2009 (TBS, 2016). The two institutions observe and exercise observational of food safety regulations and standards in Tanzania. Food safety is a cross-cutting issue. Even though the burden still rests on the Ministry of Health, Community Development, Gender, Elderly, and Children, the people who live from hand to mouth have been facing experiences of food quality in countless ways and this is an attribute of i) Lack of access to clean water; ii) Unhygienic transportation and storage of food; iii) Low education levels of the food consumers and food handlers. All these factors are due to inadequate or lack of information on food safety in Tanzania.

The two Acts of Parliament referred above provide for efficient and comprehensive regulation and measures to control food quality. They cover the import and export of foodstuffs, manufacturing, including licensing and registrations of food businesses.

Under the Act No.1 of 2003, the Local Government Authorities, and Local Councils act as the local regulatory and law enforcement agents responsible for supervising and guiding businesspeople in food trade management. They oversee pertinent business registration and collection of due fees, licensing fees, and may prescribe bylaws on modes of operation of all food businesses and pertinent, hygiene, and sanitation requirements.

The Councils is expected to conduct food handlersø medical examination, training programmes, planning locations for delivery, sampling or testing of food at the places of preparation, as well as imposing fines on food businesses that contravene established food safety laws. The Councils usually report to higher levels, which include the Ministry for Local Government currently under the Presidentøs Office. On matters relating to food safety, they give copies of their reports to TFDA. In 1997, WHO Food Safety Programme conducted a case study in Buguruni market in collaboration with other partners (WHO, 2006).

The outcome of the study initiated several actions including; i) Improvement of road access to the market by Plan International; ii) Construction of a solid waste storage bay by Japan International Cooperation Agency (JICA). iii) Construction of toilets and hand washing facilities by WHO; iv) Development of a system for the collection and sorting of solid waste for later disposal. v) Drilling of a deep well and construction of a water storage tank at the market (WHO). vi) Training of vendors on HACCP and other food hygiene principles of WHO; vii) Purchase and installation of a sodium hypochlorite solution making a machine for water and equipment sanitization (WHO). vii) Facilitated representatives of the market to attend the

Hannova Expo 2000 in Germany (WHO) The Healthy Food Market concept spilled over into several other markets in Dar es Salaam.

2.8 Compliance Factors for Safe Food

Unsafe food makes one-third of the overall population ill worldwide. Yet five simple prevention techniques could significantly reduce this burden of disease (WHO, 2006). WHO launched its five keys to safe food strategy in five simple actions, that can commence at home, or at work while preparing and consuming food. The actions include keeping hands and cooking surfaces clean; separating raw and cooking food; cook food thoroughly; keeping food stored at safe temperatures, avoiding cross-contamination, and using safe water and food raw materials.

WHO has produced a basic training manual that the Member States can use in giving effective information about the five keys strategy distinguishing the ways food is made ready for consumption including the type of food eaten as these differ enormously across and within countries (WHO, 2006 & Tearfund, 2007). Most public health authorities classify food handlers as those who prepare, process, cook, pack and distribute food or offer it for sale to consumers. Rodriguez-Torres, (2009) defines a street food vendor as a person involved in handling food for human consumption either in a business, restaurant, fast food vending place, or at home.

Rodriguez-Torres recognizes that the average person perceives a food vendor to be someone who sells food on the streets. Rodriguez-Torres (2009) suggests that a street food vendor is much more than this definition provides because the role of the food handler is also involved in food production and processing technology and refers to

the farmer as contributors to potential food hazards. The hazard perhaps could be inclusive in antibiotics that may enter the food chain through, for example, milk.

Adhering to this public health definition leads to the omission of those persons who handle fruits and vegetables. Their role in the food spectrum may result in serious potential hazards in food. Besides, training in some parts of the world such as the Caribbean, rotate only among the persons who prepare food in establishments such as restaurants, hotels, public, and private institutions including hospitals and nursing homes. The focus is to keep in mind that proper training in food handling practices or techniques combined with a commitment to behavioural change, and an effort by the universal food handlers to change behaviour, could yield great rewards in the overall health of the consumers of food and safety of food consumed.

Periodic physical examination of food handlers by medical practitioners seems important although it is not always able to show infective diseases unless exhibited by gross lesions on the exposed skin and other parts of the body that are affected by infections. Unfortunately, physical examinations do not generally show internal infections or bacterial and viral loads within the street food vendors or on the body surface of the handler or his/her clothes. Even some practitioners themselves who conduct physical examinations often offer very little evidence in support of the ability of street food vendors to carrying out safe food practices, after having passed a physical health examination.

2.9 Factors Impeding Compliance and Response to Safe Food

Many people believe that simply providing fresh, clean water supply will

substantially reduce water-borne diseases (Tearfund, 2007). What most people do not know is that safe hygienic practices and access to sanitation are crucial for combating the main health threats to children under five, in particular, diarrhoeal. The scale of the problem is immense since today, nearly twice as many people lack access to sanitation compared to water supply (Tearfund, 2007). Sanitation has raised to the international policy agenda. In 2002, sanitation was included in the Millennium Development Goals (MDGs), and specifically within the MDG 7, target 10.

In 2015, sanitation extended to and was made part of Sustainable Development Goals (SDGs) under the United Nations Goal 6 target 6.1 and 6.2 õWater Supply and Sanitationö, 6.3-6.6 Global Environmental Management Initiative (GEMI) 6a and 6b Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS). The SDGs are an extension of the previous Global Millennium Development Goals. Despite the health implication and the significance of this target, many nations have not yet given sanitation enough attention (Tearfund, 2007; Kida & Mushi, 2016; Nswilla, 2017, NBS, 2017; Moller *et al.*, 2017 & Water in the World We Want, 2019).

2.10 Success and Failures Related to the World Health Organisation Keys to Safe Food

The five keys to safe food provide the basic principles and terms that everyone should be familiar with, all over the world in preventing foodborne disease outbreaks. Many countries have reported their use of the five keys to safe food as an effective tool in controlling the disease outbreaks. Subsequently, millions of food

handlers, including consumers have been being empowered to prevent foodborne diseases, make safe and informed choices, and to have a voice in forging for a safe food agenda.

The aim to ensure the same understanding is shared along the full food chain from the farm to the table. World Health Organisation has further developed the other five keys to promoting safer aquaculture and horticulture and pertinent products (WHO, 2016). The WHO Global Five Keys to Safe Food have projects set up in several countries targeting not only street food vendors but also high-risk groups such as schoolchildren, women, and marginalised groups (WHO, 2007b).

The WHO Global Five Keys to Safe Food tool has been applied across the world. In Africa, more than 10 countries embrace them. Even so, this study was considered very important despite the safe aquaculture and horticulture. Even though, the latter is not yet widely applied in Tanzania. Aquaculture can be adapted and embraced in Tanzania especially in such regions as Dodoma that experienced outbreaks of Aflatoxicosis in 2016 resulting from poor storage of groundnuts and maize (MoHCDGEC, 2016). The WHO Regional Office for Africa has extended education on hygienic handling of food by using the five keys to safe food tools in most African countries. The settings covered include healthy kitchens at homes, schools, hospitals and other health facilities, healthy food markets, food business sites, healthy food stalls, canteens, restaurants and, supermarkets.

Various audiences for training were targeted in seminars and campaigns organised for Health Officers in Angola, and Botswana on food safety awareness. Resources

used included posters adapted and translated into Setswana in Botswana. In the Comoros food handlers including market vendors, vendors near schools, vendors of kebabs and those working in small restaurants, warehouses and abattoirs were trained. Food market vendors and the general market community were also trained in Lesotho and the Republic of Congo Brazzaville (WHO, 2007b). The Association of women vendors; staff of the Ministry of Health, WHO Country Office staff; and Local District Authorities staff collaborated as partners in the training in the Gambia, Guinea-Bissau, Mozambique, and the Republic of Congo Brazzaville. Teachers, schoolchildren, and street food vendors were targeted audiences. In Ghana, Street food vendors, School-based Health Coordinators, Circuit Supervisors, and Metro School Health Coordinators, Junior Secondary School students were targeted for the training.

In Mali, the training focused on food handlers in food establishments, and the general community (WHO, 2007b). Rwanda trained a full range of food handlers in food safety. In India, Vietnam and Laos People's Democratic Republic, the five keys to safe food have been adopted and adapted beyond the health sector not only for street food vendors but also for safe aquaculture products altogether to protect public health (WHO, 2012 & WHO, 2016). The five keys to growing safe fruits and vegetables are currently practiced in Belize, Guatemala, and El Salvador to promote health by decreasing microbial contamination of foodstuff and prepared food (WHO & Mwamakamba, 2012 & WHO, 2016).

Much progress has been made by countries in the form of back up to the five keys to safe food as a strategy for food safety learning which has been internalised with

other schemes (WHO, 2007b). Some countries, such as Haiti adopted the keys provision of safe food in rural schools a non-profit Organisation provided safe prepared food and education about it to schools in remote areas where teachers, cooks, and students began to change their food processing and consumption lifestyle. Students carried the messages home, and this slowly influenced the entire community to transform. In Vietnam, the WHO keys were supported by food customers who made use of media channels, including television, national radio station, Voice of Vietnam and associations i.e. the Farmers Association, Women's Union and Veterans Association to send the health and food agenda across all the people.

Those associations share out the information with their members reaching out to consumers in remote areas where flyers are dispensed. Audio messages were also broadcast through the village speaker systems in Vietnam (Thanh, 2015). Furthermore, in Vietnam, street food vendors, the Vietnam Farmers Association organises training on hygiene and food safety in which consumers are educated through various communication channels to be acquainted with clean and safe street food stalls. One of the challenges in the endeavour is that because some Vietnamese consumers are still poor. They are forced by circumstances to purchase and consume unsafe food or food that does not meet food hygiene and safety standards (Thanh, 2015).

Moreover, because of the lack of knowledge, or driven by profit, certain vendors purchase and sell unsafe products. In El Salvador, women spread the word on food safety through the educational programmes that sought to discuss foodborne illness

and poor nutrition by educating local women who were identified as the people most likely effectively pass on their knowledge to other people. On the other hand, one in 10 people in El Salvador live on less than two USD a day; this makes it hard for them to purchase food from quality food outlets and care less about food safety and quality and more on its availability.

A large proportion of the population El Salvador lacks enough education about nutrition. An evaluation was done in El Salvador villages in 2014; a year after the first series of workshops took place. A prospective study measuring acute gastroenteritis was conducted from house to house. The study found that foodborne diseases had decreased as the people were put into practice the five keys to growing safe fruits and vegetables. Families that applied the five keys at home reduced their chances of getting diarrhoeal by 60% compared to families in communities where the safety and hygiene measures were not practiced. Families in areas where the programme was implemented begun to eat a wider range of fruits and vegetables that led to o their improved nutrition status. The five keys have been applied to reduce incidences of diarrhoeal diseases in Benin, following a flooding event, and the controlling of cholera outbreaks in Benguela Angola. These strategies were adopted in South African during the 2010 World Cup (Mwamakamba *et al.*, 2012).

2.11 Knowledge, Attitudes, and Practices in Relation to Applied theories

The connection between KAP satisfied by the KAP model itself (Campbell, 2011). Knowledge is increasing through education and research and education may be formal or informal instruction, individual experience, and empirical involvement. it is conventionally assumed that knowledge is consistently translated into behaviour

(*Ibid:* 2011). This study used two theories: Theory Reasoned Action (TRA) and Theory of Planned Behaviour (TPB). According to Montano & Kasprzk, (2008) the two theories were further extended to the Integrated Behavioural Model (IBM) in the 1990s.

These theories with individual motivational factors serve as elements of the likelihood of demonstrating an exact behaviour. TRA includes measures of attitude and social normative perceptions that determine behavioural intention, which in turn affect behaviour. TPB has an extra notion namely, perceived control over the performance of behaviour. Of the two theories, TRA works best when applied to behaviours under an individuals' control but TPB works best when the behaviour is not perceived to be under a person¢s control. Furthermore, in IBM the most important determinant of behaviour is the intention to demonstrate behaviour by complementing four other factors of behaviour namely, knowledge and skills, behaviour, environmental constraints, and habit expands and renames attitude, normative and control elements.

These confines to the salient factors such as demographic and personality still not in the model and no clear definition of perceived behavioural control that is hard to measure model, perceived behavioural control predict actual behavioural control. As the more time passed between behavioural intent and actualisation of a behaviour, the less it will be for the behaviour to be demonstrated happening. The theory assumes that people are rational and make systematic decisions based on available information and ignores unconscious drives. The socio-economic factors that determine health include employment, levels of education, and income status.

Success in life involves society related to economic factors that influence one another. Therefore, enabling in business factors such as favourable environment, food stall infrastructures, water supply, sanitation and the provision of basic social services are often ensured by relevant public authorities in support of street food vending. Various resources generally limit street food vendors. They require more than their physical health states to engage and to comply with WHO five keys to safe food.

The other related factors, which the vendors may not know, are knowledge, appropriate attitudes, and individual behaviour, income levels, expectations and demands of clientele. Vendors require knowing the conditions for their compliance with WHO keys such as keeping hands and cooking surfaces clean, separation of raw from cooked food, heating food meticulously, storing food at a secure temperature, and using safe and clean water and safe raw ingredients for food preparation. Given that situation, the TRA might not work as they expected to respond to conditions is that is beyond the control of individuals.

Argentina Methods was an example resided on seeking medical care after old age in which TRA predicts intentions of old persons in seeking social support for health care (Montano & Kasprzk, 2008). The study of Dean *et al.* (2007) using TPB about ageing substantiated that individuals perceived control was likely to encourage training behaviour among old people. Knowledge is significant in that it is vibrant in the reasoning process of gen in the attitude-behaviour relationship (*Ibid*: 2011). Attitude involves evaluative concepts associated with the way people think, feel and behave (*Ibid*: 2011). It comprises reasoning, emotions and behavioural demonstrated

what one knows, feels and is ready and able to do (*Ibid*: 2011). It has been proposed that attitudes may inspire one's intent to a given behaviour or practice which is correlated with behaviour. For example, if a person has a positive attitude towards proper hand washing, he/she will be more likely to wash their hands (Montano & Kasprzk, 2008).

Some writers argue that an individual's attitude can be a consistent predictor of the person's actual behaviour. Conversely, if a person behaves in a certain way, then it can be unforeseen that the person has attitudes that influence him/her to behave that way; however, behaviour that is forced on a person by other people's behaviour, may be based on economic circumstances. In health-related studies, however, it has been found that knowledge is not the only factor that influences treatment-seeking practice and to change behaviour. Health programmes need to address several issues including socio-cultural, environmental, and economic and other structural. (Launiala, 2009).

2.12 Potential Causes of Food Contamination Linked to Diarrhoeal Diseases

Education related to the hygiene of food business operators has been recommended as a means of promoting safe and improved food-handling practices (Campbell, 2011). This is attributed to the fact that human handling errors have in many cases been responsible for most outbreaks of foodborne diseases in developing and developed countries alike (Todd *et al.*, 2007b). For example, unwashed hands of food handlers, who are themselves infected, can introduce and spread hepatitis õAö virus among others.

According to Todd *et al.*, (2007b) good personal hygiene and sanitary handling practices in food processing are some of the requisites of any disease prevention programmes relating to food safety. Risk factors associated with human errors and food preparation methods can l lead to a high prevalence of foodborne diseases. These have been shown in various studies including those by Todd *et al.* (2007b). The common foodborne pathogens that are associated with diarrhoeal diseases include *Campylobacter Jejuni, Clostridium botulinum, Clostridium perfringens*, *Escherichia coli* O157: H7, *Listeria Monocytogenes, Salmonella, Shigella*, *Vibrio cholerae*, Hepatitis õAö.

Others include Norovirus, *Cyclospora cayetanensis, Staphylococcus aureus, Campylobacter jejuni,* and *Toxoplasma gondii* (TEA, 2015). The health risks included improper holding temperatures for food; inadequate cooking of food, contaminated equipment, poor food storage, food from consumption of unsafe sources and poor personal hygiene in handling food (Chilukoti, 2014). The Food Safety Agency (FSA) of the UK promoted a simple food safety management pack of 4Cs principles for food businesses. This was launched in 2005. The 4Cs principle includes õCleaning, Cross-contamination avoidance, Cooking and Chillingö (FSA, 2011). Waggoner (2014) elaborated these messages as follows:

Cleanliness: Involves the act of washing hands before and after handling food, eating, visiting the toilet restroom, and making contact with people, plants or pets, animals, after coughing, sneezing, or nose swabbing. There should be thorough washing with soap and hot water food utensils, cutting boards, and tops of selling counters. Fruits and vegetables should be cleaned in running water immediately

before eating, cutting, or cooking. Cleaning the kitchen includes refrigerators and this should be undertaken before and after food preparation to avoid food contamination by crawling or flying flies, insects like ants, cockroaches, lizards, or even rats. It is a fact that an unsanitary kitchen can act as a hotspot for harmful and disease-carrying insects.

Cockroaches: There is no single home in the world, which has not been shared by cockroaches (Kreston, 2012). These disgusting creatures crawl on sinks, run down pipe, holes, around and in garbage piles or rest peacefully in the corners of refrigerators. Although cockroaches by themselves do not cause any disease when they walk on the food, they stand as vectors or carriers for millions of bacteria that cause diarrhoeal and other diseases.

Bacteria and viruses settle in crevices, cracks and between the thorax and the head where they begin to multiply. There are many fissures, clefts, and crannies on cockroaches that serve as a hideout for disease-carrying microorganisms. A study has found that the bacteria such as *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* can multiply extensively in the guts of cockroaches and cause several diseases such as urinary tract infections, dysentery, diarrhoea, pneumonia, cholera, polio, septicemia, and wound infections, digestive problems, and sepsis (*Ibid*: 2012). It is further believed that the cockroaches are a reservoir or a õmechanical transmissionö, systems indirectly spreading disease microbes to humans by way of a range of bacteria including *salmonella, Escherichia coli*, *Staphylococcus* and *Streptococcus.* Cockroaches can also harbour viruses such as the polio virus (*Ibid*: 2012).

Avoidance of Cross-Contamination: A person needs to protect oneself from infection by keeping raw food (meat, poultry, eggs, and seafood and fruit juices) far from other food. Staff at the grocery or convenience stores should always ensure that food is always separated from other stuff in the shopping cart. Foodstuff should always be wrapped in safe carrier bags to avoid fruit juices from seeping on to other food and therefore, potentially distributing harmful bacteria. Separate cutting boards should be used for processing different raw food including meat, poultry, and seafood.

Cooking: Food thermometers should be used to detect whether the cooking temperature has been able to kill harmful bacteria. While colour and temperature are changeable indicators of food safety and comfort, using a food thermometer is one such way to make sure that food has been cooked adequately. Normally, food should be cooked to a safe internal temperature to destroy harmful bacteria. Such raw food includes various forms of veal steaks, chops, and roasts and should be cooked to an internal temperature of 63℃ to 74℃ and 85℃ (145 °F to 165°F and 185°F) for a whole chicken, turkey, or duck (CFIA, 2016). For safety and quality, veal steaks should be cooked for at least three minutes before being consumed. For personal preference, customers may prefer to cook meat to higher temperatures.

Chill: Any leftover food should be chilled after consuming part of it, by immediately refrigerating. Surplus packed food should not be kept at an unsuitable temperature for more than two hours. One should always use a thermometer and read it to ensure that the temperature of the refrigerator is 40°F or lower and the temperature of the freezer is 0°F or less. Even so, the Canadian Food Inspection Agency (CFIA, 2016)

shows that bacteria can grow in the danger zone between 4°C and 63°C (40°F to 145°F). Consumable food should, therefore, be defrosted in the refrigerator, microwave, or chilly water and by no means on the counter or in boiling water. There is, however, a lack of documented evidence of improvements in food hygiene standards directly related to education or training (Campbell, 2011).

Researchers including Campbell, (2011), Gaungoo, & Jeewon, (2013), conducted a systematic review of the effectiveness of food safety training as an intervention. Food handler training can improve the practices of food handling particularly if combined with certification. Selected community-based education programmes can increase public knowledge of food safety (FDA, 2006 & Campbell, 2011). Rudder (2006) concluded that the lack of knowledge and understanding of the principles of food safety coupled with language difficulties, are significant barriers to promoting food safety and those supportive activities can make a significant impact on food safety practices. On awareness of the lack of studies and clarity on the impact of training on food safety behaviours within the food industry, Nieto-Montenegro *et al.* (2008) undertook a study that aimed at accessing and developing pilot food safety educational material and training strategy for Hispanic workers using the Health Action Model (HAM) (*Ibid*: 2008).

The Health Action Model takes into account the social and environmental factors around the worker that may affect the adoption of needed behaviours (*Ibid*: 2008). Seaman & Eves (2006) pointed out that the Health Action Model gives the most thorough description of factors that might influence behavioural changes following training on hygiene. The study conducted by *Ibid* (2008) using the Health Action

Model, found that educational lessons alone produced a significant increase in knowledge and practices to hand wash after using the toilet.

2.13 Epidemiology of Foodborne Diseases

The World Health Organisation defined foodborne diseases as transmissible ill-health conditions including of toxic nature believed to because and spread by the ingestion of food and water (WHO, 2008). Food poisoning is used as a synonymous form for foodborne diseases or foodborne illness. The diseases are regarded as acute illnesses associated with the recent ingestion of food pathogens having a short incubation period and leading to symptoms of nature gastrointestinal features. Characteristically, the diseases categorised by a combination of nausea, vomiting, stomach pains, abdominal cramps, and diarrhoeal.

Though in some cases, the diseases are not restricted to the gastrointestinal tract they may be neurological or other symptoms connected with the alimentary canal as illustrated by viral hepatitis, tuberculosis, and haemolytic-uraemic syndrome caused by *Escherichia coli* 0157: H7 (Nyamari, 2013). The pathogens that are most commonly involved are *Salmonella* spp, *Bacillus cereus, Staphylococcus aureus*, *Clostridium botulinum, Clostridium perfringen*, *Escherichia coli* 0157: H7*, Shigella* spp, *Campylobacter* spp and *Vibrio cholerae* (WHO, 2007a).

The identification of these pathogens has been a result of combined efforts of scientists in a variety of disciplines including epidemiology, public health, microbiology, medicine, and others. Surveillance and epidemiological analysis often offer initially proof of the causes of diseases. This analysis can lead to the isolation

and characterization of the suspected etiological agents. However, some infectious agents such as viruses and parasites as well as prions are difficult or impossible to culture, and hence the diagnosis of the diseases will depend on alternative methods by medical laboratory experts (Nyamari, 2013).

Each year, all over the world, an untold number of people, particularly infants and children, suffer from foodborne diseases and some eventually die. Although the role of food producers, processors, and manufacturers in ensuring food safety should not be underestimated, many cases of foodborne diseases, if not most, could be prevented. This standpoint suggests possible steps and elements in developing food safety education programmes. The objectives can be realised through the application of the WHO five keys to safe food (WHO, 2006). The burdens of foodborne diseases are yet to be defined and understood globally, regionally or at the country level (Incidence of Foodborne Illness (IFBI, 2010; Campbell, 2011; Kok & Balkaran, 2014).

Very few non-epidemic illnesses can be linked to food practices. Often these links are only recognised during disease outbreaks (*Ibid*: 2010, 2011 & 2014). The burdens caused by food and specifically pathogens are commonly transmitted through food. Although acute gastrointestinal diseases are not all foodborne diseases, as foodborne diseases do not always result in acute gastroenteritis, it is important to be aware that food does represent the only vehicle for pathogens causing acute gastroenteritis (WHO, 2008a). In cross-sectional surveys, investigators have found out the prevalence of self-reported acute gastroenteritis among persons in the

community during a set period. For example, in the retrospective study conducted in the United Kingdom, an incidence of 5.5 cases per person-year was calculated. The later prospective study indicated a calculated incidence of almost 3 times the earlier cases calculated through the retrospective study by Majowicz *et al.*, (2010).

The retrospective estimate of foodborne diseases was similar to previous estimates from retrospective studies conducted in the United Kingdom, Australia, Canada, Ireland, and the United States (Hoffman *et al.*, 2007). In addition, there was an outbreak of Aflatoxicosis in Tanzania from July to December 2016 where 68 cases and 20 deaths and a Case Fatality Rate of 29%. This was reported under the Aflatoxicosis Situation Updates and Response by the WHO Country Office, Tanzania on 11 January 2017 (MoHCDGEC, 2016). The affected regions were Dodoma and Manyara. This resulted from poor production of peanuts and maize that was not kept in clean and dry storage equipment, poor food safety and generally improper handling of food (Zain, 2011 & Nelson & Zeratsky, 2012).

According to Yard *et al.*, (2013) aflatoxins are a fungal toxin that is derived from strains of *Aspergillus flavus.* These are reported to taint an estimated one-quarter of agricultural products worldwide, with maize, cereals, and groundnuts being the most predisposed. This can be mitigated by applying the five keys to growing safe fruits and vegetables with the cases of Belize, Guatemala, and El Salvador as typical examples (WHO, 2012 & WHO, 2016). The experience of Belize, Guatemala, and El Salvador in the successful adaptation of these keys will be suitable in controlling aflatoxicosis in Tanzania and other settings with similar features.

In the case of cholera, the adaptation of methods that suits its control setting may be by training food street vendors, schoolchildren and communities to be aware of the five keys to safe food as already done and experienced in Haiti, Comoros, Angola, Gambia, Mozambique, Guinea, Botswana and The Democratic Republic of Congo. The FAO estimates that 70% of diarrhoeal diseases in developing countries are the foodborne origin (Majowicz *et al.*, 2010 & Githaiga, 2012). The globalization of the food supply systems has presented new challenges for food safety and has contributed to the international public health problem of foodborne diseases. These are attributed to the growing industrialization and trading in food products, rapid urbanisation associated with increased food preparation and food consumption outside the home leading to wide emergence of new and antibiotic-resistant pathogens (IFBI, 2010 & *Ibid*: 2011).

In starting and sustaining efforts for the prevention of foodborne diseases at national and international levels, the size of the problem requires that it be determined for appropriate action. The Department of Health in South Africa believes that when people seek medical attention, health workers are less likely to report the less severe conditions, thus posing a challenge to the health care system in keeping data to enable them timely provision of resources to respond to the outbreaks (*Ibid*: 2009). According to The Free Library (2014), food is the source of nutrients, central to health, wealth and social well-being of people and societies.

Unsafe food causes many acute and life-long diseases, ranging from diarrhoeal diseases to various forms of cancers (WHO, 2011). Evidence exists that the effect of water, poor sanitary and hygiene interventions retard children's linear growth is

independent of its effect on diarrhoeal. Several studies suggest that sanitation and hygiene interventions have a big effect on growth than it does on diarrhoeal. Diarrhoeal is a major cause of morbidity and mortality among infants and children worldwide. In developing countries, the diarrhoeal disease accounts for an estimated 17% to 21% of all deaths in children under the age of five years equating to 1.5 million deaths per year (Black *et al.*, 2010). Of all child death from diarrhoeal diseases, 78% occur in the African and Southeast Asian regions, these regions are also disproportionately burdened with infant and children's HIV infections (UNAIDS, 2007).

In 2010, the WHO cited that the main causes of death among children under five years of age are the acute respiratory infections, which account for 17% and diarrhoeal diseases up to 19% (Black *et al.*, 2010) In Tanzania, mortality due to diarrhoeal diseases for the under-fives is estimated at 12% (TDHS-MIS, 2016). The Southern Zone regions of Tanzania, including the Mbeya region, had the highest prevalence of diarrhoeal diseases at 16% and the lowest that is 8% in the Northern Zone regions (TDHS-MIS, 2016). In India, the incidence of diarrhoeal diseases stands as the number one reason for the hospitalisations of teen-agers below 14 years and accounts for 17% for hospitalisation of children in rural settings (Munos *et al.*, 2010). Consequently, diarrhoeal is the second cause of mortality for the under-fives for both globally and in Africa (Choube *et al.*, 2014). The majority of these deaths can be avoided through timely and public health interventions.

The knowledge of children's caretakers about the severity of diarrhoeal illnesses ultimately influences affects their choice for childcare practices and influences the

type of therapies given and received (Choube *et al.* (2014). Africa and South Asia are home to more than 80% of child deaths due to diarrhoeal (Moore, 2011). In addition, diarrhoeal diseases do contribute to malnutrition thereby reduce resistance to other infectious agents. Gastrointestinal illnesses may be indirect factors and a far greater burden of diseases (Tesfaye *et al.*, 2014, & Girma, 2015). According to Khalili *et al.* (2013), healthy behaviours such as good hand washing can reduce the incidences of diarrhoeal diseases by 48% (WHO, 2013). Improvement is being made in the fight against diarrhoeal diseases, but much work remains to be done. Preventive techniques reported in the literature include hygiene, balanced proper diet, medications, and dietary supplementation. Even so, by general classification, healthcare, breastfeeding, immunization, supplemental zinc, and probiotics can also be instrumental in reducing bacterial and other infections (Khalili *et al.* (2013).

2.14 Knowledge Breach on Street Food Safety

There is a lack of knowledge on microbial safety, pathogenicity, and impairment in the distribution of street food microorganisms. Some scholars suggest that attitudes might influence people's intention to demonstrate a given behaviour or practice (Campbell, 2011). Food handling is correlated with behaviour. For instance, if a person has a positive attitude towards the importance of hand washing he/she is more likely to wash hands (Campbell, 2011). Every City, excluding Mbeya City Council, has its street food specialities, structures, and regulations in running the business.

Cities, Municipalities and Towns, have law enforcement mechanisms and officers to oversee hygienic handling of food these put in place who implement logistics and regulations for street traders that the latter can learn as they work in partnership with

all health stakeholders. The law enforcement and the urban street food vendorsø policy in many countries acknowledge that the existing regulatory climate undermines the livelihoods of a growing number of street vendors. Observers consider that under the prevailing circumstances, police and civic authorities often harass street food to harass vendors and consider them as illegal encroachers of environments.

This violates the constitutional right of the people concerned as long the organ keeps threatening small businesses instead of giving due advice and guidance (Nath, 2010). Nonetheless, bacteria remain responsible for a large number of foodborne diseases. The food safety and sanitation class complying with six conditions set by the Texas Education Agency (2014 & 2015). Guide people encourage on how best to control bacterial harmful bacteria spread and grow. Acidity, Temperature, Time, Oxygen, and Moisture. This acronym is a mnemonic device used in the foodservice industry to describe the six conditions considered favourable for the growth of foodborne pathogens as explained in Table 2.1. Sometimes the food we feel affection for and count on for good health is contaminated with microorganisms that cause illness, which can be deadly. Food contamination can occur in many different ways.

Four main causes of food contamination are not limited to non-washed hands, cross-contamination such as in the process of transferring contaminants from one food contact surface to another, improper storage and inadequate cooking temperatures and/or contamination through contact with animal wastes.

Table 2.1: The Six Conditions That Promote the Growth of Foodborne Pathogens

Mnemonic Conditions		Narration of factors
F	Food	There are sufficient nutrients to promote the growth of microorganisms. Protein-rich foods, such as meat, milk, eggs, and fish are most susceptible to pathogens/habitation
A	Acid	Foodborne pathogens require a slightly acidic pH level of 4.6ó7.5 and thrive in conditions with a pH of 6.6ó7.5. The United States Food and Drug Administrationøs (FDA) regulations for acid/acidified foods require that the food be kept at pH 4.5 or below.
T	Temperature	Food-borne pathogens grow best in temperatures between 41 to 135 F (5 to 57 C), a range referred to as the temperature danger zone (TDZ). They increase in temperatures that are between 70 to 104 F (21 to 40 C).
T	Time	Food should not stay in less than two hours after it has been cooked as food-borne pathogens grow best in temperatures between 41 to 135 F (5 to 57 C), a range referred to as the temperature danger zone (TDZ). They increase in temperatures that are between 70 to 104 F (21 to 40 C).
O	Oxygen	Almost all foodborne pathogens are aerobic, that is they require oxygen to grow. Some pathogens, such as Clostridium, are anaerobic and require no oxygen.
M	Moisture	Water is essential for the growth of foodborne pathogens; water activity (a_w) is a measure of the water available for use and is measured on a scale of 0 to 1.0. Foodborne pathogens grow best in foods that have (a_w) between 0.95 and 1.0. FDA regulations for canned foods require a_w of 0.85 or below.

Source: Texas Education Agency (2014 & 2015).

The acronym õFAT TOMö is often used to remind these conditions, namely, Food contaminants can be divided into three categories: Physical, Chemical, and Biological, Table 2.2 has differentiated these types of contaminants. Many researchers have written about food safety and argue that food safety will continue to arise in unpredictable ways, mainly due to changes in food production and supply system, including the availability of more imported food in the local markets. More progress is required to protect people and reduce foodborne illnesses in the world.

Table 2.2: Hazards of Biological, Chemical, and Physical Contaminants

SN	Types	Contamination hazards
1)	**Biological**	Pathogenic bacteria, e.g. *Escherichia coli* 0157:H7, *Salmonella* species, usually associated with faecal contamination mainly from warm-blooded animals. Others such pathogens include, *Listeria monocytogenes*, *Clostridium botulinum* commonly found in contaminated in soil, water, and ruminants
		Naturally occurring plant toxins, e.g. alkaloids, cyanogens glycosides
		Fungal, e.g. ergot, mycotoxins such as aflatoxins and ochratoxins
		Parasites, e.g. *Cyclospora*, *Entamoeba, Giardia, Cryptosporidium* Viruses, e.g. hepatitis A, Norwalk virus, Rotavirus Neurodegenerative disease e.g. prions which cause Bovine spongiform encephalopathy (BSE) or õmad cow diseaseö are prion diseases in cattle
2)	**Chemical**	Pesticide, insecticide and fungicide residues (international food law includes maximum residue levels for named compounds to be used on specific fruit and vegetables) Heavy metals, e.g. zinc, lead, aluminium, cadmium, and mercury Mineral oils, e.g. diesel, grease, hydraulic oil
3)	**Physical**	Glass, metal, stones; wood and twigs; pieces of bone and plastic Staple wire, hair, and dust

Source: Types of Food Contaminants Adapted from the Texas Education Agency (2014 & (2015).

Changes are required in the environments that cause and increase the number and range of foodborne outbreaks (CDC, 2013).New and emerging bacteria, toxins, and antibiotic resistance cause more disease outbreaks. This involves different types of antibiotic resistance. Contaminated food such as organic sprouts, powder and pre-packaged food have the potential to cause diarrhoeal diseases (Krueger *et al.*, 2014).

2.15 Research Gaps Identified

In Tanzania, there is a lack of updated data on the burden of foodborne diseases and convalescent carriersø status among street food vendors. Very few studies exist on the factors influencing compliances with the WHO five keys to safe food and hardly

any in the study area. To date, there is no National Food Policy, which encourages consultation and reference. Literature reviews of research conducted in Tanzania show that apart from the one by Mwamakamba *et al*., (2012) on being a tool for food safety and or for health promotion, there is no other available published data on similar studies conducted especially in Mbeya Region.

Even if research data was collected in Tanzania by foreign researchers or Tanzanian sponsored by abroad partner the results are often published in other countries. Furthermore, many studies seen in the literature review were limited in addressing cross-sectional issues and only a few were randomised controlled studies. Studies with similar objectives as of this study accessed in literature were of the short term i.e. 1-2 moths (Woldt & Moy, 2015).

The present study aimed to inform the public not only about the safety of street food but also about the health carrier status of the street food vendors to be aware of and the consumersø perception about the health hazards of street vended food including people to purchase street vended food. It was further cited that poor knowledge and practice of hygiene and lack of basic sanitary facilities/infrastructures in food service stalls, and/or negligence in safe food handling practices are major causes of poor sanitary conditions existing in many food and drinking stall (KAP). In addition, the study indicates the type of pathogens in stools, food samples, and their severity as health hazards. The study explored the gaps in existing data about the true burden of foodborne diseases taking the study area as a base for the whole picture at the national level.

2.16 Conceptual Framework of the Study

Street food vendors were found with good and some with bad hygienic practices. Some of these factors include how the persons maintain personal hygiene including environmental hygiene. The health status of the vendors could affect their hygienic conditions. Other important factors that may influence hygienic practices among food vendors are the extent to which the vendors practice hand washing and the use of Personal Protective Equipment (PPE) for personal health. Others are food status testing equipment such as food thermometers, appropriateness of work attires including wearing jewellery all in consideration to prevent the spread of foodborne diseases.

Additional factors to these are food safety, within the settlement, inadequacy of sanitation facilities, overflowing of sewage during rainy seasons, infestations with pests, non-access to clean and safe water, the potential of contamination by livestock, and rapid food spoilage. These factors are compounded by illegal occupation or encroachments of public or private spaces, and/or social problems such as child labour, and unfair competition in the formal trade.

Governances Authorities, for street food vendorsø management and pertaining social services available to street food vendors help to share food hygiene messages conveyed through the various mass media. The framework in Figure 2.8 demonstrates not only the relationship but also the important elements of clients in relation to the domains of the street food industry.

The duration a person has worked as a vendor, his or her attended training programs or exposures do influence their hygienic practices as food vendors (Addison, 2015).

In one extreme, consumers could be great in changing the vendors' behaviours about potential food contamination ensuring food safety for health (Barro *et al.*, 2007). Consumers who are attracted by the convenience and low prices may be influenced to overlook other aspects of hygiene, sanitation and even the appropriateness of existing health practices and the potential for possible foodborne illnesses awareness. The willingness to pay for street food safety in developing countries is still low (Alimi & Workneh, 2016). The framework of this study expressed Knowledge, Attitude, and Practice (KAP), observation, microbial analysis study and summary, and the study findings, and recommend actions for immediate and future actions.
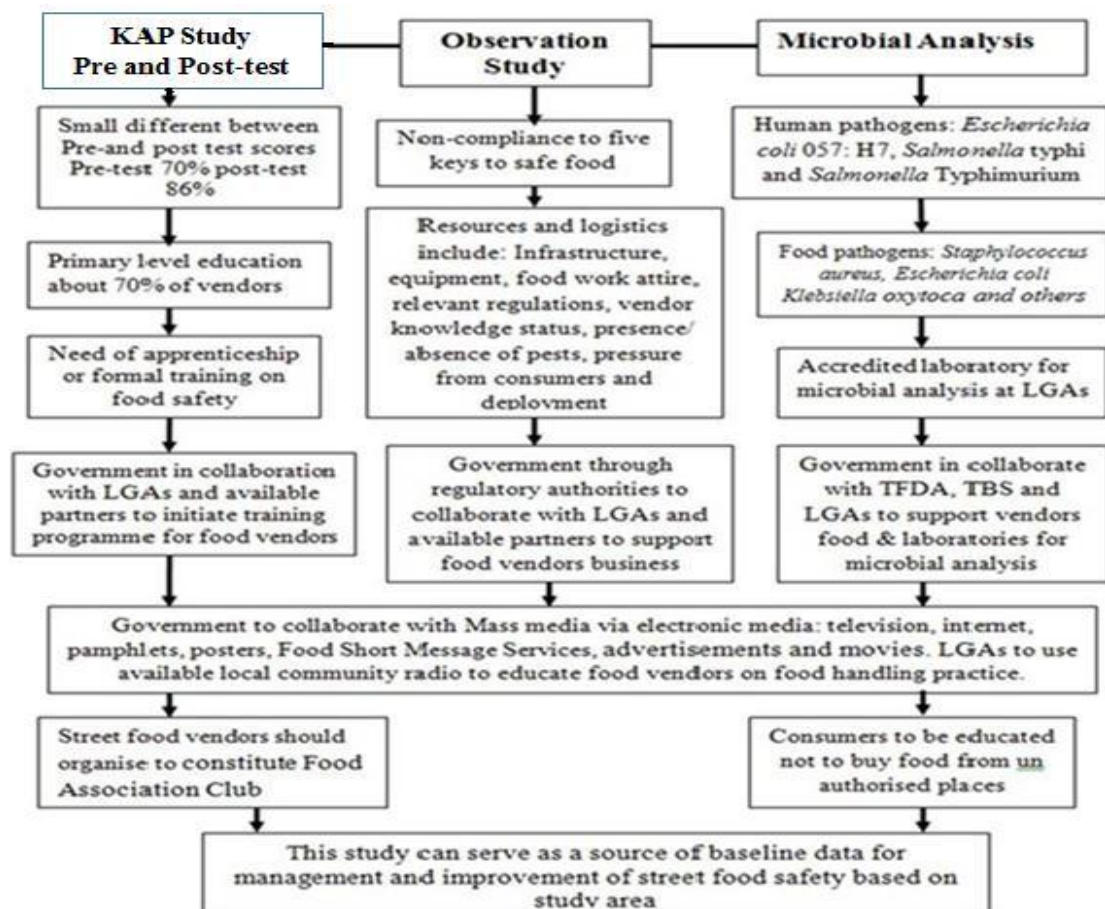
Figure 2.1 Conceptual Frameworks Of Street Food Vendors

Source: Authors surveyed in Mbeya 2014

The study places street food problems central to Local Government Authority and campaigns for collaborating partners in health to intervene and redress the ill situation. It further guides street food vendors and consumers for appropriate action. As far as the theoretical framework is concerned, Government Authorities have due responsibility to protect consumersø rights, while the critical responsibility of food safety rests on food handlers (Lin & Yamao, 2014).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides the methods, procedure, and tools applied in the study, including study design, geographical location and demographic data of the study area, research strategies, and methodology, sample size, sampling procedures, and research design. Details are also provided on the content of the structured questionnaires, translation version, ethical considerations, validity and reliability of data and data analysis and research constraints.

3.2 Study Area

The Mbeya District Council governs Mbeya City, where the study was conducted. The City is located at latitudes $8^{o}50$ and $8^{o}57$ south of the equator and longitudes $33^{o}30$ and $35^{o}35$ East of Greenwich. It has a ground area of 214 square kilometres. Geographically The Mbeya City Council as in Figure 3.5 governed by Mbeya District Council. Administratively, Mbeya City Council is divided into two divisions namely: Sisimba and Iyunga. Sisimba has 15 wards and Iyunga has 21 wards. Thus, the City comprises of 36 wards with 181 streets. Mbeya city has a total population of approximately 0.5 million people projected from the 2012 census (The United Republic of Tanzania, 2018). The population occupies an area of 214 square kilometres leading to the density of more than 2050 inhabitants per square kilometres. This congestion distress at life earning struggles for the available resources.
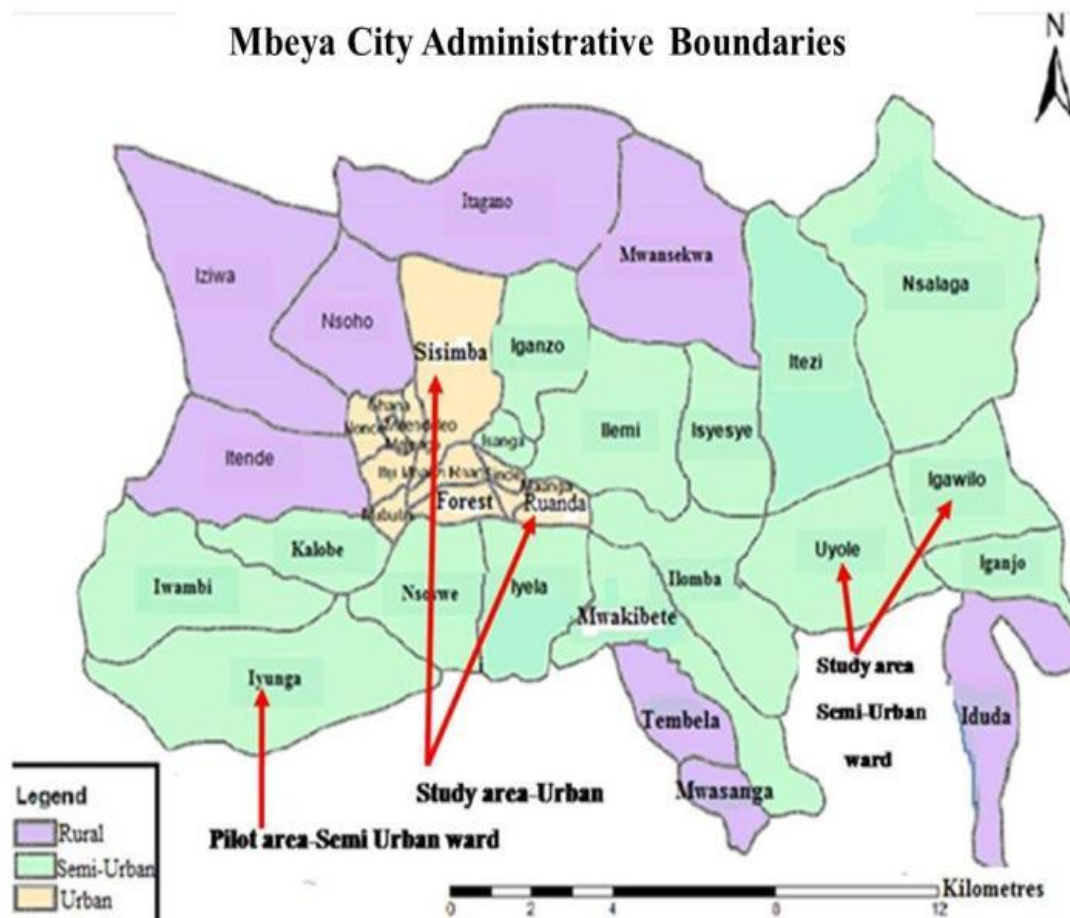
Figure 3.1: Map of Mbeya City and Location of the Study Areas
Source: GIS Mbeya City Office (2016)

Mbeya City was purposively selected for the study because not only of its location, mixed cultural norms, practices and a full range of economic activities but also because of the people's shift from rural to urban areas in search of better opportunities for livelihood. Such rural and the urban influx has caused a high human to accompany per square kilometre bringing people with different social background, and involvement in the informal business sector including street food vending such business is more profitable at Such business is profitable at the crossroads to Zambia and Malawi.

It is also encouraged by the centrality of Mbeya about the countries of Malawi, Zambia and Eastern Congo. The City is highly populated due to the inward movement of different people from rural areas as well as from and outside the region. The people engage in street food vending, petty business, hawking and others. In the study, four wards were selected as observed in Figure 3.1, two from urban and another peri-urban with a range of barriers and/or deficiencies in safe water supply, and variation between suppliers and end-users of food.

The features of urban and peri-urban/rural settings differ in terms of their cultural, demographic and socio-economic characteristics as well as the distribution of limited resources and infrastructures. Although the people of Mbeya City use similar resources, food-handling practices and the resources of water supply differ from the City centres into peri-urban areas. Food handling and health compliance practices are, therefore, subject to variations. It was this variation, which triggered the study to draw samples from both urban and peri-urban groups of people.

3.3 Demographic Structure of Mbeya-Region

The Mbeya Region, like other regions in Tanzania, has a total population dependency ratio of 89% (IOM 2008; PRB, 2012; UN, 2013 & UN, 2015). This describes the proportions of dependents per 100 working-age people in terms of the ratio of people who are generally not engaged in the production work and are under 15 years and those above 64 years (UN, 2015). The changes in the dependency ratio offer suggest of potential social support required resulting from changes in the people's age structures. Decreases in fertility levels reduce the dependency ratio for the reason that the percentage of youths is reduced while the proportion of the people

of working age rises. Beard *et al.* (2011) point out that when families have fewer children, the older-age share of the population naturally increases.

The dependency ratio comprises the percentage of children and adolescents 0-14 years old and above 15-64 years. This indicates that the entire dependency ratio is high with very few people engaged in production. A high adolescence dependency portion as observed in Table 3.1 & Figure 3.2 points out that larger savings are required for supporting the provision of social services for the family. Given that condition, diarrhoeal diseases are influenced by a socio-economic, living condition such as population growth rate, density, and sanitary conveniences, of which some settings have forecasting to undertake a major risk of diseases due to its population size and growth rate (Badu, 2013). Existing data reveals that the dependency ratio of Mbeya residents has continued to improve over the years.

The total dependency ratio in 1967 was 104%. This slightly dropped to 101% in 1978, 96% in 1988, 90% in 2002, 89% in 2012 and 2016, respectively (Figure 3.4). The national average dependency ratio by 2012 was 92% compared to the world average dependency ratio of 52% as per the International Organization for Migration (IOM) 2008 & UN, 2015).

Table 3.1: Local and International Averages of Dependency Ratios

SN	Place	Total dependency ratio (%)	Youth dependency ratio (%)	Elderly dependency ratio (%)	Potential support ratio (%)
1	Mbeya	89	85	8	8
2	Tanzania	92	66	6	16
3	World	52	40	13	8

Source: Adapted from (IOM 2008; PRB, 2012; UN, 2013 & UN, 2015)

The drop in the number of dependents against breadwinners is a positive sign of development. This is because most of the people are in the working-age group with the assumption that they work to earn a living. According to Table 3.2, & Figure 3.3 there is fast population growth and/or a demographic move towards a greater ageing cohort. Improved health of the population is likely to shift the cohort of the 0-14 years old to the higher age of 60 years and above hence increasing the cost of health care for old people who are not significantly productive (Newell *et al.*, 2010).

Table 3.2: Formula for Productive Population and Labour Force Against Non-Labour

Total Dependency ratio $\dfrac{\text{(Number of people aged 0-14 and those aged 65+)}}{\text{Number of people aged 15-64}} \times 100$

Child dependency ratio $\dfrac{\text{(Number of people aged 0-14}}{\text{Number of people aged 15-64}} \times 100$

Aged dependency ratio $\dfrac{\text{(Number of people aged 65 and over)}}{\text{Number of people aged 15-64}} \times 100$

Source: (IOM, 2008**)**

The population pyramid of Mbeya City is portrayed in Figure 3.2. The figure shows the age profile of the inhabitants with a clear domination of young people. This type of population structure demonstrates the potentials of high fertility with a broad base of children at the bottom of the population pyramid. According to IOM (2008), the active age starts at 15 to 64 years. Nevertheless, in the study area, the active working-age was predominantly a person aged 18 years.

Mbeya City has a high-population-density and a comparatively higher-level scarcity of resources implying the exhaustion of land to provide enough food, water, and social services including roads for the growing and healthier population. Street food vendors in Mbeya City are engaged in selling food at markets, garages, construction sites, offices, shops, industries, minor works, and roadsides.
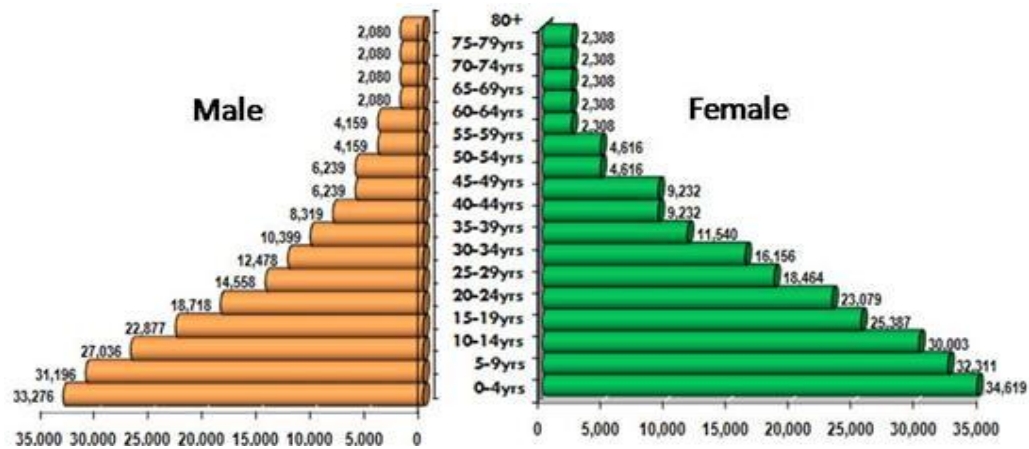
Figure 3.2: Pyramidal Age Structure of Mbeya City Population
Source: Data anticipated from Census 2012 to 2016 for (This Study, 2019

Mbeya region lies between latitude 7º and 9º 31ø south of the Equator and between longitude 32º and 35º East of Greenwich. Currently, the Mbeya region, shares borders with Malawi. Todate, the region has seven Councils: Mbarali, Chunya, Rungwe, Kyela, Busokelo, Mbeya Council and Mbeya City Council. Mbeya region was originally part of the colonial Southern Highlands Province with Mbeya as the capital established by the British in 1927 as seen in Figure 3.3.

According to the framework developed and presented in chapter two and the aims of the study as stated in chapter one, the research method comprised two approaches namely: qualitative and quantitative. Data collection techniques included questionnaires, direct in-place observations using a checklist, and documentary reviews to triangulate the facts. Open and closed questionnaires and observation checklists were targeted to the studyøs objectives. These questionnaires were the fundamental tool used to collect data on food handling practices behaviours and other health information about street food vending.
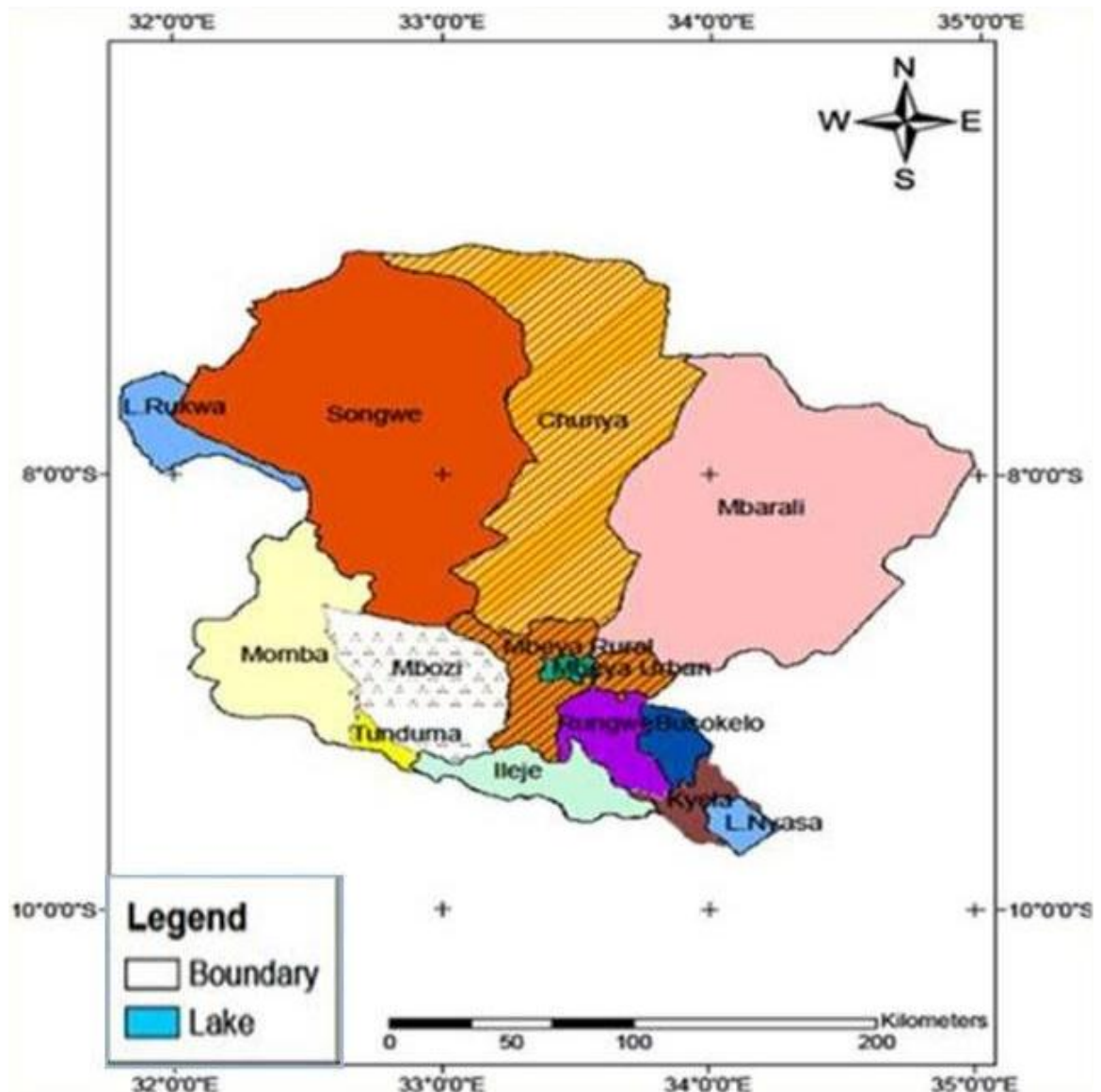
Figure 3.3: Mbeya Region with its 11 Councils, before July 2016

Source: Map modified from GIS Mbeya City Office (2016)

3.4 Study Methodology

The õClosed-ended questionsö had a special purpose including assisting the investigator in harmonising questions to gather consistent data from particular vendors while õopen-ended questionsö aimed to focus on the actual practices of street food selling in Mbeya City. At the respondentsø vending places the researcher used checklist observation checklists to observe the vendors operating in their actual

situations and administered the appropriate questionnaire. Descriptive statistics and thematic analysis were used to present the research results and findings.

3.5 Research Design

The study deployed a cross-Sectional study design of matched cases with due pre-testing and post-testing of the research tool. The design was used due to the nature of the study, which included ready for both qualitative and quantitative data. The design employed was purposive where participants were selected using a simple random sampling technique based on and response to the study location.

Quantitative, qualitative and observation study methods were used to cover part one research question by conducting interviews using a semi-structured and observation questions. The second part covered multiple, true or false and Likert scale questions administered at two-time points. These questionnaires were administered to 96 respondents are one time covered 100% as a pre-test and 75 (78%) post-test a second time. A simple two-group comparison case was used to establish the controlling factors to the people's non-conformity with five keys to safe food. The five keys to safe food were each analysed under Knowledge, Attitude, and Practices depending on their scores.

3.6 Sample Size

The target population for this study was all food sellers vending ready to eat food and snacks during the day in the streets and other communal places but excluding such activities conducted in guesthouses in Mbeya City urban and peri-urban selected wards. The population of street food vendors in Sisimba, Ruanda, Igawilo,

and Uyole comprised 125 vendors. The sample size of the street food vendors was attained with the support of the published table Appendix 3.4 and calculation using the formula for sample size all adopted from Singh and Masuku, (2014). A simplified formula to calculate sample sizes.

This formula was used to calculate the sample size at 95% confidence level and P =0.05 are assumed where:

n= is the calculated sample size.

N= is the population size, 125 street food vendor existing in the selected four

wards.

e= is the level of precision P=0.05.

$$n = \frac{N}{1+N(e)^2} = \frac{125}{1+125(0.05)^2} = 95.3 \approx 96 \text{ Street food vendors}$$

From the calculation above a sample size of 96 food vendors were obtained and from four wards before random selected in each ward based on the 95% confidence level with ±5% precision. The same sample was also obtained from the published table given in Appendix 3.4 of Singh and Masuku, (2014) based on the number of street food sellers existing in four wards.

3.7 Sampling Procedures

In the drawing, the sample of 96 street food vendors from Mbeya City the respondents was stratified by location. Mbeya City has two divisions: Iyunga 21 and Sisimba 15 wards all summed to 36 wards, which were grouped into two strata. The wards were those within urban and those in peri-urban features. The wards were

assigned to two divisions, urban and peri-urban wards with a high and low proportion of street food vendors.

Two wards were randomly selected from each stratum. Two urban wards with a high proportion of street food vendors (Sisimba and Iyunga) and two peri-urban wards with a low proportion of street food vendors Uyole and Igawilo. In the random selection of the two wards from urban and peri-urban, the names of the wards were written on pieces of paper then the papers were folded and shaken in a container. After that, a paper was handpicked. The container was re-shaken and a further paper was picked.

The process was repeated for all four wards urban and peri-urban in each of the wards 96 street food vendors were randomly selected to be interviewed. Accordingly, the design, Involved experimental (48) and control (48) groups equal in the number of respondents in both urban and peri-urban areas that means, 24 respondents from Ruanda and Sisimba urban wards made-up (48) respondents and the same equal number from Uyole and Igawilo peri-urban respondents 24 made up (48) respondents. The respondents were informed about the study and were given the option to participate or not to participate in the study.

The investigator interviewed and collected data and samples from 24 street food sellers in each ward. Consequently, the sampling approach showed a stratified sampling strategy. This approach assumed that the environments of the different wards, when mixed urban and peri-urban, would provide a common street vending atmosphere that would be representative of the urban and rural.

3.8 Data Collection Instruments

The questionnaires sought to collect Socio-demographic data on the cross-section of street food vendorsø population. This aimed at determining the -education level of street food vendors, their sex, gender, ethnicity, and operating location whether urban or peri-urban and income and/or capital investment in the business. Data collection also included surveillance of physical participants, their working environment, equipment infrastructure/food stalls, sanitation including solid and liquid waste management, safe water storage, in business areas, childrenøs relatives, types of vended cuisines, customersødemands.The questionnaires were also translated into Kiswahili, the National language for the respondentsø easy understanding Appendixes (2.1 & 2.2).

The closed questions encompassed the Thurstone and Likert scales (Trochim, 2006; James & Perla, 2007; Boshoff, 2007; Dawes, Alvin & Ronald, 2008; Chang, 2009 & 2011).Data collected focused primarily on food management, ecological and personal cleanliness, and jeopardy factors of faecal-oral spread. Sanitation of the sellersø environment and their physical cleanliness and fitness were assessed, while ecological cleanliness was measured in terms of hygiene of the food surroundings including the efficiency of processes and belongings in general (Carifio & Perla (2007) adopted from (WHO, 2006b). The experimental group was coached on food management using the WHO five keys of safe food preparation.

The street food sellers in the experimental group were trained on sundry food management including the full planned span. The national language (Kiswahili) which is much more understood by street food vendors was applied. After the

training programme was completed, the second set of measurements followed within six months. This included structural and observational questionnaires for both the experimental group that had received the training and the control group comprising those who did not receive the training. The designed path stipulated four stages. This was meant to appraise the quality of hygienic practices of the street food vendors in Mbeya City. This stage ended with questionnaire development and observation of ethical issues as portrayed in Figure 3.1.Step three encompassed the basis and effect link of the variables that influence the types of information collected and analysis undertaken for data validity and reliability. Stage four dealt with data interpretation using various tools of analyses as observed in Figure 3.4.

Figure 3.4: Designed Path Stages Model for the Study Adapted from (Alsolaiman, 2014)

The questionnaires were formulated in line with the findings from the different literature. The researcher brainstormed for the various questionnaire items to match the aims of the study. In principle, it was crucial to digest the content of each question for effective formulations and completion of the questionnaires. The development of the questionnaires and items checklists went through various stages including screening for clear language, matching research aims, trial interviewing and observations. A clear understanding of the questionnaires was important hence, they were printed in two languages English and Kiswahili. The questionnaire had 100 items apportioned into three parts. Part one had eight items, which aimed to capture respondentsø basic data. Such as part two contained 41 items to establish the Knowledge, Attitude, and Practices and compliance of the food vendors to five keys to safe food.

Part three had 51 items designed to establish whether the street food vendorsø practices influenced non-compliance with the five keys to safe food. In this study, each of the questionnaires included three sections. Section one delved on the demographic outline of the street food vendors, section two analysed the KAP of the street food sellers of five keys to safe food.

Furthermore, the third section investigated by observation, on how street food vendors handle food in their natural environs. It aimed to record the hygiene practices for each WHO five keys and cultural factors. The questionnaires were circulated to colleagues with a request for them to check them for clarity and content validity. Revisions were made by including the colleaguesø recommendations and hence the final questionnaires were presented in Appendixes 2.1 & 2.2.

The questionnaire structure was compiled by, among others with Likert scale, checklist and coding guides. The notion was to capture information about a full range of street food vendors and their compliance with the five keys to safe food. The rationale that a questionnaire normally transforms diverse languages of similar questions was asked to all the respondents in spite of the language used. This aimed to assess the uniformity, precision, and/or perception that transverses all the questionnaire adaptations.

3.9 Ethical Reflections

The research clearance letter from the OUT was submitted to the National Institute for Medical Research (NIMR) for the relevant Research Clearance Certificate, which is a precondition for conducting medical research as shown in Appendixes 3.1 and 3.2. Together the two permits were submitted to Mbeya City Council where the research was conducted. Following these submissions, the Mbeya City Authority issued an introductory letter to Ward Executive Officers and who in turn introduced the researcher to the Street Executive Officers, and consequently to the Local Street Leadersø under which food vendors operate. The introduction letters were reflected in Appendix 3.3.

Pre-arrangements were made by the researcher in the preparation for entry into the street food setting in the study areas. The Ward Executive Officers were informed as well as the Street Executive Officers and Street Chairpersons of the respective wards about the aims of the study and the intention of researching the sites. All the goals were made clear to the various local leaders. The consent was sought from each

eligible and willing respondent. In extreme cases, adding to the oral consent, some respondents demanded to be provided with a written and signed consent. The participants were assured that their participation was voluntary and all information collected would be handled with the strictness stated in the consent form.

No rewards were given for participation and no penalties were incurred for not participating. Confidentiality and anonymity were observed throughout the study. Some of the respondents thought the researcher was a Health Inspector, a local council representative with food inspection rules and/or a member of the press. No vendor identified by name or sample was released as all data was treated confidentially and anonymously. Respondents were free to take part or to withdraw from the study in line with the structured consent form. All information collected was safeguarded, preceding entry to the street food setting approach and only the researcher had to obtain access to the collected data. The researcher carried out a pilot testing of the developed questionnaires. The data collection instruments were piloted at Iyunga ward Mbeya City. Iyunga is a nearby ward, a mixed urban and peri-urban Figure 3.4.

The advantage of this choice was that it represented both urban and peri-urban conditions. After the pilot testing, a deeper understanding of the questionnaire was achieved, and more light was shed on issues to be corrected and emphasised during research as well as throughout the questionnaires as in Appendices 2.1 & 2.2. The pilot involved 10 households in the natural settings and heads of households participated in the piloting to match up with the broader execution of the study. Corrections and all the necessary amendments were made in the questionnaires to

match those anticipated for the real study. Hence, the pilot testing acted as a control measure for the strength and consistency of the tool.

A plan of how and when data would be collected was prepared. During the research, informed oral and written consent was sought before the questionnaires were administered referred to Appendices 1.1 & 1.2. The participants in the study were informed about the aims of the research, and the use that would be made up of the findings. Respondentsø anonymity was guaranteed by using codes instead of names. All information collected during the research was treated with due confidentiality. Only the researcher had access to the collected data or information. The consent form as in Appendixes 1.1 & 1.2 observed and endorsed with the signature and date of both the participants and the investigator.

The consent provided written tips about the study guarantee for confidentiality, as well as the potential use of the findings. In the course of fieldwork, some of the respondents demanded to be given written consent about their participation while others proceeded to fill the questionnaires after consent. This flexibility in the fieldwork as intended to the participants in the research. The data collection had two categories of sources, primary and secondary sources. Primary data were obtained from field interviews and observations while the secondary data was obtained from reports and documents review. The information collected was primarily about food preparation; ecological and personal cleanliness of vendors; danger factors of faecal-oral spread. Other information included personal hygiene of vendors gauged by their neatness in terms of personal appearance and physical conditions.

Environmental sanitation was gauged on the assessment of the freshness of the food and the surroundings including the competence of handlers, tableware, and availability of health facilities such as for washing hands. In addition to personal and ecological hygiene, the study involved gathering information from the observation checklist. For primary data, a stool and food sample was collected from street food vendors who were willing to participate in the study. The food temperature was tested using food thermometers before the sample was taken.

Thereafter the food was packed into cold boxes and immediately transported to the Mbeya Zonal laboratory (Accredited level three) for the pathogenic test. The samples were sent to a laboratory to test for pathogenic organisms including; *Escherichia coli*, *Vibrio cholera*, and *Salmonella* spp. The Laboratory Scientist tested for protozoa and helminths as well as pathogenic organisms using BBL Crystal auto-reader machine at Mbeya Zonal Consultancy Laboratory Hospital. The data for pathogenic organisms were further processed under Biological Safety Level three (BSL3) cabinets. The Mbeya Zonal Laboratory has accredited Level III with International Organization for Standardization (ISO) 15189 version 2012 of 20th May 2014.The MacConkey agar and Sorbitol MacConkey (SMAC) agar supplemented with 4-methyl-umbelliferyl-D-glucuronide (MUG) for detection of *Escherichia coli* O157: H7 and Salmonella-Shigella agar culture was used for bacterial pathogens.

Biochemical reagents isolated organisms while the application of taxonomic analysis, involved reading was manual and automated using Bobbed Lethal (BBL) Crystal Auto-reader machine catalogue number 245 300 (Lo-Ten-Foe *et al.*, 2007;

Lim *et al.*, 2010 & BDTM, 2013). The specimens were examined microscopically for protozoa and helminths through direct saline wet preparation (Donkor *et al.*, 2009 & Acharya, 2015). The researcher prepared the procedure regarding how samples stored and what time the sample was sent for testing for pathogenic organisms in stool and food specimens at Mbeya Zonal Consultancy Hospital before the start of laboratory work. The pathogen isolates were identified by standard biochemical tests and by comparing their characteristics with those of known taxa, as described by Chessbrough, (2006); Oyeleke & Manga, (2008); Hawksworth, (2011); Lahr *et al.*, (2011); & Greuter *et al.*, (2012).

The researcher agreed with Lab Analysts that the BBL Crystal auto-reader be performed well and be used as an option to the optical analysis of the BBL Crystal response prototype in an experimental background.The main remunerates of this method are improved speed and the exclusion of biased human analysis of the readings. The BBL Crystal auto reader has been used as a counter to the microbiology laboratories for most health facility settings (Lo-Ten-Foe *et al.*, 2007). The BBL Crystal enteric/nonfermenter identification system (Becton Dickinson) is the method used for classifying gram-negative bacilli (Lo-Ten-Foe *et al.*, 2007).The BBL Crystal classification method is used for the identification of aerobic gram-negative microorganisms that go to the family of Enterobacteriaceae and some of them were more often isolated through glucose-fermenting and nonfermenting gram-negative bacilli.

The second phase of the study entailed at least two hours or so of training in which 48 participants in the experimental study group were invited to take part in the

training. There was no payment for the training, only soft drinks and fare were offered for those who attended the sessions. Four training sessions of 12 participants, two from the urban wards (Ruanda and Sisimba) and the other, two from peri-urban (Igawilo and Uyole) wards were conducted. The training of street food vendors was influenced by the time, distance from the training venue the nature and location of the street food vendors.

The food vendors were trained in food safety using the WHO five keys of safe food as a tool (Donkor *et al.*, 2009 & Andy *et al.*, 2015) the tool covers different issues including personal hygiene, sanitation, and food-borne illnesses, and their impact on informal sector economy. After the training, the food vendors were given the post-test and the data obtained were combined with those collected in the pre-test. The language of communication used at the training was Kiswahili that is spoken by all respondents. The results were collected during the training from the selected sellers about their food handling practices.

3.10 Data Analysis

In data analysis, quantitative and qualitative data collected through questionnaires supported by an observation checklist were combined, coded and quantified. The data were handled based on real-time-data-entry thus, edited, cleaned, entered and analysed using Statistical Package for Social Sciences SPSS version 20 and other included online VassarStats. Data were cleaned in SPSS by running frequencies and cross-tabulations. Preliminary frequencies were tracked to identify missing variables. Binary and multiple logistic regression analysis was conducted and results were presented in the next chapter four using Odds ratio with 95% confidence interval,

and P-value <0.05 was considered statistically significant.

The data was analysed and presented in numbers, frequency tables, pie and bar charts diagrams ratios, percentages, figures including illustrations. The presentation of pre-test, post-test, and loss-to-follow-up model in Figure 4.1 highlighted the way the respondents were counted in two-time point.

3.11 Validity and Reliability of the Study Data

Validity describes testability and repeated similar results in scientific research. A test or measure is valid if the inferences made from it are proper, meaningful and useful, in different situations. In this way, validity would conform to the lowest measures of dogmatic requires. Validity entails the grounds in which data is gauged and found to be suitable, useful and in this study, the case to make safe food. Reliability is a measure, which may be trustworthy although not valid, that is why data cannot be valid without being reliable. Reliability is compulsory, though, it may not necessarily be a satisfactory condition for validity. In eliminating bias, four wards out of the 36 were selected two wards from urban and another two from peri-urban. Each selected wards represents 24 respondents; 24 for control and another 24 respondents for experimental.

The strength of the study was purposeful in making sure that opportunity, preconceptions, any confusing factors are redressed during the study design, sampling, and information collected. The limitation of using the õYesö and õNoö questions responses may hinder the collection of more valid data and because of bias and possible unreliability of data. In addition, the questionnaires were tested

comprehensively and an interactive review process was undertaken to maximize content validity before the actual start. For more rapport between the interviewer and the interviewed, friendliness was ensured with the clear elaboration of the purpose of research.

This helped to reduce any suspicions that the researcher and the local leaders had a secret agenda that was harmful to the vendors and a threat to their businesses especially as related to extra taxation. On the other hand, the study involved both direct and indirect observations. The street food vendors were not informed about the observation being made of their operations but informed about the coming of researcher and these minimised doubts by their attitudes and support on street food vendorsøattitudes during the study. The researcher was fully involved from the stage of development of the questionnaires, piloting, and real fieldwork.

The researcher took part in administering the questionnaires, which had also been translated into Kiswahili. Colleagues at the office proofread the draft questions and due corrections were incorporated before piloted. The questionnaires used in the interviews were directly related to the objectives of the study. The study involved direct and indirect observations of the street food vendors. As there is no research without challenges, the researcher experienced some constraints during the study-included unavailability of some documents for documentary review. The postponement of interviewers and their rescheduling was due to social conditions such as funerals that differed from one case to another. Some respondents were sick or attending a member of the family in healthcare. Other constraints included time

limitation, cost and lack of some laboratory equipment, reagents and some were not ready at the time of interviews. These constraints resulted in a longer duration of fieldwork, missing some appointments, and training, as a result, increased costs of the research work.

CHAPTER FOUR

PRESENTATION OF RESULTS

4.1 Introduction

The results of the study are arranged under sub-titles by first presenting pre and post-test results in two graphs one showing how participants were sorted for pre-test, post-test, and loss to follow-up and the other being the training results including three tables for which their interpretations are presented in chapter five. The chapter also includes two tables of stool and food sample results followed by pie charts and tables displaying demographic data and socio-economic data that were obtained from the open and closed questionnaire results and the observation checklist data. Other important contributing factors including environmental and sanitation aspects distressing food safety practices that were observed in the field are also presented. A detailed discussion of the results and comparison with other research findings represented in chapter five.

4.2 Pre-Test, Post-Test, and Loss to Follow-Up

The approach highlighted the way the respondents were counted in two-time points as shown in Figure 4.1. The pre-test and post-test results were based on the five keys to safe food tool and were assessed under KAP as presented in Table 4.1ó4.3. In phase one, all 96 respondents were reached and interviewed in both urban and peri-urban 48 respondents each division and 24 respondents in each selected ward. In the second phase, only 75 (78%) respondents out of the 96 took part. Of all the respondents 36 or (75%) in the experimental group out of 48 and 39 (81%) of the control group were reached in the. second phase.

The Odds Ratio (OR) stands at 95% with a confidence limit of 1.30 (0.85-1.94) and P=0.30. It can, therefore, be concluded that those who participated in the post-test training were less in numbers compared to those who were not trained but participated in the post-test. On the other hand, this gives the impression that there is no association in the flow of participants OR= 0.92 (0.50-1.70) p=0.92 to the loss-to-follow-up respondents in post-test trained and untrained in phase two participation as the loss-to-follow was likely to have different reasons.
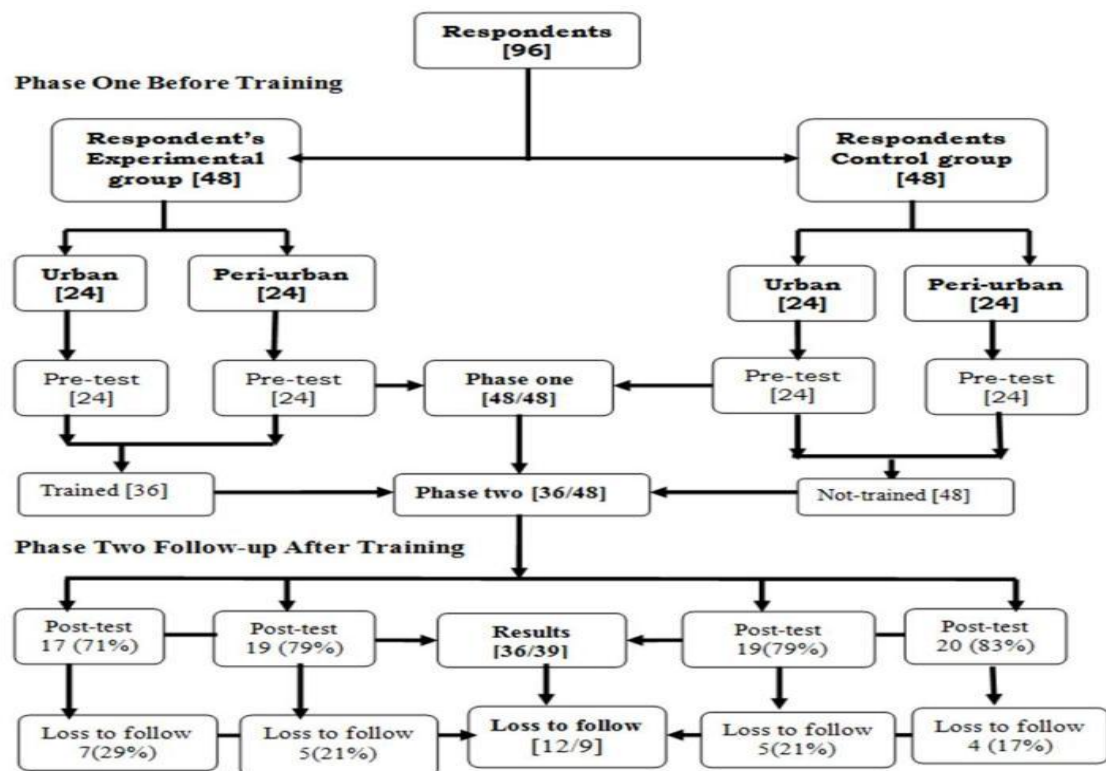
Figure 4.1: Approach of Pre-Test, Post-Test, and Loss to Follow-Up
Source: Based on the Author's formulation (This Study, 2019)

4.3 Results of Pre and Post-Test Training on WHO Five Keys to Safe Food

The street food vendors in the study area were given pre-test training about the five keys and were assessed under KAP. Namely keys: 1) "Keep Clean" personal hygiene means keeping healthy verified by reliable and reputable medical examination every six months, and ensuring that all surfaces coming in contact with food are adequately

sanitised. 2) õUse safe raw materials and waterö ensuring that the sources of food raw materials are sound, reliable and safe clean water is used and is convenient. 3) õCook food thoroughly,ö meaning food should be cooked until the critical temperature above 60°C reaches the critical centre of the food. 4) õAvoid cross-contaminationö which prohibits allowing cooked food to be contaminated by raw food in any possible way. 5) õKeep food at safe temperaturesö meaning that cooked food waiting to be served should be kept at or above the critical temperature and food consumed cold should be refrigerated immediately after tits preparation while left-overs food should be frozen preferably at -18°C or below.

Table 4.1: Comparison Case Scores of Street Vendors on Pre and Post-Test Training

N0=96 pre-test and post-test attempt after training N0= 36

SN	Keys	Pre-test %	Post-test %	Odd Ratio (95% CI)	P-Value
Knowledge		**57**	**84**	**1.47 (0.95-2.28)**	**0.08Ä**
1	Keeping clean	86	97	1.13 (0.76-1.69)	0.56Ä
2	Avoiding cross contamination	66	74	1.12 (0.73-1.73)	0.60Ä
3	Cooking food thoroughly	39	83	2.13 (1.33-3.41)	0.002**
4	Keeping food at safe temperatures	49	80	1. 63(1.04-2.56)	0.03*
5	Using safe water and raw materials	60	85	1.42 (0.92-2.18)	0.11Ä
Attitude		**79**	**92**	**1.16 (0.77-1.75)**	**0.47Ä**
1	Keeping clean	85	82	0.96 (0.64-1.46)	0.86Ä
2	Separate raw from cooked food	78	96	1.23 (0.82-1.85)	0.32Ä
3	Cook thoroughly	91	100	1.10 (0.74-1.63)	0.64Ä
4	Keeping food at safe temperatures	46	80	1.74 (1.10-2.75)	0.02*
5	Using safe water and raw materials	93	100	1.08 (0.72-1.60)	0.72
Practice		**75**	**83**	**1.11 (0.73-1.68)**	**0.63Ä**
1	Keeping clean	97	100	1.10 (0.72-1.60)	0.72Ä
2	Separate raw from cooked food	90	100	1.11 (0.75-1.65)	0.60Ä
3	Cooking thoroughly	57	100	1.06 (0.67-1.68)	0.82Ä
4	Keeping food at safe temperatures	37	86	2.32 (1.45-3.74)	0.0004***
5	Using safe water and raw materials	94	75	0.80 (0.53-1.20)	0.28
Average score		**70**	**86**	**1.23 (0.81-1.87)**	**0.34Ä**

Source: Authorø study (2019).

OR=Odd Ratio; CI=Confidence Interval, *=Significant at 0.05 (cut off point) chance ** =Significant at the 0.001 chance *** =Significant at the 0.0001 chance, Äns=non-significant at above 0. 05 chance level; Odd Ratio>1 positive association, Odd Ratio<1 negative association and Odd Ratio=1 neutral.

The outcomes of pre and post-test compared after the training were as detailed in Tables 4.1ó4.3. The Knowledge of street food vendors key 3) cooking food thoroughly had previously scores of 39% while the post-test scored 83% after training this score was statistically significant at OR= 2.13 (1.33-3.41) p<0.002. Also, the Knowledge of key 4) keeping food at a safe temperature at <5°C and >60°C increased significantly at OR= 1.63(1.04-2.56) p<0.03.

The Attitude of the respondents on key 4) keeping food at safe temperature increased from 46% to 80% after training this was statistically significant at OR= 1.74 (1.10-2.75) p<0.002. Furthermore, the Practice on key 4) keeping food at the safe temperature the scores further increased from 37% to 86% in the post-test and this was statistically significant at OR= 2.32 (1.45-3.74) p<0.0004. Keeping food at a safe temperature was very vital key for street food vendors in terms of their KAP as they were most likely well informed. In general, the training increased the KAP of the street food vendors across the fives keys from 70% to 86% on the average scores as observed in Table 4.1. This is revealed in the Theory of Reasoned Action that the knowledge of individual vendors predicted the attitude as normative perceptions determined behaviour towards compliance of five keys to safe food.

It can, therefore, be realised, that street food vendorsø economic gains matters more than the safety of the peoplesø health. If street food vendors are to attract more customers from the public, they first have to make sure that the food and the service standards are of high quality, putting peopleøs health first. The street food vendors lacked food safety training that is necessary for them to improve their hygienic standards in food vending. This is proof of weak follow-up and technical support of

the vendors by City Health Food Inspectors for effective compliance with the five keys to food safety.

Table 4.2 portrayed that pre and post-test training for untrained food vendors as they increased their KAP slightly as compared to trained food vendors. Under the Knowledge key 2) separate raw from cooked food scores decreased from 66% to 41% post-test significantly at OR= 1.61 (1.00-2.06) p>0.05 as well as in Attitude key 2) the scores decreased from 78% to 49 % post-test significantly at OR= 1.59 (1.01-2.50) p>0.04. Contrary-wise, these two keys showed that the pre and post-test exposure did decrease awareness of the individual food vendors showing that in the key number two for both Knowledge and Attitude there was substantially no association between pre and post-test for untrained food vendors. In addition, Knowledge on key 3) cooking food thoroughly increased from 39% to 72% significant at OR=1.85 (1.14-2.98) p<0.01. Practice on key 5) using safe water and raw materials increased from 37 % to 78% significant at OR=2.11 (1.31-3.41) p<0.002.

On average scores Attitude partially changed between pre and post-test scores at OR= 1.01 (0.67-1.54) p=1. The results suggest that there is no difference between pre and post-test exposure among the untrained group. This finding is reflected in the Theory of Planned Behaviour that the individual perceived control promoting practicing behaviour among the un-trained food vendors across five keys in the study area. It further anticipates that those vendors with adequate, formal post-primary education and given incentives can easily cope with better practices than the majority.

Table 4.2: Comparison of Cases of Untrained Street Vendors on Pre-Test and Post-Test

N0=96

SN	Keys	Pre-test %	Post-test %	Odd Ratio (95% CI)	P-Value
Knowledge		**57**	**78**	**1.37 (0.88-2.12)**	**0.16Ä**
1	Keeping clean	86	93	1.08 (0.72-1.62)	0.71Ä
2	Separating raw from cooked food	66	41	1.61 (1.00-2.06)	0.05*
3	Cooking thoroughly	39	72	1.85 (1.14-2.98)	0.01*
4	Keeping food at safe temperatures	49	72	1.47 (0.93-2.32)	0.98Ä
5	Using safe water and raw materials	60	95	1.58 (1.03-2.42)	0.03*
Attitude		**79**	**78**	**1.01 (0.67-1.54)**	**1.00Ä**
1	Keeping clean	85	84	1.01 (0.67-1.52)	1.00Ä
2	Separating raw from cooked food	78	49	1.59 (1.01-2.50)	0.04*
3	Cooking thoroughly	91	96	1.33 (0.83-2.13)	0.24Ä
4	Keeping food at safe temperatures	46	61	1.33 (0.83-2.13)	0.24Ä
5	Using safe water and raw materials	93	98	1.10 (0.71-1.57)	0.79Ä
Practice		**75**	**81**	**1.08 (0.71-1.64)**	**0.72Ä**
1	Keeping clean	97	95	1.02 (0.69-1.52)	0.92Ä
2	Separating raw from cooked food	90	92	1.02 (0.68-1.53)	0.92Ä
3	Cooking thoroughly	57	57	1.00 (0.63-1.58)	1.00Ä
4	Keeping food at safe temperatures	37	78	2.11 (1.31-3.41)	0.002**
5	Using safe water and raw materials	94	84	0.89 (0.60-1.34)	0.58Ä
Average scores		**70**	**79**	**1.13 (0.74-1.73)**	**0.58Ä**

Source: Author's study (2019).

CI= Confidence Interval; *=Significant at 0.05 (cut off point) chance; **=Significant at the 0.001 chance=***=Significant at 0.0001 chance=Äns=non-significant at above 0.05 chance level; Odd Ratio>1 positive association, Odd Ratio<1 negative association and Odd Ratio=1 neutral.

Table 4.3: Comparison case Scores for Trained and Untrained Street Food Vendors

N0=36 trained N0=39 not trained both attempt post-test

SN	Keys	Trained %	Untrained %	Odd Ratio (95% CI)	P-Value
Knowledge		**84**	**78**	**0.93 (0.61-1.41)**	**0.73Ä**
1	Keeping clean	97	93	0.96 (0.64-1.43)	0.84Ä
2	Separating raw cooked food	74	41	0.55 (0.35-0.89)	0.01*
3	Cooking thoroughly	83	72	0.87 (0.57-1.32)	0.51Ä
4	Keeping food at safe temperatures	80	72	0.90 (0.60-1.37)	0.62Ä
5	Using safe water and raw materials	85	95	1.12 (0.75-1.67)	0.59Ä
Attitude		**92**	**78**	**0.85 (0.56-1.28)**	**0.43Ä**
1	Keeping clean	82	84	1.02 (0.68-1.55)	0.92Ä
2	Separating raw from cooked food	96	49	0.48 (0.31-0.75)	0.001**
3	Cooking thoroughly	100	96	0.98 (0.66-1.45)	0.92Ä
4	Keeping food at safe temperatures	80	61	0.76 (0.49-1.18)	0.22Ä
5	Using safe water and raw materials	100	98	0.98 (0.66-1.45)	0.92Ä
Practice		**83**	**81**	**0.98 (0.65-1.47)**	**0.92Ä**
1	Keeping clean	100	95	0.95 (0.64-1.41)	0.81Ä
2	Separating raw from cooked food	100	92	0.92 (0.62-1.37)	0.68Ä
3	Cooking thoroughly	100	57	0.57 (0.57-0.87)	0.01*
4	Keeping food at safe temperatures	86	78	0.91 (0.60-1.37)	0.65Ä
5	Using safe water and raw materials	75	84	1.12 (0.74-1.70)	0.60Ä
Average scores		**86**	**79**	**0.92 (0.61-1.39)**	**0.69**

Source: Authorøs study (2019).

OR=Odd Ratio; CI= Confidence Interval; *=Significant at 0.05(cut off point) chance; ** =Significant at the 0.001 chance=*** =Significant at 0.0001 chance=Äns= non-significant at above 0.05 chance level; Odd Ratio>1 positive association, Odd Ratio<1 negative association and Odd Ratio=1 neutral.

Table 4.3 showed the comparison case of trained and untrained food vendors both of whom attended pre and post-test. Key 2) under Knowledge was statistically significant at OR= 0.55 (0.35-0.89) p= 0.01. The untrained scored less by 45% compared to the trained street food vendors. Under Attitude key 2) separating raw from cooked food the untrained scored less by 49% almost 50% compared to the trained food vendors the different is highly significant at OR=0.48 (0.31-0.75)

p=0.001.In the Practice key 3) cooking food thoroughly the untrained also scored less by 43% compared to the trained street food vendors the difference is statistically significant at OR= 0.57 (0.57-0.87) p= 0.01. Although the difference in other keys was not significant, it was enough to suggest that training was absolute in all stances, as it is shown in this study that exposure only increases the KAP. There was a slight difference in the overall five keys across KAP between trained and untrained food vendors as observed in Table 4.3.

4.4 Pathogens Isolated From Stool Specimens in the Study area

The results showed in Table 4.4 reflected foodborne disease pathogen carrier status from the stool specimens collected from the street food vendors from four wards. Table 4.2 showed that 25 stool specimens were drawn from the four wards namely: Ruanda, Sisimba, Uyole, and Igawilo. Only five and specifically those drawn from Ruanda and Sisimba ward were contaminated with foodborne disease pathogens often implicated in diarrhoeal diseases. The pathogens isolated include *Escherichia coli* O157: H7, *Escherichia coli, Salmonella* Typhi and *Salmonella* Typhimurium. These were among the top ten least wanted foodborne diseases in food and they are known to have fatal consequences for consumers.

Table 4.4 Pathogens Isolated in Collected Stool Specimen

SN	Ward	Isolated Pathogen
$A_1 14$	Ruanda	*Escherichia coli* 0157: H7
A_1-17	Ruanda	*Escherichia coli*
A_1-03	Ruanda	*Salmonella* Typhi*
$A_1.16$	Ruanda	*Salmonella* Typhimurium
$B_2.16$	Sisimba	*Salmonella* Typhi*

Source: formulated by Researcher of this Study, (2019).
Note: i)   Reading machine made by BBL-Crystal Auto-reader: cat. No. 245300 (BDTM, 2013).
        ii)   * Similar pathogen in different stool specimen samples
        iii)   Isolates were taxonomically annotated

The results in Table 4.4 justify that the health carrier status of food vendors in the study area stood at 20%. Thus, the street food vendors were asymptomatically capable of transmitting foodborne diseases even though they do not show any symptoms of diseases. These included two isolates of *Salmonella* Typhi, one isolate of *Escherichia coli* 0157: H7, one isolate of *Escherichia coli* spp, and one isolate of *Salmonella* Typhimurium. The most common pathogens among the isolates were *Salmonella* sppat 60% i.e. three-fifth of all isolates. The disease carrier status of street food vendors in Ruanda ward and the widespread confirmation of food contamination with microbial pathogens in the study area show that there was a potential risk for diarrhoeal disease outbreaks in Mbeya City and particularly in the Ruanda ward.

4.5 Pathogens Isolated in Collected food Samples in the Study Area

Of the 78 various food samples collected 21 (27%) had pathogens that can cause foodborne diseases as shown in Table 4.4). *Bacillus cereus* was isolated in a sample of cooked maize mixed with beans. *Enterobacter cloacae* were isolated in one cooked liver sample. Two pathogens *Acinetobacter baumannii* and *Acinetobacter haemolyticus* were found in cooked beans while *Bacillus megaterium* and *Lactococcus raffinolactis* were found in a stiff porridge sample. Of all isolates, only pathogens were isolated. Pathogens like viruses, protozoa, and helminths, which are the common causes of diarrhoeal diseases, were not isolated from samples in the study area. *Escherichia coli*, *Salmonella* spp, and *Escherichia coli* 0157: H7, *Staphylococcus aureus*, and *Enterobacter cloacae* are potential sources of foodborne hazards with grave consequences.

The frequency of occurrence of isolated pathogens in food suggests that consumers in Mbeya City were exposed to a high risk of contracting diarrhoeal diseases through the consumption of street food. Of the suggestions made was to educate the consumers not to purchase street food that was sold in unauthorized places and not to rely on convenience or low prices of the food. The analysis of microbial data in both Table 4.4& 4.5suggest that non-compliance among food vendors to the five keys to safe food revealed the significant risk of diarrhoeal diseases.

Table 4.5: Pathogens Isolated in Collected Food Samples

Sample code	Ward	Food types	Isolated pathogen
A$_2$-12	Ruanda	Cooked liver	*Enterobactercloacae*
B$_2$-04	Sisimba	Cooked beans	*Acinetobacter baumannii* and *Acinetobacterhaemolyticus*
B$_2$-04	Sisimba	Stiff porridge (Ugali)	*Bacillus megaterium* and *Lactococcus raffinolactis*
B$_2$-07	Sisimba	Chicken fried	*Staphylococcus intermedius*
B$_2$-23	Sisimba	Cooked maize with beans	*Bacillus cereus*
C$_2$-10	Uyole	Cooked rice	*Escherichia coli*
C$_2$-06	Uyole	Pickles (raw vegetable mixed)	*Escherichia coli*
B$_2$-16	Sisimba	Mandazi (African buns)	*Enterobacterasburiae*
B$_2$-15	Sisimba	Porridge	*Escherichia coli*
D$_2$-11	Igawilo	Cooked pork soup	*Klebsiella oxytoca*
C2-17	Uyole	Sour milk	*Hasnia alivei*
A$_2$-02	Ruanda	Rice	*Escherichia coli*
A$_2$-10	Ruanda	Pickles (raw vegetable mixed)	*Enterococcus faecium*
A$_2$-25	Ruanda	Chips	*Klebsiella pneumoniae*
A$_2$-22	Ruanda	Sardines	*Staphylococcus aureus**
A$_2$-27	Ruanda	Sour milk	Yeast cells
C$_2$-20	Uyole	Rice	*Staphylococcus aureus**
C$_2$-16	Uyole	Juice	*Enterobacter aerogenes*
A$_2$-19	Ruanda	Meat/fish	*Corynebacterium bovis*

Source: Formulated by (This Study, 2019).

Note: i) Reading machine made by BBL-Crystal Auto reader: cat. no. 245300 (BD^{TM}, 2013)

ii)* Similar pathogen in different type of food samples

iii) Isolates were taxonomically annotated

4.6 Other Factors Contributing to the Prevalence of Diarrhoeal Diseases

From the data in Table 4.6, it can be deduced that only 27% of the vendors in the study area had a secondary level of education and above. The 27% could effectively translate the five keys to safe food into positive Knowledge, Attitude and Practices. That was why the expected change after training on awareness and necessity to comply with the keys to safe food remained minimal. This was the fact that the more time between behavioural intent and doing the behaviour, the less likely the behavioural change will happen. Hence, the Integrated Behavioural Model (IBM) assumes that people were rational and made systematic decisions based on available gen and ignores unconscious the drives such as the socio-economic factors include health, employment, education, and income were also related to economic factors that influenced behaviour of one another.

The results suggest that the dressmaking of studies can only be done up to a basic minimum level. It is a fact that scientific issues cannot be correctly interpreted and put into action by persons without adequate capacity to appreciate what has been taught in respect to food safety. According to other findings, there were many other factors associated with food handling practices.

In the Tanzania education system, the curriculum for Biology (Microbiology), Chemistry and Physics carry elements of food safety. Thus, in the Tanzanian context, the minimum education level towards which food vending training should have targeted would probably best be a secondary school where biology, physics, and chemistry as part of the curriculum taught. For example, those with secondary school education and above can best appreciate microbiological multiplication in

food influenced by time and temperature.

It is, recommended that the WHO Global Five Keys to Safe Food tool should be issued with instructions that all basic related knowledge on food hygiene and safety should be a pre-requisite for effective application of the WHO five keys to safe food tool. Even tailored training requires specific basics, the lack of which creates a health risk for the people. Education plays a vital role in one's hygiene and the higher the education acquired by a person, the higher is the person's level of personal hygiene (Quiliope & Teves (2016). Lack of such training has been observed as a gap in the five keys guide leading to non-compliance by vendors. Table 4.5 showed that the majority of street food handlers were women 73(76%) out of 96 this is significant at p=<0.0001. It is therefore supported the assertion that street food business is largely in the hands of women (FAO 2012).

Therefore, the economic importance to families is underpinned by these findings since it is believed by many sociologists that, empowering women is not only empowering the family but also the nation in totality. At this height, gender was not, a lawful reason or a strongest predictor for them not complying with the five keys except for the fact that most women vendors had not had education beyond primary school, a level considered necessary in conceptualising the messages of the WHO five keys as captured showed in Table 4.1.

Of 67 (70%) of the respondents had primary formal education, 26 (27%), secondary education, only one (1%) had a university level of education and 2% had not had any formal school as observed in Figure 4.1. A great majority had primary or secondary

education. This gap is statistically significant at p=<0.0001. From the data in Table 4.6, it can be presumed that only 28% of the vendors in the study had a secondary level of education and above. Hence, only 28% might have been able to effectively translate the WHO keys to safe food into KAP. That is why the expected change after training on awareness and necessity to comply with the WHO keys to safe food remained insignificant and for any change realised it was either positive or negative in some keys. The results suggest that the dress making of studies can only be done up to a basic minimum level.

Table 4.6: Demographic Profile of Food Handlers by Sex, and Education

N=96

Sex	Frequency	%
Female	73	76
Male	23	24
Total	**96**	**100**
OR=3.17 (1.85-5.41) p=<0.0001		

Education	Frequency	%
No School	**2**	**2**
Primary School	**67**	**70**
Secondary School	**26**	**27**
University	**1**	**1**
Total	**96**	**100**
The goodness of fit test p=<0.0001		

P= P-value

It is a fact that scientific issues cannot be correctly interpreted and put into action by persons without adequate capacity to appreciate what has been taught in respect of food safety though this may not be the only reason, as they might have been other factors associated. Figure 4.2 describes the most active age group of the street food vendors ranging from 18 to 40 years. Their age was symmetrically distributed for which 70 (73%) out of 96 respondents stood out as the dominant workforce in the

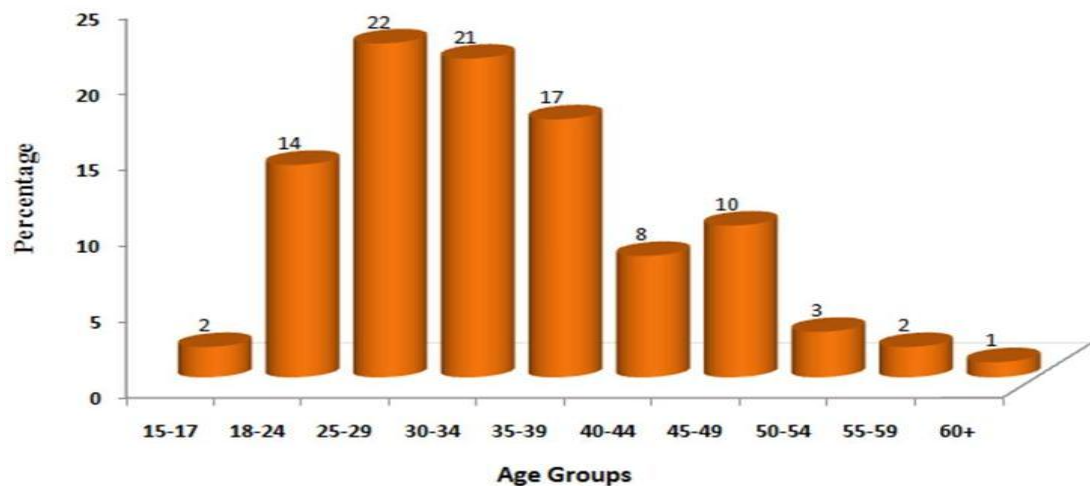study area. Even so, the issue of child labour that is youth below 18 years old was represented by 2%.

Figure 4.2: Symmetrical Distributions of Participants' Age Groups
Source: Author's study (2017)

Poor personal hygiene including poor use of protective clothing was observed in 48 (50%) out of 96 of all the vendors were contributors to diarrhoeal diseases in the study area. Thirty-eight (41%) out of 96 of the street food vendors were observed to be wearing jewellery, chains, and watches during food preparation. Twelve (13%) out of 96 dealt with ready food to be served and was kept in hot pots with either lids or other kinds of cover and the eating and cooking utensils were kept stored upside down as observed in respect of only 9% of the vending outlets observed in Table 4.7.

Only 3 (3%) of 96 of street food vendors observed did wash hands between food handling and money handling and/or toilet breaks. This behaviour if not observed in food vending is more likely to cause microbial contamination. Besides, the presence of pests and pet animals was observed. These were loitering around tables and cupboards as seen in 8% of street food vending points. Tablewares were seen in 2%

of the outlets. These were full of food stacked on top of each other during food displays, storing and serving.

Table 4.7: Demographic Characteristics of Street Food Vendors

Vendors handling money and washing hands before serving another customer

Characteristics	Frequency	Percentage
Hand wash	3	9
No hand wash	93	91
Total	**96**	**100**
OR=32.33 CI=9.91-105.43 p=<0.0001		
Defective, damaged, plastic containers, cracked, rusted, chipped and unsuitable utensils and crockeries and cutleries were discarded		
Yes	3	3
No	93	97
Total	**96**	**100**
OR=32.33 (9.91-105.43) p=<0.0001		
The presence of insects, pests and pet animals in the food vending areas?		
Yes	8	8
No	88	92
Total	96	100
OR=11.5 (5.30-214.93) p=<0.0001		
The temperature of food at service delivery		
<63°C (145 °F)	72	94
63°C-85°C (185°F)	5	6
Total	**77**	**100**
OR=14.4 (5.57-37.22) p=<0.0001		
smoking, spitting, chewing gums, eating and sneezing or coughing onto food		
Yes	4	13
No	26	87
Total	**30**	**100**
OR=6.69 (3.51-12.76) p=<0.0001		
Frequency of inspections to street food vendors by Environmental Health Officers		
Once per week	68	71
Once per month	10	10
Not done	18	19
Total	**96**	**100**
The goodness of fit test p<0.0001		

OR=Odd Ratio; P= P-Value

As showed in Table 4.7, 3% of cutleries were defective, damaged, cracked, and some were in the form of plastic containers that are unsuitable for use in the food business. Normally, the plastic polycarbonate or polycarbonate (PC contains recycle code-7 and polyvinyl chloride (PVC) marked recycle code-3 leach from cans and migrate into the food in contact. Using plastic containers for serving food may be dangerous and pose health risks for breast and prostate cancer, and heart disease,

among other diseases. Furthermore, more research is required in this area, as there is very little known about the potential health effects of chemicals that leach from plastic food containers.

In one extreme, only 6% of the street food vendors sold food at a required temperature between 63°C-85°C (185°F) while only one street food vendor had a food thermometer for testing critical temperatures of cooked food. The temperature of food at service delivery outlets showed that 72 (94%) out of 77 of ready to eat food was observed sold at temperatures of <63°C (145°F). It is very risky to consume food that is below the required temperature as it favours the growth of food microbial pathogens. In this finding, the risk was statistically significant at OR=14.4 (5.57-37.22) p=<0.0001.

Table 4.8: Street Food Industry Employment Contribution in the Study Area

Characteristics	Frequency	Percentage
In employment	70	73
No employment	26	27
Total	**96**	**100**
OR 4.26 (2.41-7.55) p=<0.0001		

Street food vending business is a key economic resource for street food sellers as it employs people with low or no capital investment, little education, little or no professional training significantly at OR= 4.26 (2.41-7.55) p=<0.0001. From this study, it can be concluded that street food vending business contributes significantly to family welfare as well as the national economy including employment creation to the tune of 73% as found in the study area as observed in Table 4.8 & Figure 4.3 indicated the presence of casual helpers that is those who provide services on an irregular basis in street food vending and this includes members of the family standing at 73% and two under-five children observed in the study area while

helping their parents and so, these together with the casual helpers represent 47%.

This finding was statistically significant at p=<0.0001. Helpers in the street food vending were used to purchasing food from the market and other materials, fetching water, serving food, washing crockeries and cutleries. All these involved were without any food safety training. In addition, the presence of family members to the tune of 20% added to the burden of health risks in food handling practices. Besides, including the food handling behaviours, including smoking, spitting, chewing gums, eating and sneezing or coughing in the proximity of food were observed in 13% of the vending sites.

Temporary casual and non-casual labourers in the street vending services
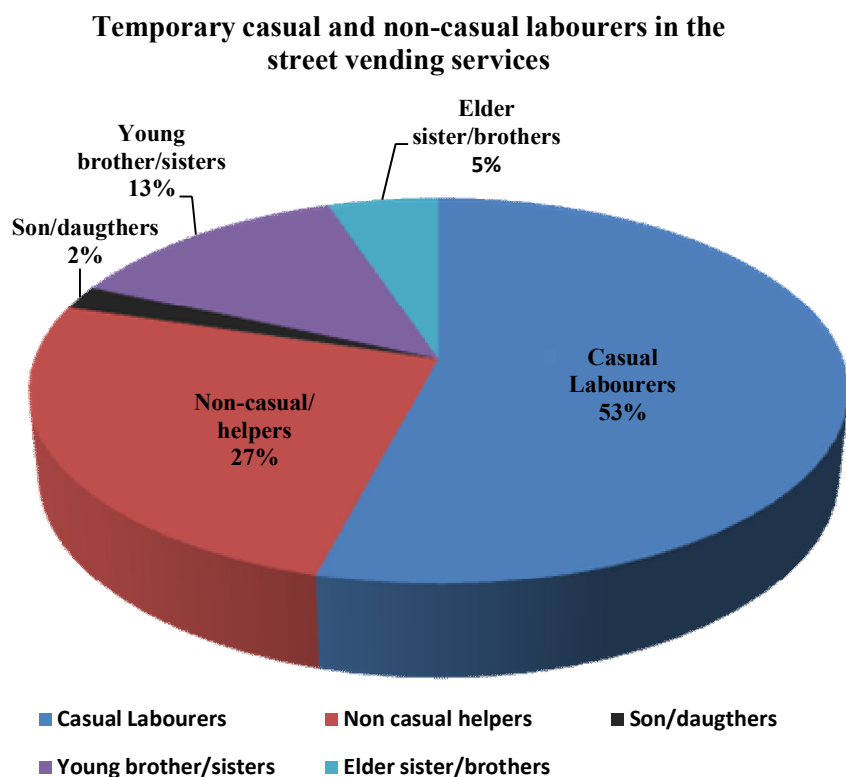
Figure 4.3: Temporary Casual and Non-Casual/Helpers in the Street Food Vending Services

These casual helpers were employed daily as needed. They have no work contract as they are paid for the hours they work. This study observed them working temporarily and they were not bound by the food safety regulations including their registration, medical examination certificates required by existing regulations. Their health status was unknown and they were no guarantee for the standard of food safety handling practices. Therefore, they were not bound to comply with food safety regulations.

The presence of helpers who provide services on an irregular basis in street food vending included members of the family standing at 73% including two under-five years old children who were helping their parents while the non-casual helpers make up 27%. Casual helpers in street food vending were used to purchase food from the market, fetching water, serving food, washing crockeries, cutleries and all were without any food safety training. This study suggests that food vendors and their casual labourers should be recognised and given apprenticeship training or basic training on food safety and in order for them to promote food safety culture in the food industry.

4.7 Environmental and Sanitary Factors Distressing Food Safety Practices

The observed food vending was prepared and served under tainted conditions and in congested environments. The available food stalls in the study area were not only limited with respect to infrastructure and operated in environments that had poor sanitary conditions or are dilapidated structures. These were made of temporary materials such as timbers, bamboo, rust black leaked corrugated irons, tarpaulins, sulphate bags plastics, boxes, and sunburnt bricks. Some food vendors were without food stalls and food was prepared and served in open spaces like corridors,

roadsides, and most encroached pavements.

The equipment for preparing and serving food was also poor and temporary and included plastic containers, cups, plates, glazed ceramic mostly cracked, damaged plates and cups, dirty thermal flasks, some woven bamboo used as a lid for food pans. The cupboards were full of dust and cockroaches were crawling on the tables disgusting to eating customers. There was also more the lack of formal food facilities and safe water supply, no toilets and there were designated areas for food vended services. These were some of the critical issues in the study area. Additionally, most threatening was the inadequate solid and liquid waste management often running with foul water in the open drains with filthy smells, poor management system. Foul water was also often running within the open smelling drains. There was poor management of toilet facilities. For available toilets, these were filthy with a lack of water.

The existing social services facilities were compromised beyond repair. The walls were full of stains and grease. The overall condition of the infrastructure for food vending was poor compared with many other settings for business. There were differences in the level of urbanization and socio-economic system. Most of the food vendors provided their services in foul conditions without Personal Protective Equipment (PPE). Most used and reused the same water to clean utensils, wipe tables with bare hands, plates, and cups were wiped with dirty rugs andmoney was handled alongside serving food without washing hands. All these may be attributed to the reported incidences of diarrhoeal diseases. The mere existence of toilet facilities does not ensure good sanitary conditions. Instead, it creates a favourable

breeding environment for flies and other pests that may carry along with pathogenic contamination for food and utensils.

All these insecure situations are bound to result in the occurrence of diarrhoeal diseases. Worse still raw materials are generally of poor quality and they were stored in unsafe temperatures for long periods. Making them prone to diarrhoeal diseases. Furthermore, no study has been conducted in this area to establish the causal association of the diarrhoeal disease outbreaks within the setting about water pollution and effluent discharges from institutions and community settlements.

CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 Introduction

This chapter discusses the results presented in chapter four in response to research objectives and hypotheses. The discussions and comparisons with the findings of other researchers have at times been collapsed into one paragraph for ease follow up. Towards the end of the chapter, a section presents how the specific objectives and hypotheses were achieved and systematically presented. The chapter has a section showing the findings of the research and their relation with the two hypotheses presented in chapter one.

5.2 Results of Pre and Post-Test Training on Five Keys to Safe Food

As highlighted in the literature review, although many studies have looked at the knowledge, attitudes, and practices of food handlers for food safety, are using The WHO five keys to safe food. Most of the research reports focused on food handlers' informal settings, such as hotels and restaurants. The rationale to undertake this study, therefore, guided by the need to assess the factors affecting food handling and hygiene in the informal sector. The assumption was that there was improper handling of food by street food vendors and that the suspected doubtful practices were bound to lead to health risks of consumers of food from street food vendors. A comparable study conducted by Njaya in (2014) involved 78% of 60 respondents as well as by Nyamari of Kenya (2013) involving 82% out 343 respondents.

Often were studies of Thanh in Vietnam (2015) 89% out of 120 respondents and Campbell in South Africa (2011) 69% out of 150 respondents. All these studies

supported the assertion that street food vending is not only among priority occupations for many young people particularly women in the contemporary world but it stands as a stepping-stone onto more worthwhile businesses worldwide (TEA, 2012). In this study, 73 (76%) out of 96 of the street food handlers were women. This observation is, therefore, supported by the assertion of FAO (2012) that street food business is largely in the hands of women.

The findings underpin the economic importance of food vending to families. It is believed by many sociologists that, empowering women does not only imply empowering the family but also the nation. In the study, the most active age group among the food vendors was symmetrically from 18 to 40 years is 70 (73%) out of 96 respondents as shown in Figure 4.1. This finding corresponds to the other study conducted by Njaya in (2014) involving 78% of 60 respondents; Nyamari in Kenya (2013) involving 82% out 343 respondents; Thanh in Vietnam in (2015) involving 89% out of120 respondents and Campbell in South Africa (2011) involving 69% out of 150 respondents.

5.3 The Influence of Education And Socio–Economic Factors to the Food Industry

The education profile of the respondents in the study area indicates that 67 (70%) of the respondents had primary formal education, 26 (27%), secondary school education, one (1%) university education and 2% had not had formal school education. This is comparable with the study conducted by Edima *et al.* (2014) at Yaounde City, Cameroon who found that 38% of the street food vendors had not

received any formal education.

Also the studies conducted in Malawi by Campbell (2011); Muyanja *et al.*, in 2011 in Uganda; Nyamari in 2013, Kenya; Njaya in 2013 Zimbabwe; Monney in 2013 Ghana; Samapundo *et al.*, in 2014 Haiti; Ntomola, in 2014 Tanzania; Lin & Yamao in 2014 Japan; Thanh in 2015 Vietnam; Alimi, *et al.* in 2016 Nigeria & Campbell in 2011 South Africa. These studies undertaken in developing countries involved food handlers who had attained primary school and higher educational levels being up to 94 (98%) in Kenya according to Nyamari (2013).

Studies in developing countries have shown that low educational levels and lack of employment were the key factors describing street food vending business. On the contrary, consumersø attitudes and perceptions of health risks relating to street food were determined by knowledge of food safety and other demographic and socio-economic factors including age, gender, education and economic status (Alimi, 2016c).

This study has shown that the educational level of street food vendors was similar to the results found in other settings in the world (Chukuezi, 2010 & Choudhury *et al*, 2010). Regulation of street food vendors has been regarded as one of the interventions complimenting training that could support the improvement of the quality of the street food sector (Campbell, 2011).Street food vendors should be regularly inspected, as is the case with formal vendors in restaurants. Such a move would ensure that the vendors are exposed to training programmes, to alert them on basic requirements for hygienic handling of food in the street vending outlets.

It is also, presumed that when street food vendors grow older and wealthier they move onto other occupations that are better paying and with less physical challenges such as harassments by the militia who often crack down informal business in urban areas. Lucan *et al.* (2013) point out that many vendors are harassed by regulatory authorities, and sometimes are reluctant to speak to anyone who is not a regular customer. This is due to not only fears to jeopardise their businesses but most street food vendors are not licensed. These trigger fear of harassment by Council militia who do not support informal businesses and it is always alleged that all such businesses are a threat to public health because they do not comply with the WHO five keys. A study was done in Ankara, Turkey, Mekelle town, Bahir Dar town and Ethiopia indicated that knowledge of good food handling practices is significantly related to safe food handling practices (Bas *et al.*, 2006; Kibret & Abera, Nigusse & Kumie, 2012).

Similarly, a study done in central India, Bangladesh, and Nigeria indicated that food-handling practices were related to the educational status of the food handlers (Mudey *et al.*, 2010; & Tessema *et al.*, 2014). While Egan (2006) concluded that knowledge alone does not result in significant changes in food handling practices. Studies done in Nigeria and Kenya in 2009 showed that poor infrastructure and types of the premises, cleanliness of equipment, and self-esteem were also factors that influence food-handling practices (Tessema *et al.*, 2014).

On the positive side, street food vending business is a key economic resource for street food sellers. The business employs people with low capital investment, little education, little or no professional training; and is gender-biased preferring mostly

women who in most cases support the family base (Campbell, 2011). From this study, it can be concluded that street food vending business contributes significantly to family welfare as well as the national economy including employment creation to the tune of 73% as established in the study area.

Street vending provides for economic development as a first job, which helps to relieve poverty in many settings (Mukhola, 2014). The business is the main source of income for the poor. If this enterprise is not handled correctly, it may have awful consequences. For instance, without proper guidance for food vendors, the business can result in diarrhoeal disease outbreaks for the consumers (Mukhola, 2014). The social and economic space, increasing the presence of food traders in the City makes their numbers unmanageable and it is difficult to ensure the quality of their business including such health risky business of food vending (Kok, & Balkaran, 2014). The vendors are to undergo a complete physical medical examination and obtain health certificates from the authorised offices in the City. The health certificate is to be kept by the vendors, presented on inspection and renewed annually (Ackah *et al*., 2011).

Food hygiene practices studied in Johannesburg showed that the vendors there purchased fresh produce from 192 retailersø daily, prepared enough food for the day and gave away or took home the leftovers. Kok & Balkaran (2014) found that taking leftovers home was prone to spreading microbial content with the possibility of infecting people in the home of food vendors. Various studies showed that poor knowledge and practices health and sanitation, have the potential to spread diarrhoeal diseases. (Mendedo *et al*., 2017). The lack of basic sanitary facilities, unsuitable infrastructure in food services and the negligence in safe food handling

are the major cause of diarrhoeal disease outbreaks especially in many food and drinking stalls (Mendedo *et al.*, 2017).

5.4 Prevalence Of Microbial Pathogens in Food Vendors' Stool specimens

In the study area, the prevalence of microbial pathogens in vendors stool samples. This was 20% of the pathogens listed in Table 4.4 are among the top ten least wanted foodborne pathogens according to TEA, (2012) & CFIA, (2016) and include: 1) *Campylobacter*, 2) *Clostridium botulinum*, 3) *Escherichia coli* O157: H7, 4) *Listeria monocytogenes*, 5) *Norovirus*, 6) *Salmonella*, 7) *Staphylococcus aureus*, 8) *Shigella*, 9) *Toxoplasma gondii*, 10) *Vibrio vulnificus.* Studies in many settings showed that the occurrences of *Salmonella* spp were prevailing at around 2 to 5% in untreated typhoid infections some of the survivors of typhoid can turn into chronic carriers and stand as an agent for the continuous spread of the disease condition according to Ahmed (2007).

Of the stool isolates, there was no single stool sample found with more than one pathogen or with co-infections. Some pathogenic species may at times interact within the host (Diedrich, 2011). As in the case of parasite interactions that include microbial interference, one bacterial species can suppress the virulence or colonization of other bacteria, such as *Pseudomonas aeruginosa*, which suppress pathogenic *Staphylococcus aureus* colony formation (Sievert *et* al., 2013). Furthermore, according to Thanh, (2015) *Salmonella* spp, *Escherichia coli*, and *Staphylococcus Aureus* isolated in the study area were antimicrobial-resistant pathogens.

On the other hand, the prevalence of pathogens isolated in street food vending points was 27%. Thus, 21 out of 78 food-collected samples had pathogens that were capable of causing diarrhoeal diseases. This finding was similar to that in the study by Campbell in (2011) South Africa; Schmidt in (2011) Canada; Githaiga in 2012 & Nyamari in (2013) Kenya; Tiisekwa in (2013) Tanzania. The comparable studies also conducted in Tanzania and other countries include Njaya in (2013) Zimbabwe; Samapundo (2013) in Haiti; Ntomola in (2014) Tanzania; Omemu *et al.*, in (2014) Nigeria; Girma in (2015) Ethiopia; Thanh in (2015) Vietnam.

5.5 Prevalence of Microbial Pathogens in Food Vending Samples

Of the total food samples collected in the study area, one sample involved sardines and cooked rice and indicated *Staphylococcus aureus* 2 (3%) out of 78). The study of Abdalla *et al.* (2009) established that in food processing, foodborne microbes could be introduced from infected humans who handle the food or by cross-contamination from other raw agricultural products and/or the environment. Abdalla (2009) identified hands as the most significant source of transfer of pathogens from faeces, face, skin, or other sites to vendors' food and food handling systems.

The pathogens such as *Escherichia coli*, *Salmonella*, *Shigella*, *Campylobacter*, and *Staphylococcus aureus* were the diarrhoeal disease risks to consumers. *Escherichia coli* were isolated in two samples of cooked rice and a sample of a pickle. The study by Kayombo and Mayo (2018) isolated *Escherichia coli*, *Citrobacter* spp, *Proteus* spp, *Klebsiella* spp, *Salmonella* spp, and *Bacillus* spp, in fresh vegetables in Dar-es-Salaam City, Tanzania. *Escherichia coli* were also isolated in two samples of cooked rice and a sample of a pickle. These pathogens are known to cause serious food

poisoning according to the study of CFIA (2016); Adem *et al*. (2008); Khanjar & Alwan (2014).

5.6 Other Factors that Contribute to the Prevalence of Diarrhoeal Diseases

Abdalla *et al*. (2009); Kok & Balkaran (2014), emphasized that contaminated hands were the most common sources of transfer of micro-organisms from food handlersø faeces, face, skin, or other parts of the body on to the food. Other infections macro and microorganisms often found in food were not isolated, in this study, not because they were not present, but they were not targeted through the methods used in the data analysis for this study (2012; Neza & Centini, (2016). The relative proportions of pathogenic to non-pathogenic strains in the study area were unknown. Some of the bacteria, which were associated with food spoilage, include *Klebsiella oxytoca* and yeast cells (Sperber & Doyle, 2009 & FDA, 2012).

Indeed, the above limitation was expected because of the laboratory capacity and experienced existing personnel. Although the study of Tessema *et al.* (2014) conducted in Nairobi, Kenya cited that the gender of street food vendors was closely related to food of bad handling practices of street food vendors and general food handling practices. The street food vending lies in the informal sector which when compared with the formal sector, receives only a token help in terms of public support services (Tessema *et al*., 2014).

5.7 Environmental Quality and Sanitation of Food Vending Areas

The street food-vending environment of the study area was observed lied in worse conditions especially in the operating places. With the shortage of designated area,

even the places they work were overcrowded. Food vendors observed moving with their food, lined in the corridors, open spaces with minimal services. Food vendors had no running water so they carry water along with plastic containers for washing their utensils and hand washing. The street food business is not depended on sanitation per see as they move to were the customers are and the needs of sanitation follow after. Food vendors can illegal work where there is no toilet, encroach places, which are not theirs.

The existing toilets facilities nearby are privately owned. However, for those occupied spaces in food, stalls especially in market places the toilets are contracted to privatesø owner. Given this situation, there is no guarantee of toilet facilities for them and their customers as this makes to be an individual business. The private toilets are dirty as they are not manned or properly supervised by the Health Officers in the Authority concerned although their frequency of inspecting the food vendors in the study area once per week was as high as 71%. In reality, this was not worth the situation on the study ground. The existing social facilities they were once working at the beginning and no maintenance at all and this left sewerage system went un-repaired.

This liquid waste is discharged untreated into the surface of the water, shed on the ground and the sewerage is seen flowing in the open drains with foul smelling. This wastewater may have facilitated the adverse health effects include diarrhoeal disease outbreaks in the study area. It is hat attributed to inadequate safe water, sanitation, and hygiene if actions are not taken. The City Councils and the authorities concerned in collaboration with available stakeholders should take the lead in planning

designated special areas for food vending with the provision of clean and safe water, solid waste management, toilets as well as hand washing facilities and consistency maintenance. In doing so, will minimise the burden of diarrhoeal diseases in the study area.

5.8 Extent to Which the Research Specific Objectives in the Study were Achieved

i)   Under the establishment of street food vendors Knowledge, Attitude and Practice using WHO five keys to safe food tool it was established that training food vendors irrespective of their baseline education level was in enhancing hygienic food handling practices of street vendors. The study reveals that exposure to KAP increased the knowledge level of untrained vendors. Since the trained vendors had, a more positive attitude on food handling practices compared to the untrained.

ii)   The prevalence of health carriers on diarrhoeal disease pathogens in the stools of selected street food vendors in the study area was found to be 20% (Convalescent carrier). Five out of 25 stool samples were confirmed to have pathogens capable of causing diarrhoeal diseases. In developing countries, diarrhoeal disease-account for between 17% to 21% (Black *et al.*, 2010).

iii)   The prevalence of microbial contamination in the street vended food in the study area was found to be at 27% that is 21out of 78 food samples were confirmed to have microbial pathogens, as observed in Table 4.5. This was indeed an indicator of the need for urgent intervention by authorities in the City Council.

5.9 Research Findings in Relation to the Hypotheses

I) the assumption that street food vendors handling practices influence the prevalence of diarrhoeal disease outbreaks. This was proven true because the health carrier status of food vendors in the study area was found to be 20% and the food they served was found to be 27% (21out of 78) food samples with microbial pathogens capable of causing diarrhoeal diseases.

ii) The contention that street vended food causes microbial contamination and contributes to the transmission of diarrhoeal disease outbreaks in Mbeya city. The assumption was proven to be true because in stool specimens five (20%) out of 25 were found with microbial pathogens capable of causing diarrhoeal disease outbreaks.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study revealed the features of food vending business including health practices, knowledge, and a working environment that needs complementary support from public services. The data analysis suggests that improvement in the provision of education, training on food handling practices, including clean safe water supply, sanitation, and solid waste management, suitable infrastructures, suitable food equipment, and social services ought to be made more readily available in all areas involved food vending.

The improvement of the existing infrastructure, food equipment, toilet facilities, waste management, safe and clean water system need to be subjected to regular inspection and maintenance. This study discovered that exposure itself increased the knowledge of untrained vendors, the trained vendors were more confident in attitude compared to the untrained. The study, therefore, provides Mbeya City with proven evidence that the KAP of food vendors and the WHO five keys can be adapted in all settings to improve food safety in Mbeya and other parts of Tanzania. This needs to be undertaken on a continuous basis.

Food vendors were observed to be selling food in a filthy environment, and it was associated with food contamination and the health carrier status of food vendors and pathogens found in stools and food samples was likely related to the prevalence of diarrhoeal diseases in the study area.

6.2 Recommendations

Based on the findings of this study, it is recommended that:

1) Councils should collaborate with various stakeholders to complement the improvement of infrastructure, food equipment, safe water system, sanitation, and social services for better quality street food vending business on a regular basis.

2) Councils should plan regular training for all casual labourers, non-casual labourers/helpers, newcomers through apprenticeship or formal training on food safety for enhanced compliance with the WHO five keys to safe food.

3) Central Government in collaboration with Local Councils Authorities to update their data on the burden of diarrhoeal diseases and convalescent carriersø status among street food vendors to assist them to assess improvements related to their interventions.

4) Central Government should facilitate the formulation and improvement of the National Food Policy with a focus on food vending standardisation, frequent consultations, and reference to changing the status through regular training, dissemination of food safety hygiene messages and communication through various public and social media.

5) Future research should focus on microbiological analysis of the consumers of street vended food to provide a wider picture of the contribution of microbial pathogens to the prevalence of diarrhoeal diseases.

REFERENCES

Abdalla, M. A., Suliman S. E. & Bakhiet, A. O. (2009). Food safety knowledge and practices of Street food vendors in Atbara City (Naher Elneel State Sudan). *African Journal of Biotechnology,* 8, 6967-6971.

Acharya. (2012). Formal Ether Sedimentation technique for the concentration of stool Parasites. Retrieved on 05th July, 2017 from; https://microbeonline.com/formal-ether-sedimentation-techniques/.

Acharya, V. V. (2015). Direct Saline/Iodine Wet Mount for Diagnosis of Intestinal Parasites, Retrieved on 05th July, 2017 from; http://microbeonline.com/saline-wet-mount-diagnosis-intestinal-parasites/.

Adem, H, Daniel, A. & Girma, Z. (2008). Occurrence of *Escherichia coli* O157: H7 in retail raw meat products in Ethiopia. *Journal of Infectious Developing Countries*, (2), 389-393.

Ahmed, H. H. S. (2007). Salmonella Carriers among Public Food Handlers in Khartoum Municipality. A thesis submitted for award of Master Degree in Microbiology at the University of Khartoum, Sudan.

Alimi, B. A. (2016a). Risk factors in street food practices in developing countries: A Review. *Food Science and Human Wellness*. 5(3), 141ó148.

Alimi, B. A., Oyeyinka, A. T. & Olohungbebe, L. O. (2016b). Socio-economic Characteristics and willingness of consumers to pay for the safety of fura de nunu in Ilorin, Nigeria *Quality Assurance Safety, Crops Foods*, 8, 81ó86.

Alimi, B. A. & Workneh, T. S. (2016c). Consumer awareness and willingness to pay for the safety of street foods in developing countries: a review. *International Journal of Consumers. Studies*, 1, 242ó248.

Alsolaiman, S. M. (2014). An Empirical Study of the Factors Impacting on the Involvement of Clients in Saudi Arabian Construction Projects. Thesis for the award of the degree of Doctor of Philosophy at the University of Brisbane, Australia.

AMREF, (2007). Communicable Diseases:Diseases of Faecal-oral Contamination. 63pp. Retrieved on 06th May, 2019 from; [http://www.col.org/resources/crsMaterials/Pages/comDiseases.aspx]. Visited on 6/5/2015.

Andy, E., Mangai, J. M., Kayong, E. A., Afoi, B. B., Goshit, J. D., Kasang, N. & Innocent, O. (2015). Assessment of Practice of Food Safety and Hygiene among Food Vendors within Jos North Local Government Area of Plateau State, Nigeria.*International Journal of Medical and Health Research*, 1(2), 83-86.

Asiegbu, C. V., Lebelo, S. L. & Tabit, F. T. (2016). The food safety knowledge and microbial hazards awareness of consumers of ready-to-eat street-vended food *Control*, 60, 422-429.

Badu, M. (2013). Assessing the Impact of Climate Change on Human Health: Status and Trends of Malaria and Diarrhoea with respect to Temperature and Rainfall Variability in Nepal. *Journal of Science, Engineering and Technology,* 9(1) 96-105.

Barro, N., Bello, A. R., Itsiembou, Y., Savadogo, A., Ouattara, C. A. T. & Nikiema, A. P. (2007). Street vended foods improvement: contamination mechanism and application of food safety objective strategy: critical preview. *Pakistan Journal of Nutrition*, 6, 1-10.

BD[TM], (2013). Product catalog, Industrial Microbiology, helping people live

healthylive.[https://www.brunschwig-ch.com/pdf/downloads/BD_Industry Catalog14.pdf]. 59pp.Visited on 19/08/2016.

Beard, J. R., Biggs, S., David E. Bloom, D. E., Fried, L. P., Hogan, P., Kalache, A. & Olshansky, S. J.(Eds) (2011). Global Population Ageing: Peril or Promise, Geneva: World Economic Forum.

Bhowmik, S. K., (2010). *Street Vendors in the Global Urban Economy*, New Delhi: Routledge.

Black, R. E., Cousens, S., Johnson, H. L., Lawn, J. E., Rudan, I., Bassani, D. G., Jha, P., Campbell, H., Walker, C. F., Cibulskis, R., Eisele, T., Liu, L. & Mathers, C. (2010). Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional, and national causes of child mortality in 2008: A systematic analysis. *Lancet,* 375, 1969ó1987.

Boegh-Petersen, J. & Tøstesen, M. (2010). Street food in Kolkata-A hygienic perspective. *Indian Journal Microbiol,* 51(1), 10ó6.

Boshoff, C. (2007). A psychometric assessment of E-S-QUAL: a scale to measure Electronic service quality, *Journal of Electronic Commerce Research*, 8(1), 101-114.

Brown, A., Msoka. C.& Dankoco, I. (2015). A Refugee in my Own Country: Evictions or Property Rights in the Urban Informal Economy? *Urban Studies,* 52(12, 2234ó2249.

Campbell, P. T. (2011). Assessing the Knowledge, Attitudes and Practices of Street Food Vendors in the City of Johannesburg regarding Food Hygiene and Safety. A dissertation for the award of Master degree in of Public Health at University of the Western Cape, South Africa..

CFIA, (2016). 10 least wanted Foodborne diseases. Retrieved on 23rd June, 207 from; http://www.foodsafetynews.com/2015/09/the-5-most-dangerousfood borne-pathogens/#.WDKZyblG3Qw.

Carifio, J. & Perla, R. J. (2007). Ten common misunderstandings, misconceptions, persistent myths and urban legends about Likert scales and Likert response formats and their antidotes. *Journal of Social Sciences*, 3(3), 106-16.

CDC, (2013). Vital Signs: Carbapenem-resistant Enterobacteriaceae. *Morbidity Mortality Weekly Report*, 62(9), 1656170.

Chilukoti, B. (2014). World Health Day: 5 common causes of food contamination you should know! Retrieved on 30th Nov. 2016 from; http://www.thehealthsite.com/diseases-conditions/world-health-day-5-common-causes-of-food-contamination-you-should-know/.

Choube, A., Bahal, S. P., Srivastawa, A. & Sharma, M. (2014). Knowledge and childcare practices regarding childhood diarrhoea - A cross-sectional study. *Indian Journal of Community Health,* 26(3), 285-291.

Chowdhury, F. R., Nur, Z., Hassan, N., Seidlein, L. N., & Dunachie, S. (2017).

Pandemics, pathogenicity and changing molecular epidemiology of cholera in the era of global warming. *Annals of Clinical Microbiology and Antimicrobials* 16(1), 10.

Choudhury, M., Mahanta, L., Goswami, J., Mazumder, M. & Pegoo, B. (2010). 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.

Christison, C. A., Lindsay D. & von Holy, A., (2008). Microbiological survey of ready-to-eat foods and associated preparation surfaces in retail delicatessens, Johannesburg, South Africa. *Food Control*, 19, 7276733.

Chukuezi, C. O. (2010). Safety and Hygienic Practices of Street Food Vendors in Owerri, *Nigeria Studies in Sociology of Science,* 1(1), 50-57.

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, 62, 178-186.

Dawes, J. (2008). Do Data Characteristics Change According to the number of scale points used? An experiment using 5-point, 7-point and 10-point scales. *International Journal of Market Research*, 50(1), 61-77.

Dean, R. N, Farrell, J. M, Kelley, M. L., Taylor, M. J. & Rhodes, R. E. (2007). Testing the efficacy of the theory of planned behaviour to explain strength training in older adults. *Journal of Aging and Physical Activity*, 15 (1), 1-12.

Department of Health, (2009). Food-Borne Illnesses in Mpumalanga Province. Statistical Notes. Retrieved on 30th June, 2015 from; http://www.nmc.gov.za/Docs/Food_Poisoning.pdf.

DHIS, (2016). Annual Diseases Report Mbeya City Council; Online tool.

Diedrich, C. R. (2011). HIV-1/Mycobacterium tuberculosis Co-Infection Immunology: How Does HIV-1 Exacerbate Tuberculosis*? Infection* and *Immunity*, 79(4), 1407-1417.

Dipeolu, A. O., Akinbode, S. O. & Okuneye, P. A. (2007). Income Generating Potentials of Street Food Vending Businesses in Ogun State, *Nigeria ASSET an International Journal Series C.,* (2007) 2 (1), 180-189.

Donkor, E. S., Kayang, B. B., Quaye, J. & Akyeh, M. L. (2009). Application of the WHO Keys of safer food to improve food handling practices of food vendors in a poor resource community in Ghana. *International Journal of Environmental Research Public Health.* 6(11), 2833-42.

Edima, H. C., Tem Nnam, Awono Enama, R. K. T., Biloa, D. M. & Ndjouenkeu, R. (2014). Case Study of the Street Food Sector in the Metropolitan Areas of a Cameroonian City, Yaounde. *International Journal of Current Microbiology of Applied Science*, 3(9),740-751.

FAO, (2007). School kids and street food, Spotlight magazine. Agriculture and Consumer Protection Department, United Nations. Retrieved on 5/05/2015 from; http://www.fao.org/AG/magazine/0702sp1.htm.

FAO & WHO (2008). Report of the thirty-ninth session of theCodex Committee on Food Hygiene. New Delhi, India.

Faruque, S. M, Islam, M. J., Ahmad, Q. S., Biswas, K., Faruque, A. S. G., Nair, G. B., Sack, R. B., Sack, D. A. & Mekalanos, J. J. (2006). An improved technique for isolation of environmental Vibrio cholerae with epidemic potential: monitoring the emergence of a multiple-antibiotic-resistant epidemic strain in Bangladesh. *Journal of Infectious Diseases.* 193, 1029ó 1036.

FDA, (2006). Managing food safety: A regulatorøs manual for applying HACCP principles to risk-based retail and food service inspections and evaluating voluntary food safety management systems.

FDA (Eds.) (2012). *Bedbug Book, Foodborne Pathogenic Microorganisms and Natural Toxins.* Food and Drug Administration, United State; 292pp.

FSA, (2011). Foodborne Disease Strategy 2010-15. Food standard Agency (FSA) Programme for the Reduction of Foodborne Disease in the United Kingdom. p. 24.

Gaungoo, Y. & Jeewon, R. (2013). The effectiveness of training among food handlers: A review on the Mauritian Framework. *Current Research Nutrition Food Science*; 1(1), 1-9.

Ghosh, M., Wahi, S., Kumar, M. & Ganguli, A. (2007). Prevalence of enterotoxigenic Staphylococcus aureus and Shigella spp. in some raw street vended Indian foods, *International Journal of Environmental Health Research*, 17(2), 151ó158.

Girma, G. (2015). Prevalence, Antibiogram and Growth Potential of Salmonella and Shigella in Ethiopia: Implications for Public Health. A Review, 33, 74-88.

Githaiga, G., M. (2012). Microbial Quality, Strain Distribution and Enterotoxigenicity of Selected Foodborne Pathogens in Relation to the Hygienic Practices in Industrial area, Nairobi, Kenya. A dissertation forward of Master of Science degree at University of Nairobi, Kenya.

Green, A. J. & Sánchez, M. I. (2006). Passive internal dispersal of insect larvae by MigratoryBirds. *Biology Letter*, 2, 55ó57.

Greuter, W., Garrity, G., Hawksworth, D. L., Jahn, R., Kirk, P. M., Knapp, S., McNeill, J., Michel, E., Patterson, D. J., Pyle, R. & Tindall, B. J. (2011). Draft BioCode (2011): Principles and rules regulating the naming of organisms. *Taxon*, 60, 201-212.

Halpern, M., Senderovich, Y. & Izhaki, I. (2008). Waterfowl: the missing link in epidemic and pandemic cholera dissemination? *PLoS Pathology*. 4(10),

e1000173.

Hawksworth, D. L. (2011). Introducing the Draft BioCode (2011). *Taxon*, 60(1), 199ó 200.

Herrera, J., Kuépié, M., Nordman, C., Oudin, X. & Roubaud F. (2012). Informal Sector and Informal Employment: Overview of Data for 11 Cities in 10 Developing Countries, WIEGO Working Paper (Statistics), 9, Cambridge, MA, retrieved on 20th June, 2017 from; [http://wiego.org/sites/wiego.org /files/publications/files/Herrera_WIEGO_WP9.pdf].Visited on 20/06/2017.

Hoffman, S. Fischbeck, P. Krupnick, A. & McWilliam, M. (2007). Using expert Elicitation to link foodborne illnesses in the United States to foods. *Journal of Food Production,* 70, 1220-1229.

Ifeadike, C. O., Ironkwe, O. C., Adogu, P. O. & Nnebue, C. C. (2014). Assessment of the food hygiene practices of food handlers in the Federal Capital Territory of Nigeria. *Tropical Journal of Medical Research*, 17(1), 10-15.

IOM, (2008). World Migration 2008: Managing Labour Mobility in the Evolving Global Economy, Geneva: Hammersmith Press.

Kang, J. W. & Magoncia, G. V. (2016). How to fill the Working-AgePopulation Gap in Asia: A Population Accounting. Asian Development Bank economics working paper series No. 499. 42pp.

Kayombo, M. C. & Mayo, A. W. (2018). Assessment of Microbial Quality of VegetablesIrrigated with Polluted Waters in Dar es Salaam City, Tanzania. *Environment and Ecology Research* 6(4), 229-239.

Kida, T. & Mushi, D. (2016). Implementation of SDGs in Tanzania: The Way Forwardø Southern Voice, retrieved on 25th June, 2019 from;

http://southernvoice.org/implementation-of-sdgs-in-tanzania-the-way-forward/.

Khairuzzaman, M. D., F. M., Chowdhury, S. Zaman, A. A., Mamun, M. D. & Bari, L. (2014). Food Safety Challenges towards Safe, Healthy, and Nutritious Street, Foods in Bangladesh. *International Journal of Food Science,* 2, 1-9.

Khalili, M., Mirshahi, M., Zarghami, A., Rajabnia, C., M. &Farahmand, F. (2013). Maternal Knowledge and Practice Regarding Childhood Diarrhoea and Diet in Zahedan, Iran. *Health Scope*, 2(1), 9885.

Khanjar, A. F. & Alwan, M. J. (2014). Genotypic Study of Escherichia coli O157:H7

isolated from stool Samples of Humans and Cattle.*International Journal of Advanced Research*, 2(6), 204-212.

Khijjah, R. & Rozga, D. (2010). The report on Children and Women in Tanzania. Retrieved on 30th December, 2016 from; [http://www.unicef.org/tanzania /SITAN_Mainland_report.pdf]. Visited on 30/12/2016.

Khoje, A., Metcalf, C. A., Diggle, E., Mlozowa, D., Jere, C., Akesson, A., Corbet T. & Chimanga, Z. (2012). Cholera outbreak in districts around Lake Chilwa, Malawi: Lessons learned. *Malawi Medical Journal*, 24(2), 29633.

Kibret, M. & Abera, B. (2012). The sanitary conditions of food service establishments Andfood safety knowledge and practices of food handlers in Bahir Dartown. *Ethiopian Journal of Health Science*. 22(1), 27635.

Kok, R. & Balkaran, R. (2014). Street Food Vending and Hygiene Practices and Implications for Consumers. *Journal of Economics and Behavioural Studies,* 6(3), 188-193.

Kreston, R. (2012). Everything you did not want to know about cockroaches. Retrieved on 30/07/2017 from; http://blogs.discovermagazine.com/body horrors/ 2012/05/09/cockroaches.

Krueger, A. L., Greene, S, A., Barzilay, E. J., Henao, O. &Vugia, D., (2014). Clinical outcomes of nalidixic acid, ceftriaxone, and multidrug resistant nontyphoidal *Salmonella* infections compared with pansusceptible infections in Food Net sites, 2006-2008.*Foodborne Pathogens and Diseases*, 11(5), 335-341.

Lahr, D. J. G., Lara, E., & Mitchell, (2012). ōTime to regulate microbially Eukaryote nomenclatureö. *Biological Journal of the Linnean Society,* 107(3), 469-476.

Lim, J. Y., Yoon, J. W., & Hovde, C. J. (2010). A Brief Overview of *Escherichia coli* O157:H7 and Its Plasmid O157. *Journal of Microbiology and Biotechnology*, 20(1), 5614.

Lin, W. Y. & Yamao, M. (2014). Street foods safety in Yangon: A case study on street food vendorsø socio-economic and production aspects.Proceedings of the First Asia-Pacific Conference on Global Business, Economics, Finance and Social Sciences. (AP14 Singapore Conference): 978-1-941505-15-1 Paper ID: S458 0.Singapore, Japan. pp.1-10.

Liu, H., Thomas I. Wahla, T. I., Baib, J. & Seale, J. L.Jr. (2012). Understanding Food-Away-From-Home Expenditures in Urban China.26 pp.

Lo-Ten-Foe, J. R., Ververs, M. A. C. & Buiting, A. G. M. (2007). Comparative evaluation of automated reading versus visual interpretation with the BBL Crystal enteric/nonfermenter identification system in a clinical setting. *European Journal of Clinical Microbiology and Infectious Diseases*, 26(6),

443ó444.

Lucan, S.C.,Varona, M. Maroko, A. R.Bumol, M.D.J, Torrens, BAL &Wylie-Rosett, J. (2013). Assessingmobile food vendors (a.k.a. street food vendors)ô methods, challenges, and lessons learned for future foodenvironment research. *Public Health*, 127(8), 766ó776.

Launiala, A. (2009). How Much Can a KAP Survey Tell us About Peopleøs Knowledge Attitudes and Practices? Some Observations from Medical nthropology Research on Malaria in Malawi. *Anthropology Matters,* 11 (1): http://www.anthropologymatters.com/journal/2009-1/index.html. Visitedon 21/08/2011.

Majowicz, S. E., Musto, J., Scallan, E., Angulo, F. J., Kirk, M., O'Brien, S. J., Jones, T. F., Fazil, A. & Hoekstra, R. M. (2010). The global burden of nontyphoidal Salmonella gastroenteritis. *Clinical Infectious Diseases,* 15, 50(6), 882-889.

Maung, N. S., Soe, H. Z., Lwin, A. M. M., Myint, M. Oo, C. C., Thein, M., Aye, T.T., Aye, W. H. &Myint, M. (2012). Raising food safety by food safety training program to street-food vendors in urban area of Yangon. Application for presentation of a research paper at the 41th Myanmar Health progress.

Mayo Clinic, (2014). Disease and Conditions: Food Poisoning, retrieved on 05th December, 2016 from; http://www.mayoclinic.org/diseases-conditions/food-poisoning/basics/definitions/con-20031705].

Mendedo, E. K., Berhane, Y. & Tadesse, B. (2017). Haile Factors associated with sanitary conditions of food and drinking establishments in Addis Ababa, Ethiopia: cross-sectional study *Pan African Medical Journal*, 15(28), 237.

MoHCDGEC, (2016). Emergency Operation Centre: Cholera Outbreak Situation.6pp.

MoHCDGEC, (Eds) (2015). National guideline for Prevention and Control of Cholera. 54pp.

Moller, V., Roberts, J, B., Tiliouine, H., & Loschky, J. 2017. ̶Waiting for Happiness inAfrica ̶World Happiness Report 2017, Helliwell, J., Layard, R., and Sachs, J. (Eds). Online: http://worldhappiness.report/wpcontent/uploads/sites /2/2017/03/HR17-Ch4_w-oAppendix.pdf.

Montano, D. & Kasprzk, D. (2008). The Theory of Reasoned Action, Theory ofPlanned Behavior and the Integrated Behavioral Model. In Glanz, K.M., Rimer, B.K. & Viswanath, K. (Eds.). *Health behavior and health education: Theory, research and practice,* pp., 4th Edition, San Francisco, California: Jossey- Bass.

Monney, I., Agyei, D. & Owusu, W. (2013). Hygienic Practices among Food Vendors in Educational Institutions in Ghana: The Case of Konongo *Foods*, *2*, 282-294.

Mudey, D., Goyal, R., Dawale, A. & Wagh, V. (2010). Health status and personal

Hygieneamong food handlers working at food establishment around a ruralteaching hospital in Wardha district of Maharashtra, India. *Global Journal of Health Science*, 2(2), 1986206.

Muhonja, F. & Kimathi, K. (2014). Assessment of hygienic and food handling practices among street food vendors in Nakuru Town in Kenya. *Science Journal of Public Health,* 2, 6, 554-559.

Mukhola, M. S. (2014). Street-food Vending: Training Directed at Better Food Handling and Associated Environmental, *The Journal of Anthropologist,* 17*(*1), 251-258.

Mwamakamba, L., Mensah, P., Fontannaz-Aujoulat, F. Hlabana, M., Maiga, F. Bangoura, F.,Mohamed, C. &Ingenbleek, L. (2012). The WHO Five Keys to Safer Food: A Tool for Food Safety Health Promotion. *African Journal of Food, Agricultural Nutritional* and *Development,* 12(4), 1-15.

Muyanja, C., Nayiga, L., Brenda, N. &Nasinyama, G. (2011). Practices, knowledge andrisk factors of street food vendors in *Uganda. Food Control*, 22, 1551-1558.

NBS, (2017). The Importance of Promoting OfficialStatistics forMonitoring Environmentally-Related SDG Indicators and Climate Change: Tanzania Experience, Presentation at Side Event at the 48th session of the United Nations Statistical Commission,https://unstats.un.org/unsd/statcom/48th-session/side-events/documents/20170307-1MTanzania.pdf.

Nath, S., S. (2010)*.* Street Food Vendors in Delhi: Nomads in the storm of modernity. A thesis for award of master degree at the University of Vianna, German. 73pp.[http://othes.univie.ac.at/10256/1/2010-06-09_0208808.pdf]. Visited on 1/04/2015.

Nelson, J. K. & Zeratsky, K. (2012). Fruit or vegetable ô Do you know the difference? Retrieved on on 20/12/2016. from; [http://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/expert-blog/fruit-vegetable-difference/bgp-2005614].

Newell, D. G., Koopmans, M. M., Aidara-Kane, V. L. & Kruse, H. (2010). Food-

borne diseases the challenges of 20years ago still persist while new ones continue to emerge *International Journal of Food Microbiology,* 139, 3ó15.

Neza, E. & Centini, M. (2016). Microbiologically contaminated and Over-Preserved Cosmetic Products According Rapex 2008ó2014. *Cosmetics*, 3, 3.

Nicolas, B., Razack, B. A., Yollande, I. & Aly, S. (2007). Street-Vended Foods Improvement: Contamination Mechanisms and Application of Food Safety Objective Strategy: Critical Review. *Pakistan Journal of Nutrition*, 6, 1-10.

Nieto-Montenegro, S., Brown, L. & LaBorde, L.F. (2008). Development and Assessment of Pilot Food Safety Educational Materials and Training Strategies for Hispanic Workers in the Mushroom Industry Using the Health Action Model. *Food Control*, 19(6), 616-633.

Nigusse, D.& Kumie, A. (2012). Food hygiene practices and prevalence of intestinal parasites among food handlers working in Mekelle university studentøs cafeteria, Mekelle. *Global Advanced Research Journal* of*Social Science* (GARJSS), 1(4), 065ó071.

Njaya, (2013). Nature, Operations and Socio-Economic Features of Street Food Entrepreneurs of Harare, Zimbabwe. *Journal of Humanities and Social Science*, 19(4), 49-58.

Njaya, T. (2014). Operations of Street Food Vendors and their Impact on Sustainable Urban Life in high densitysuburban is of Harare, in Zimbabwe.*Asian Journal of Economic Modelling,* 2(1), 18-31.

Nswilla, A. (2017). Consultation with Dr. Nswilla regarding Domestication of SDG, 28th September, 2017, Dar es Salaam.

Ntomola, S. S. (2014). Determination of Hygienic Practice and Status of Food Handlers InCatering Premises: A Case Study of Ilala Municipal Council, Tanzania. A Dissertation Submitted in requirements For the Degree of Master of Environmental Studies-Health Stream of the Open University of Tanzania, Dar-es-Salaam, Tanzania.79pp.

Nyamari, J. (2013). *Evaluation of Compliance to Food Safety Standards amongst food handlers in selected Hospitals in Kenya*. A Thesis submitted for the Award of the Degree of Doctoral of Philosophy in the school of Public Health of Kenyatta University, Kenya.134pp.

Odonkor, S. T., Adom, T., Boatin, R., Bansa, D. &Odonkor, C. J. (2011). Evaluation of Hygiene practices among street food vendors in Accra metropolis, Ghana. *Elixir Food Science*, 41, 5807-5811.

Omemu, A. M.& Aderoju, S. T. (2008). Food safety knowledge and practices of street Foodvendors in the city of Abeokuta, Nigeria. *Food Control*, 19(4), 396-402.

Pajot, M. & Aubin, L. (2011). *Does street food vendor training improve food safety? Acritical Appraisal of the literature*. Retrieved 30th April, 2015; http://findebookee.com/f/food-handlers-food-safety-training.

Park, S. H., Kwak, T. K. & Chang, H. J. (2010). Evaluation of the food safety training for street food vendors in restaurant operations.*Nutrition Research Practice,* 4(1), 58668.

Petersen, J., B. & Tostesen, M. (2010). *Street food in Kolkata-A hygienic perspective*; pp.69. retrieved on 20th April, 2017 from; http://innoaid.org/wp-content/uploads/2012/04/Hygiene-Report.pdf.

Pokhrel, P. & Sharma, D. (2016). A study on assessment of food safety knowledgeand practices among the street food vendor of urban and semi-urban areas of Guwahati, Assam. *International Journal of Home Science*; 2(2), 85-89.

PRB, (2012). Population and Economic Development 2012 Data Sheet; and United Nations Population Division, World Population Prospects: The 2010 Revision. Retrieved on 30th April, 2016 from; [http://www.prb.org/DataFinder/Topic/Rankings.aspx?ind=264].

Prüss-ustin, A.,Wolf, J.,Corvalán, C., Bos, R. & Neira, M. (2016). Preventing disease through healthy environments: a global assessment of the burden of diseases from environment risks. Geneva.

Ren, H. (2012). Plastic Waste Recycling and Greenhouse Gas ReductionTaking Copenhagen as an example from life cycle assessment perspective. A thesis for award of Master Degree at Aalborg University, Denmark. 89pp.

Rheinländer, T., Olsen, M., Bakang, J. A., Takyi, H., Konradsen, H, F. & Samuelsen, H. (2008). Keeping up appearances: perceptions of street food safety in urban Kumasi, Ghana. *Journal of Urban Health*, 85, 952-964.

Rijswijk, W. & Frewer, L. J. (2008). ―Consumer perceptions of food quality and safety and their relation to traceability‖, *British Food Journal*, 110(10), 1034-1046.

Roever, S. (2014). Informal Economy Monitoring Study Sector Report: Street Vendors Cambridge, MA, USA: WIEGO.72pp.

Roever S. & Skinner, C. (2016). Street vendors and cities.16pp.

Rudder, A. (2006). Food Safety Risk Assessment of Ethnic Minority Food Retail Businesses. *Food Control,* 17(3), 189-196.

Said, M. D. (2006). Epidemic cholera in KwaZulu-Natal: The role of the natural and social Environment. The thesis for award of Doctor Degree of Philosophy at the University of Pretoria, South Africa. 230pp.

Samapundo, (2012). *Post-harvest handling, processing and preservation. Laboratory of Food Microbiology and* Roever, S. (2014). Informal Economy Monitoring Study Sector Report: Street VendorsCambridge, MA, USA: WIEGO.72pp.

Samapundo S., Climat R., Xhaferi, R. & Devlieghere, F., (2014). Food safety knowledge, attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti, *Food Control*, 50, 4576466.

Samapundo, S., Climat, R., Xhaferi, R. & Devlieghere, F. F. F. (2015). *Food safety knowledge, Attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti*, 50, 4576466.

Schmidt, C. (2011). Assessing the Cost-effectiveness of Alternative Measures Aimed at Reducing the Prevalence of Foodborne Microbiological Hazards. A Thesis for the award of the degree of Doctor of Philosophy at the University of Guelph, Canada. 240pp.

Seaman, P. & Eves, A. (2006). The Management of Food Safety-The Role of Food Hygiene Training in the United K Service Sector. *International Journal of Hospitality Management,* 25(2), 278-296.

Senderovich, Y., Izhaki, I. & Halpern, M. (2010). Fish as reservoirs and vectors of Vibrio cholerae, *Food control,* 50, 4576466.

Sievert, D.M., Ricks, P., Edwards, J.R., Schneider, A.& Limbago, B, (2013). National Healthcare Safety Network (NHSN) Team and Participating NHSN Facilities. Antimicrobial-resistant pathogens associated with healthcare-associated infections: summary of data reported to the National Healthcare Safety Network at the Centreøs for Disease Control and Prevention, 2009ó 2010. *Infectious Control Hospital Epidemiology,* 34 (1), 1ó14.

Singh, A., & Masuku, M. (2014). Sampling Techniques & Determination of Sample Size in Applied Statistics Research: An Overview. *International Journal of Economics, Commerce and Management*, II(11), 1-22.

Smith, S. (2008). Cholera óCopepod Connection? Received on 25th March, 2016 from; [http://yyy.rsmas.miami.edu/ groups/ohh/gallery/courses/4-sept8smith-cholera.pdf].

Sperber, W. H. & Doyle, M. P. (Eds.) (2009). *Compendium of the Microbiological Spoilage of Foods and Beverages*. Hardover: Springer.

Taché, J. & Carpentier, B. (2014). Hygiene in the home kitchen: Changes in behaviour and impact of key microbiological hazard control measures. *Food Control,* 35, 392-400.

TBS, (2016). *The Standard, Act 2009*27pp.

TDHS-MIS, (2016). *Tanzania Demographic and Health Survey and Malaria Indicator Survey 2015-16.* Dar es Salaam, Tanzania, and Rockville, Maryland, USA:MoHCDGEC, NBS, OCGS, and ICF. 630pp.

TEA, (2012). Food safety and sanitation guideline: Restaurant Management, retrieved on 20th July, 2017 from; [http://cte.sfasu.edu/wp-content/ uploads/2012/11/Food-Safety-and-Sanitation-Guidelines-Restaurant-Management-PPT.pdf].24pp.

TEA, (2015). Culinary Kitchen MatLucan h Calculations. [Http://cte.sfasu.edu/wp-content/uploads/2015/02/Culinary-Kitchen-Math-Calculations-PT.pdf].13pp. Visited on 30/06/2017.

TEA, (2014). Foundations of Safe Food Purchasing, Receiving and Storage 16pp. retrieved from on 30/06/2017 from; [http://axtellisd.net/view/619.pdf].

Tearfund, (2007). Sanitation and hygiene in developing countries: identifying and responding to barriers A case study from Madagascar, Research *reports* and studies.

Tesfaye, A. D., Moges, T. W., Feleke, M. Y. & Getnet, A. G. (2014). Prevalence and Antimicrobial Susceptibility Patterns of *Shigella* and *Salmonella Species* among Patients with Diarrhoea Attending Gondar Town Health Institutions, Northwest Ethiopia. *Science Journal of Public Health,* 2(5), 469-475.

Tessema, A. G., Gelaye, K. A. & Chercos, D. H. (2014). Factors affecting food handling Practices amongfood handlers of Dangila town food and drinkestablishments, North West Ethiopia. *BioMedCentralPublic Health,* BMC Public Health, 7(14), 571.

TFDA, (2016). The Tanzania Food, Drugs and Cosmetics Act, 2003.89pp.

Thanh, T. N. C, 2014). Food safety behaviour, attitudes and practices of street food vendors and consumers in Vietnam. A dissertation submitted for the award of Master degree of Science in Nutrition and Rural Development at Gent of University of Bioscience Engineering, Vietnam.77pp.

The Free Library, (2014). Public health and food safety in the WHO African region. (n.d.).[http://www.thefreelibrary.com/Public+health+and+food+safety+in+the+WHO+African+region. -a0301283177]. Sited on 24/05/ 2015.

The United Republic of Tanzania, (2018). National Population Projections: National Bureau of Statistics, Ministry of Finance and Planning Dar es Salaam and Office of the Chief Government Statistician Ministry of Finance and Planning Zanzibar, Tanzania.

Tiisekwa, A. B. (2013). Compliance by street salad and juice vendors with national food Safety and quality requirements a case of Morogoro municipality, Tanzania. A dissertation submitted for award of Master degree of Science in Food Science at Sokoine University of Agriculture, Morogoro, and Tanzania.110pp.

Todd, E. C., Greig, J. D., Bartleson, C. A. & Michaels, B. S., (2007a). Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 2 Description of outbreaks by size, severity and settings. *Journal of Food Protection*, 70(8), 1975-1993.

Todd, E. C., Greig, J. D., Bartleson, C. A. & Michaels, B. S. (2007b). Outbreaks where Food Workers have been implicated in the Spread of Foodborne Disease. Part 3. Factors Contributing to Outbreaks and Description of Outbreak Categories. *Journal Food Protection*; 7, 219962217.

UN, (2015). Department of Economic and Social Affairs, Population Division World Population Prospects: The 2015 Revision, Key Findings and Advance Tables, Working Paper No. ESA/P/WP.241.

UN, (2013). Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2012 Revision, New York, 2013. [http://data.un.org/Data.aspx? d=PopDiv&f=variableID%3A43]. Visited on 24/02/2016.

UNICEF, (2010). Children and Women in Tanzania, Volume 1Mainland, retrieved on 20th October, 2016 from; [http://www.unicef.org/tanzania/SITAN_ Mainland_report.pdf]. Visited on 20/10/2016.

Veras J. F., Carmo L. S., Tong L. C., Shop J. W., Cummings C., Santos D. A., Cerqueira, M. M. O. P., Cantini A., Nicoli, J. R. & Jett M. (2008)**.** A study of the enterotoxigenicity of coagulase negative and coagulase positive staphylococcal isolates from food poisoning outbreaks in Minas Gerais Brazil. *Jounal of Infectious Diseases*, 12, 410-415.

Water Aid, (2015). *Post-MDGs toolkit: The post-2015 framework: How it will happen*. Retrieved on 30th December, 2015 from; [http://www.makepoverty history.com.au/wp-content/uploads/2013/06/Wateraid-Post-MDGs-toolkit.pdf

Water in the World We Want. (2019). SDG 6 Project Final Report. United Nations University Institute for Water, Environment and Health; United Nations Office for Sustainable Development; Korea Environment Corporation; Ministry of Environment, Republic of Korea. 28pp.

WHO, (2006). *Food Safety; WHO-AFRO*: Brazzaville, Congo.

WHO, (2007a). *Initiative to Estimate the Global Burden of Foodborne Diseases* [http://www.who.int/foodsafety/foodborne_disease/ferg/en/index.html]. Visited on 20/10/2016.

WHO, (2007b). WHO Five Keys to Safer Foods in the African Region.27pp.

WHO, (2008a).*Foodborne disease outbreaks: Guidelines for investigation and control*, 162pp. [http//www.who.int/foodsafety/publications/foodborne disease/outbreak_guidelines.pdf]. Visited on 21/10/2016.

WHO, (2010). *World Health Organization Equity and Social Determinants of PublicHealth programmes*, Edited by Blas E and AS Kurup. Geneva 2010.

WHO, (2011). Food safety and foodborne illness; Fact sheet N°237. [http://www.who.int/mediacentre/factsheets/fs237/en]. Sited on 30/9/2016.

WHO, (2012). Five keys to growing safer fruits and vegetables: promoting health by Decreasing microbial contamination. Publication by WHO, Geneva 27, Switzerland 40pp.

WHO, (2014). Preventing diarrhoeal better water, sanitation and hygiene exposures and Impacts in low-and middle-income countries. Geneva.

WHO, (2016). Five Keys to safer aquaculture products to protect public health. Publication by WHO, Geneva 27, Switzerland. 40pp.

Zain, M. E. (2011). Impact of mycotoxins on humans and animals. *Journal of Saudi Chemical Society*, 15(2), 129-144.

Zeru, K. & Kumie, A. (2007). Sanitary conditions of food establishments in Mekelle town, Tigray, north Ethiopia. *Ethiopian Journal of Health Development*, 21, 3-11.

APPENDIXES

Appendix 1.1: Informed Consent Form-English version

THE OPEN UNIVERSITY OF TANZANIA
DIRECTORATE OF RESEARCH, PUBLICATIONS AND POSTGRADUATE STUDIES

P.O. Box 23409,
Dar es Salaam, Tanzania
http://www.out.ac.t

Tel: 255-22-2666752/2668445 ext.210
Mail: drpc@out.ac.

Informed Consent Form

I am a postgraduate student at The Open University of Tanzania. My name is Peter Ludoviki Meleki and I can be contacted at 0756449455: E-mail: peter_meleki@yahoo.co.uk.

I am health expert taking PhD study focused on WHO five Keys to Safe Food. As a course requirement, I require to collect information on how street food vendors complied with WHO five keys to safe food with inferences to diarrhoeal diseases. I am therefore asking if you would agree to participate in my research by answering a questionnaire of which you will be asked open and closed, multiple, true and false questions while at the workplace. The questions will take up to 30 minutes. However, questions will include details about your social affairs, demographics, your own personal details and views, feelings on food handling practices.

There are minimal risks for participation in this study. However, you may feel emotional discomfort when answering questions about personal beliefs. There are no direct benefits to subjects. Though, it is hoped that your participation will help researchers to learn more about how social influences and affect attitudes towards compliance to WHO five keys to safe food. All information provided will be confidential and will only be reported as group data with any identified information.

All data, including questionnaires, will be kept in a secure location and only those directly involved with the research will have access to them. After the research is

completed, and data analysed and inferences drawn the questionnaires will be destroyed by shredding or burning.

You do not have to participate at all, or, even if you agree now, you can terminate your participation at any time without prejudice. You also do not have to answer individual questions you do not want to answer. Your name will not be attached to the questionnaire and I will ensure that your participation remains confidential. This consent form will be kept separate from the questionnaire for all participants.

A benefit you may experience by participating in this study is greater knowledge of your perceptions/feelings about the compliance to WHO five keys to safe food.

If you have any questions or concerns, please feel free to ask me phone: 0756 449455 or NatHREC via óe-mail: hq@nimr.or.tz/info@nimr.or.tz
I have read, understood, and received a copy of the above consent and desire of my own
free will and volition to participate in this study.

Participantøssignature: _____ Date: _____

Researcherøs signature: _____ Date_____

Appendix 1: Fomu ya Makubaliano ya Utafiti -Kiswahili version

CHUO KIKUU HURIA CHA TANZANIA
KURUGENZI YA UTAFITI, UENEZAJI HABARI NA MAFUNZO YA UZAMILI

S.L.P 23409
Dar-es-Salaam, Tanzania
http://www.out.ac.tz

Simu: 255-22-2666752/2668445 ext 210
Barua pepe: drpc@out.ac.tz

Fomu ya Makubaliano ya Utafiti

Mimi ni mwanafunzi wa Chuo Kikuu Huria cha Tanzania. Jina langu ni Peter Ludoviki Meleki.Ninasoma shahada ya uzamivu: mawasiliano yangu ya simu: 0756449455: barua pepe: peter_meleki@yahoo.co.uk.

Mimi ni mtalaamu wa Afya katika Ofisi ya Sekretarieti ya Mkoa wa Mbeya ninafanya utafiti juu ya kanuni tano za Umoja wa Mataifa zinazolenga usalama wa vyakula dhidi ya magonjwa ya kuharisha.

Nitahitaji kukusanya takwimu kutoka kwa Mama/Baba lishe ili kuweza kubaini jinsi kanunitano za usalama wa vyakulazinavyotekelezwa. Nitakuuliza kama utapenda kushiriki katika utafiti kwa kujibu wa maswali ambayo yapo kwenye dodoso. Yapo maswali ya moja kwa moja, ya kuchagua, ya kujibu kweli/si kweli, ndiyo/ hapana na utayajibu wakati ukiendelea na kazi yako ya kuhudumia wateja. Maswali yatachukua takribani dakika 30.

Baadhi ya maswali yatahusu taarifa zako binafsi, hali ya maisha, biashara yako pamoja na mazingira unayofanyia kazi, maoni na mapendekezo juu ya biashara ya Mama/Baba lishe.

Pia nakuhakikishia kuwa Hakuna hatari ya kushiriki katika utafiti huu, isipokuwa unaweza usijisikie vizuri unapojibu masawli kulingana na dhamira yako au imani yako. Pia hakuna faida ya moja kwa moja kutokana na kujibu maswali utafiti huu. Hata hivyo ni mategemeo yangu kuwa ushiriki wako utasaidia msahili kujifunza mwenendo mzima katika tasnia ya Mama/Baba lishe dhidi ya utekelezaji wa kanuni tano za utayarishaji wa vyakula salama.

Taarifa zote utakazotoa zitakuwa siri, takwimu zitakazokusanywa hazitaandikwa kwa majina. Madodoso yatahifadhiwa mahali salama ni watafiti tu ndiyo watakaohusika kuyahifadhi. Baada ya utafiti madodoso yatatupwa kwa usalama ili kulinda usiri wa wasahiliwa.

Unaweza kutokushiriki auhata kama ukikubali sasa napo unaweza kukataa muda wowote bila kulazimishwa.Si lazima kujibu maswali ya binafsi kama hutaki kujibu. Jina lako halitaandikwa kwenye dodoso ulilojibia na utahakikishwa kuwa ushiriki wako utakuwa siri. Aidha fomu hii itawekwa tofauti na dodoso utakalojibia.

Faida ya kushiriki katika utafiti huu ni pamoja na kupata ufahamu, wako jinsi unavyotekeleza kanuni tano za kutayarisha chakula bora na salama. Kama una swali lolote au dukuduku, tafadhali uwe huru kuniuliza kupitia simu: 0756449455 au kuandikia kwa kamati ya Maadili ya Utafiti Taifa barua pepe: hq@nimr.or.tz/info@nimr.or.tz.

Nimesoma, na kuelewa na nimepokea nakala ya fomu ya makubaliano na nina uhuru wa kuamua mwenyewe kushiriki/kutokushiriki katika utafiti huu.

Saini ya anayesahiliwa: _____ Tarehe:

_____

Saini ya msahili:_____ Tarehe:_____

Appendix 2: Questionnaires for data collection-English version

Part one:

Demographic profile data**:**

Region--------------- Council------------ Ward -------------- Street----------------------------------

Name of interviewer: ------------------------- Start time--------- Finish time: --------------------

---------------- Signature of interviewer----------------- Date----/-----/-------------------------------

Personal particulars:

1. Working place of the respondent: 1=Urban 2= Semi-urban

2. How old are you: [-----]

3. Sex: 1= female   2=male 4. Can you tell us your tribe: --------------?

5. Marital status: 1=single 2=married/spouse 3= widow/widower 4=divorce 5) separate

6. Education level: 5= university 4=college 3=secondary 2=primary 1= no school

7. Are you a full or a part-time street food vendor: --

8. Can you tell us your average income per day? --

9. Is there any person(s) assist you in doing your business? 1= Yes 2= No if yes how many--

   and what is your relationship? 1) Casualhelper(s) 2) son/daughter 3) young brother/sister

   4) uncle 5) others specify---------- If no why? --

10. What types of food do you sell? Mention it --

11 Can you tell me how many customers do you serve a day--------

12. What resources of food handling are available do you use?

1	Safe water	4	Electricity	7	Warm pans	10	Cupboard
2	Running water	5	Waste disposal	8	Hot pots plastic	11	Oven
3	Thermometer	6	Refrigerator	9	Cutleries/crockery	12	shelves

   Others specify:---

13. Do you have Personal Protective Equipment? 1= yes, 2=no if yes list them-----------------

   If not,why? --

14. Have you ever received any training in food handling? 1=yes 2=no

   If yes mention training-------------when did it conducted-------------- and duration of the

   Training---- if no how do you manage handling food? --

15. Where do you hear about good food handling practice?

1	posters	4	newspaper	7	parents	10	Meeting
2	radio	5	friends	8	colleges	11	internet
3	drama	6	Manager/chef	9	Video/TV		

Others specify:_____

16. What are the reasons that made you to engaging on food handling business? --------

17. Can you tell how many times city Health Officers visited you here for food handling inspection within the last six months: 1) every week 2) every month 3) every aftertwo months 4) never. Others specify:-------------------------

18. What type of food do you prepare**:** 1) Ready to eat 2) cooked on site 3) raw 4) cooked on site And raw

19. Is street food vending an important mean of employment to you? 1=yes 2=no; If yes why-----------------------------------If not why? ----------------------------------

20. Are Street-vended food a significant part of the urban food supply. 1=yes 2=no If yes why---if not why? -------------------------------

21. What type of supportive infrastructure did the street food vendor serve? 1) open space 2) pulled cart 3) roadside stands 4) food stalls 5) paving-side shops others specify:-----------

22. Do you have ever joined with any club include: 1) Food Handler Association 2) Football 3) Business Food Association. Others specify:-------------------

Part two: WHO Five keys tosafe food: Pre and Post-test questionnaire

Knowledge: Key 1 – Keep clean

No	Category	T=True	F=False	1=Correct 2=Incorrect
* Please tick [✓] in the checkbox provided (Number 1 and 2 is for interviewer use only)				
1	Do you think it is important to wash hands before handling food.	❏	❏	
2	Wiping cloths can spread microorganisms.	❏	❏	
Key 2 – Separate raw and cooked				
3	The same cutting board can be used for raw and cooked foods provided it looks clean.	❏	❏	
4	Raw food requires to be stored separately from cooked food.	❏	❏	
Key 3 – Cook thoroughly				
5	Cooked food does not require to be thoroughly reheated.	❏	❏	
6	Proper cooking temperature includes meat cooked to 40 °C.	❏	❏	
7	Food should not be left at room temperature for more than 2 hours.	❏	❏	
Key 4 – Keep food at safe temperatures				
8	Cooked meat can be left at room temperature overnight to cool before refrigerating.	❏	❏	
9	Cooked food should be kept very hot before serving	❏	❏	
10	Refrigerating food only slows bacterial growth.	❏	❏	
Key 5 – Use safe water and raw materials				
11	Safe water can be identified by the way it looks.	❏	❏	
12	Safe water used to wash fruit and vegetables.	❏	❏	

Attitude: Key 1 – Keep clean

* Please tick [✓] in the checkbox provided for a correct answer)				
N0	Category	1=Agree	2=Not sure	3=Disagree
13	Frequent hand-washing during food preparation is worth the extra time.	❏	❏	❏
14	Hands should be washed with water and soap for at least 5 seconds.	❏	❏	❏
15	Keeping kitchen surfaces clean reduce the risk of diseases.	❏	❏	❏
Key 2 – Separate raw and cooked				
16	Keeping raw and cooked food separate helps to prevent disease.	❏	❏	❏
17	Using different knives and cutting boards for raw and cooked foods is worth the extra effort.	❏	❏	❏
Key 3 – Cook thoroughly				
18	Meat thermometers are useful for ensuring food is cooked thoroughly.	❏	❏	❏
19	Soups and stews should always be boiled to ensure safety.	❏	❏	❏
Key 4 – Keep food at safe temperatures				
20	Thawing food in a cool place is safe.	❏	❏	❏
21	Do you think it is unsafe to leave cooked food out of the refrigerator for more than two hours.	❏	❏	❏
Key 5 – Use safe water and raw materials				
22	Inspecting food for freshness and wholesomeness is valuable.	❏	❏	❏
23	Do you think it is important to throw away food that has reached their expired date?	❏	❏	❏

No	Category	Always=1	Most times=2	Some Times =3	Not often=4	Never =5
**Practice: Self-reported individual behaviour Key 1 – Keep clean**
* Please tick [✓] in the checkbox provided for a correct answer)
24	Do you wash your hands before and during food preparation.	❏	❏	❏	❏	❏
25	Do you clean surfaces and equipment used for food preparation before re-using on other food.	❏	❏	❏	❏	❏
Key 2 – Separate raw and cooked						
26	Do you use separate utensils and cutting-boards when preparing raw and cooked food.	❏	❏	❏	❏	❏
27	Do you separate raw and cooked food during storage.	❏	❏	❏	❏	❏
Key 3 – Cook thoroughly						
28	Do you check that meats are cooked thoroughly by ensuring that the juices are clear or by using a thermometer.	❏	❏	❏	❏	❏
29	Do you re-heat cooked food until it is piping hot throughout.	❏	❏	❏	❏	❏
Key 4 – Keep food at safe temperatures						
30	Do you thaw/defrost frozen food in the refrigerator or another cool place.	❏	❏	❏	❏	❏
31	After you have cooked a meal do you store any left-over in a cool place within two hours.	❏	❏	❏	❏	❏
Key 5 – Use safe water and raw materials						
32	Do you check and throw away food beyond its expiry date.	❏	❏	❏	❏	❏
33	Do you wash fruit and vegetables with safe water before eating them.	❏	❏	❏	❏	❏
Source: adapted from (WHO, 2006)						

Part 3: Observational checklist

	Food hygiene utensils checklist interviewer circle the answer if the respondent has it at the point of sale			
	*Please tick [✓] in the checkbox provided (**Remarks is for interviewer only**)			
No	**Question**	**Answers**		
		Yes= 1	**No = 2**	**Remarks**
1	A piped water tap with hot/ an improvised container rust less or water for washing utensils and hands.	❏	❏	
2	Spout container for drinking water.	❏	❏	
3	Narrow-mouthed container for water storage.	❏	❏	
4	Wide-mouthed container for water storage.	❏	❏	
5	A bowl/cup/kettle powering for washing hands.	❏	❏	
6	A bowl or buckets for washing utensils.	❏	❏	
7	Clean hand drying machine/ tissue paper disposable.	❏	❏	
8	Soap powder or liquid for washing utensils.	❏	❏	
9	Use of water guard /candle filter.	❏	❏	
10	Packets/bottles of used water guard.	❏	❏	
11	Use broom and mops for cleaning.	❏	❏	
12	Do waste bins have lids? /pedal operated?	❏	❏	
13	All refrigerators kept at below 4°C.	❏	❏	
14	All freezers hold food at below -18°C.	❏	❏	
15	Plastic tablecloths.	❏	❏	
16	Pots with lids or covers for cooked food.	❏	❏	
17	Using a cloth for wiping hands, spillages, and boards.	❏	❏	
18	Single-use paper handkerchief is preferable.	❏	❏	
19	Availability equipment for testing cooked food-thermometer.	❏	❏	
20	Dress in clean light-colour (white) and proper			

No	Question	Yes	No	Remarks
	attire-open toe sandals, strong smelling perfume and aftershave not allowed.	❏	❏	
21	Chopping knives colour coded.	❏	❏	
22	Cutting/chopping board coloured coded.	❏	❏	
23	Clean towels for wiping crockery.	❏	❏	
24	The presence of food warmer utensils.	❏	❏	
25	Separate area for storing, preparing raw food apart from the cooked, cleaning and serving areas.	❏	❏	
26	Use clean tongs, forks, spoons or disposable gloves when handling, serving or selling food and avoid bare hands.	❏	❏	
27	Non-perishable food to be stored in a clean protected and closed container/cupboard to prevent cross-contamination by pests.	❏	❏	

Food Hygiene: Practices of individual behaviour

*Please tick [✓] in the checkbox provided (Remarks is for interviewer only)

No	Question	Answers		
		Yes= 1	No = 2	Remarks
28	Fingernails kept short and clean-nail polish is not allowed.	❏	❏	
29	Free from jewellery, chains, and watches (only plain wedding band and sleeper earrings) are acceptable during food preparation.	❏	❏	
30	Boils and cuts protected by green or blue waterproof plaster (metal detectable if required).	❏	❏	
31	Eating and cooking utensils are kept in the stored upside down.	❏	❏	
32	Presence of insects, pests and pets animals.	❏	❏	
33	Control: smoking, spitting, chewing gums, eating and sneezing or coughing onto food.	❏	❏	
34	Control: spitting and cleaning nose, ears or any			

	other body orifice.	❏	❏	
35	Presence of any defective, damaged, cracked, rusted, chipped and unsuitable utensils and crockery are discarded.	❏	❏	
36	Avoid touching food contact surfaces of the crockery.	❏	❏	
37	Plates filled with food should not be stacked one on top of the other during display, storing or serving.	❏	❏	
38	Printed material never used to serve food. Aluminium foil, waxed paper, food grade plastic to be used for packing and serving food.	❏	❏	
39	Never blow into plastic bags, wrappers or packages used for food.	❏	❏	
40	All beverages offered for sale should be dispensed only in their individual original sealed containers or from taps fitted to bulk containers Bulk containers should be covered wita h tight-fitting lid.	❏	❏	
41	Street food vendors should avoid handling money. If this is unavoidable, the food handler should wash his hands after handling money and before handling food again.	❏	❏	
42	Ready-to-eat foods intended for continuous serving should be kept at the following holding temperatures for food served hot 63°C or above.	❏	❏	
43	For food served cold at 7°C or below.	❏	❏	
44	For food served frozen.-18°C or below.	❏	❏	
45	Readily perishable food should be placed or stacked in clean containers placed in a clean ice box or refrigerator in which the food should not exceed a temperature 10°C.	❏	❏	

46	All enclosed spaces, cupboards, shelves and racks used for the storage of food should be constructed so as to be easily cleaned and to protect the food from pests.	❏	❏	
47	The principle õFirst in, first outö should be applied tthe o stock rotation and date marking on all food containers shall be checked before the food is used.	❏	❏	
48	Expired food to be separated from unexpired and shall not be sold or used for the preparation of food.	❏	❏	
49	Soak and thoroughly wash fresh vegetables and fruit whether for cooking or consuming raw, with sufficient running safe water, to remove adhering surface contamination.	❏	❏	
50	Infected handler is not allowed to serving food.	❏	❏	
51	Check if there is/are pupil(s) dressed in uniform while assisting serving food.	❏	❏	
Source: Based on Author's formulation, 2019				

Appendix 3: Madodoso ya kukusanya takwimu-Kiswahili version

Sehemu ya kwanza 1: Takwimu za Utambulisho**:**

Mkoa--------------- Halmashauri------------ Kata -------------- Mtaa/Kitongoji----------------------------

Namba ya mhojiwa: ----------------------- Muda wa kuanza--------- Muda wa kumaliza: --------------

Sahihi ya anayehoji--- tarehe----/-----/-------------------------

Sehemu ya Pili: Taarifa binafsi za Mhojiwa:

1. Mahali anapoishi mhojiwa: 1=Mjini 2= pembeni mwa mji

2. Je, unaweza kunitajia miaka/ umri wako?_____

3. Jinsi yako ni: 1= Mwanaume 2= Mwanamke

4. Je, Unaweza kunitajia kabila lako: 1) Kyusa 2) Safwa 3) Ndari) mwinginetaja:-----------------------

5. Je unaweza kuniambia hali yako ya ndoa: 1=Hajaoa/Hajaolewa 2=Ameoa/ameolewa

   3= Mjane 4= Mtalaka

6. Je, unaweza kunitajia kiwango chako cha elimu?1=hakna shule 2=shule ya msingi

    3=sekondari 4.Chuo 5. Chuo kikuu

7. Je, umesajiliwa kama Mama/Baba Lishe? 1=ndio 2= hapana kama ndio tangu lini --------------------

    kama hapana kwa nini?--

8. Je, shughuli yako hii unafanya kwa muda au ndio shughuli yako ya kujipatia kipata?: 1=muda

    2= ya kudumu

9. Je, kuna mtu/watu wa/anayekusaidia katika biashara yako? 1=ndio 2=hapana kama ni ndio

    Je, anayekusaidia ni 1= vi/kibarua 2= mtoto/watoto 3= shemeji 4= mjomba/wajomba. Wengine

wataje---

10. Je, unaweza kuniambia kwa wastani katika siku moja unauweza chakula cha shilingi ngapi?----

11. Je, wewe kwa kawaida unauza vyakula vya aina gani? --

12. Je, wewe unatumia vifaa vya aina gani katika kutayarisha vyakula vyako?

1	Maji salama	4	Umeme	7	Sufuria za moto poa	10	Kabati
2	Friji	5	Kifaa cha taka	8	Hot poti	11	Oveni
3	Themometa	6	Maji ya kutiririka	9	Sahani na glasi	12	Shelfu

    vingine taja:--

13. Je, una vifaa vya usafi kwa ajili ya kujizuia na maambukizi ya magonjwa? 1-ndio

     2=hapana kama ndio vitaje:------------------------------------- kama hapana hauna kwa nini?----

14. Umewahi kupata mafunzo yoyote juu namna ya kutayarisha vyakula? 1=ndio 2= hapana

     kama ndio taja hayo mafunzo ------------------------na mafunzo hayo uliyapata lini?-------------na

     pia mafunzo yalikuwa ya muda gani?1=wiki 2=mwezi 3=mwaka 4=elezea muda--------------------

     kama jibu ni hapana unawezaje kuendesha/kumudu shughuli ya Mama/Baba Lishe

     ----

15. Je, wewe kama Mama/Baba Lishe kabla hujaanza kufanya shughuli hii habari za biashara za Mama/Baba lishe ulisikia/ulizipata kutoka wapi?

1. Wazazi, rafiki na redio 2. Mpishi, chuo na vido/TV 3. Mkutano mabango ana ngoma ene; lingine taja:---

16. Je, wewe kama Mama/Baba Lishe ni sababu gani zilikufanya ujishirikishe na biashara hii?--

17. Katika kipindi cha miezi sita unaweza kunitajia Maafisa Afya wa Jiji wamekutembelea mara ngapi kwa ajili ya kukagua shughuli zako

1)mara moja kwa wiki 2) mara moja kwa mwezi 3) mara moja kwa miezi miwili 4) kamwe

5) elezea safari walizotembelea:---

18. Je Mama/Baba lishe ana cheti cha kupima Afya (1) Ndio (2) hapana kama ndio cheti kipo ukutani kama hapana kwanini?---

19. Unaweza kunitajia aina ya biashara yako ya Mama/Baba Lishe 1) Unauza chakula Kilichopikwa tayari 2) Unapikia chakula chako hapa 3) Unauza vyakula ambavyo havijapikwa 4) Unauza vyakula vilivyopikwa tayari na vingine ambavyo havijapikwa

20. Je, unafikiri biashara ya Mama/Baba Lishe ni muhimu na pia ni njia mojwapo ya kuongeza ajira? 1= ndio 2= hapana kama jibu ni ndio eleza kwa nini?------------------------- kama jibu ni hapana eleza kwa nini?---

21. Je, vyakula vya Mama Lishe vina muhimu katika kuongeza uwepo wa huduma za vyakula hapa mijini? ---

22. Je chakula chako unakiuzia katika jengo la namna gani? I= eneo la wazi kando kando ya maduka 2= eneo la wazi pembeni mwa barabara 3 = kwenye toroli la kuvutwa 4= kwenye kibanda cha muda 5= eneo lingine elezea--

23. Je, umejiunga na chama chochote mathalani: 1= ndiyo 2= hapana kama ndiyo taja: 1) Chama cha wauza vyakula 2) Chama cha Mpira 3) Chama cha Wafanya Biashara. Chama kingine taja---
----

Sehemu ya Pili: Misingi mitano ya chakula salama: Dodoso la Awali na Marudio

Ufahamu: Ufungo namba 1: Kujiweka salama

Weka alama ya [✓] kwenye kiboksi (namba1 na 2 ni kwa matumizi na muuliza maswali)				
Na	**Shughuli**	**N=Ndio**	**H=Hapana**	**1=Sahihi 2=sisahihi**
1	Je, unafikiri ni muhimu kunawa mikono kabla ya kutayarisha chakula.	❏	❏	
2	Vitambaa vya kuvutia meza na vyombo vinaweza kusambaza vijidudu vya magonjwa.	❏	❏	
Ufunguo namba 2: Tenganisha chakula kibichi na kilichopikwa				
3	Ubao wa kutayarishia vyakula vibichi unaweza kutayarishia vyakula vilivyopikwa mradi tu kama unaonekana ni msafi.	❏	❏	
4	Vyakula vibichi vinaweza kuchanganywa na vyakula vilivyopikwa.	❏	❏	
Ufunguo namba 3 – Pika vyakula mpaka uhakikishe vimeiva				
5	Vyakula vilivyopikwa havihitaji kupasha moto tena.	❏	❏	
6	Nyama inatakiwa ipikwe katika joto lisilozidi nyusi joto40°$_C$?	❏	❏	
7	Chakula hakitakiwi kukaa katika joto la ndani ya nyumba kwa zaidi ya masaa 2.	❏	❏	
Ufungo namba 4: Hifadhi vyakula katika joto salama				
8	Nyama iliyopikwa inaweza kuachwa katika joto la ndani ya nyumba usiku kucha ili izipoe kabla haijawekwa kwenye friji.	❏	❏	
9	Vyakula vilvyopikwa ni lazima vihifadhiwe vikiwa moto kabla havijaliwa.	❏	❏	
10	Vyakula vilivyogandishwa vinazuia bacteria kuota.	❏	❏	
Ufunguo namba 5: Tumia maji na vyakula vibichi vilivyosalama				
11	Maji salama unaweza kuyatambua kwa jinsi yanavyoonekana.	❏	❏	
12	Maji salama yanatumika kuosha matunda na			

Weka alama ya [✓] kwenye kiboksi (namba1 na 2 ni kwa matumizi na muuliza maswali)			
Na	Shughuli	N=Ndio	H=Hap ana	1=Sahihi 2=sisahihi
	mboga mboga.	❏	❏	

Tabia: Ufunguo namba 1 – Kujiweka salama

Weka alama ya [✓] kwenye jibu sahihi ndani ya kiboksi				
Na	Shughuli	Nakubali =1	Sina uhakika =2	Siku-baliani =3
13	Kuosha mikono mara kwa mara wakati wa kutayarisha vyakula ni kupoteza muda.	❏	❏	❏
14	Inatakiwa kunawa mikono kwa maji na sabuni kwa muda usiopungua sekunde 5.	❏	❏	❏
15	Kuweka jiko katika hali ya usafi hupunguza uwezekano wa kupata maambukizi ya magonjwa.	❏	❏	❏
Ufunguo namba 2: Kutenganisha vyakula vibichi na vilivyopikwa				
16	Kutenganisha vyakula vibichi na vilivyopikwa inasaidia kuzuia magonjwa.	❏	❏	❏
17	Kutumia visu na vibau/meza tofauti kwa vyakula vibichi na vilivyopikwa ni muhimu.	❏	❏	❏
Ufunguo namba 3: Pika chakula mpaka kiive vizuri				
18	Madhumuni ya themometa ya nyama ni kuhakikisha kuwa nyama imepikwa na kuiva vizuri.	❏	❏	❏
19	Supu na nyama ni lazima ichemshwe ili kuhakikisha usalama wake.	❏	❏	❏
Ufunguo namba 4: Hifadhi chakula katika joto salama				
20	Je, ni salama kuyeyusha chakula kilichogandishwa katika eneo la ubaridi	❏	❏	❏

Weka alama ya [✓] kwenye jibu sahihi ndani ya kiboksi				
Na	Shughuli	Nakubali =1	Sina uhakika =2	Siku-baliani =3
21	Je, unafikiri kuwa si salama kuacha chakula kilichopikwa nje ya friji kwa zaidi ya masaa 2?	❏	❏	❏
Ufunguo namba 5: Tumia maji na vyakula vibichi vilivyosalama				
22	Je, ni muhimu vyakula vikaguliwe kwa madhuni ya kuthibitisha ubora na usalama wake?	❏	❏	❏
23	Je, unafikiri ni muhimu kutupa vyakula ambavyo tarehe zake za kutumika zimeisha?	❏	❏	❏

.

Taarifa inayohusu tabia ya utendaji wa mtu binafsi					
Ufunguo namba 1: Kujiweka salama					
Weka alama ya [✓] kwenye jibu sahihi ndani ya kiboksi					
Na	Shughuli	Mara kwa mara=1	Mara nyingi =2	Wakati mwingine= 3	Sio mara zote =4	Kamwe =5
24	Je, unanawa mikono kabla na wakati wa kutayarisha vyakula.	❏	❏	❏	❏	❏
25	Je, unasafisha vifaa vilivyo tumika kutayarisha chakula kimoja kabla ya kuvitumia kwenye matayarisho ya vyakula vingine.	❏	❏	❏	❏	❏
Ufunguo namba 2: Kutenganisha vyakula vibichi na vilivyopikwa					
26	Je , unatumia vifaa tofauti na vibao/meza tofauti wakati unapotayarisha vyakula vibichi na vilivyopikwa.	❏	❏	❏	❏	❏
27	Je, unatenganisha vyakula vibichi na vilivyopikwa wakati	❏	❏	❏	❏	❏

Na	Shughuli	Mara kwa mara=1	Mara nyingi =2	Wakati mwingine= 3	Sio mara zote =4	Kamwe =5

Taarifa inayohusu tabia ya utendaji wa mtu binafsi

Ufunguo namba 1: Kujiweka salama

Weka alama ya [✓] kwenye jibu sahihi ndani ya kiboksi

	wa kuhifadhi.					

Ufunguo namba 3: Pika chakula mpaka kiive vizuri

| 28 | Je, unaangalia nyama kama imeifa vizuri kwa kuangalia kama ina inatoa maji meupe au kwa kutumia themometa? | ❏ | ❏ | ❏ | ❏ | ❏ |
| 29 | Je, chakula kilichopoa unapasha moto mpaka kionyeshe dalili ya kuchemka kupata moto vya kutosha? | ❏ | ❏ | ❏ | ❏ | ❏ |

Ufunguo namba 4: Hifadhi vyakula katika joto salama

| 30 | Je, unayeyusha chakula kilichogandishwa kwa kuweka sehemu ya ubaridi. | ❏ | ❏ | ❏ | ❏ | ❏ |
| 31 | Je, baada ya kutayarisha chakula, unahifadhi kiporo sehemu ya baridi ndani ya muda wa masaa mawili. | ❏ | ❏ | ❏ | ❏ | ❏ |

Ufunguo namba 5: Tumia maji na vyakula vibichi vilivyosalama

| 32 | Je, unakagua na kutupa vyakula ambavyo vimeisha muda wake. | ❏ | ❏ | ❏ | ❏ | ❏ |
| 33 | Je, unaosha matunda na mboga mboga kwa maji safi na salama kabla ya kula. | ❏ | ❏ | ❏ | ❏ | ❏ |

Chanzo: Dodoso limeasiliwa kutoka (WHO, 2006)

Sehemu ya 3: Dodoso la kuangalia Mama/Baba Lishe namna anavyotayarisha na kutoa huduma za vyakula kwa wateja

	Kipengele kinachohusu vifaa anavyotumia Mama/Baba Lishe ambavyo Msahili ataviwekeaalama ya [✓] kama vipo sehemu ya kutolea huduma			
Na	**Swali**	**Majibu**		
		Ndio = 1	**Hapana = 2**	**Ushauri =3**
1	Kuna bomba la maji moto/chombo cha kuwekea ambacho hakina kutu kwa ajili ya kuoshea vyombo na kunawia mikono.	❏	❏	
2	Kuna chombo maalumu kwa ajili ya kuwekea maji ya kunywa (Spout container).	❏	❏	
3	Kuna chombo cha chenye mdomo mwembamba kwa ajili ya kuwekea maji ya kunywa.	❏	❏	
4	Kuna chombo cha chenye mdomo mpana kwa ajili ya kuhifadhia maji ya kunywa.	❏	❏	
5	Sahani au kikombe/birika kwa ajili ya kumiminia maji ya kunawa mikono.	❏	❏	
6	Kuna sahani au ndoo kwa ajili ya kuoshea mikono.	❏	❏	
7	Kuna mashine/karatasi za tishu kwa ajili ya kukaushia mikono.	❏	❏	
8	Kuna sabuni ya unga/maji kwa ajili ya kuosha vyombo.	❏	❏	
9	Je, dawa ya kutibu maji/filta ya maji ya kunywa.	❏	❏	
10	Kuna paketi/chupa za dawa ya kutibu maji zilizotumika.	❏	❏	
11	Mopu na brumu zinatumika katika kufanya usafi.	❏	❏	
12	Vifaa vya taka vina vifuniko/au vinafunuliwa kwa miguu.	❏	❏	
13	Friji zote zina joto la chini ya 4^oC.	❏	❏	
14	Freza zote zina ubaridi wa chini ya -18^oC.	❏	❏	
15	Meza zimefunikwa na plastiki.	❏	❏	
16	Sufuria za kupikia zina mifuniko/zinafunikwa.	❏	❏	

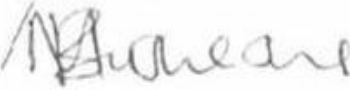| Kipengele kinachohusu vifaa anavyotumia Mama/Baba Lishe ambavyo Msahili ataviwekeaalama ya [✓] kama vipo sehemu ya kutolea huduma			
Na	**Swali**	**Majibu**		
		Ndio = 1	**Hapana = 2**	**Ushauri =3**
17	Nguo inatumika kukausha mikono, meza na vyakula vilivyomwagika.	❏	❏	
18	Handikachifu/karatasi ya tisu inatumika mara moja tu.	❏	❏	
19	Kuna themometa ya kuangalia kama chakula kimeiva.	❏	❏	
20	Mtoa huduma amevaa ngua rasmi nyeupe,viatu ambavyo havioneshi vidole na pafumi nzito hazitakiwi.	❏	❏	
21	Visu vya kukatia nyama na mboga mboga vimetanganishwa kwa rangi?	❏	❏	
22	Vibao na meza za kukatia nyama na mboga mboga vimetanganishwa kwa rangi?	❏	❏	
23	Kuna taulo safi la kukaushia vyombo	❏	❏	
24	Kuna mashine ya kupashia vifaa joto.	❏	❏	
25	Kuna sehemu za kuhifadhia, kutayarishia vyakula vibichi na vilivyopikwa, kusafishia na kutolea huduma.	❏	❏	
26	Kuna matumizi safi ya uma, vijiko, glafu wakati wa kuhudumia vyakula, kuepuka kutumia mikono.	❏	❏	
27	Vyakula vinahifadhiwa kwenye stoo safi, kama vile vyombo, makabati ili kuzuia kuchafuliwa na wadudu?	❏	❏	
28	Kucha ni fupi na safi, rangi kwengye kucha hairuhusiwi.	❏	❏	
29	Uvaaji wa pete, cheini, mikufu, bangili na saa isipokua pete ya harusi na heleni ndiyovinaruhusiwa wakati wa kutayarisha	❏	❏	

	Kipengele kinachohusu vifaa anavyotumia Mama/Baba Lishe ambavyo Msahili ataviwekeaalama ya [✓] kama vipo sehemu ya kutolea huduma			
Na	**Swali**	**Majibu**		
		Ndio = 1	**Hapana = 2**	**Ushauri =3**
	vyakula.			
30	Vidonda vifungwe kwa plasta ambayo haingizi maji.	❏	❏	
31	Vifaa vya kupikia vinatakiwa vihifadhiwe stoo na sehemu ya juu ielekezwe chini [upside down].	❏	❏	
32	Kusiwe na dalili ya wadudu kama mende, inzi, panya, paka na mbwa n.k.	❏	❏	
33	Kuzuia: kuvuta sigara, kutema mate, kutafuna bigijii, kupiga chafya na kukoholea chakula.	❏	❏	
34	Sitisha kutema mate, chafya, kupenga kamasi na kukohoa.	❏	❏	
35	Kusiwe na kifaa chochote kijiko, kikombe, glasi, sahani ambayo kimepasuka, kuwa na kutu au kimemeguka.	❏	❏	
36	Epuka kushika chombo vya chakula kwa ndani.	❏	❏	
37	Sahani zenye vyakula epuka kuweka juu ya nyingine wakati wa kuzihidhi au kutoa huduma.	❏	❏	
38	Kamwe makaratasi yaliyorudifiwa yasitumike kuweka vyakula, aluminium foili, makaratasi ya tekiawei, makaratasi ya plastiki yaliyoruhusiwa tu ndio yatumike katika kupaki na kuuzia vyakula.	❏	❏	
39	Ni marufuku kupuliza mifuko ya plastiki, au mifuko yoyote iliyotumika kufunga/kuwekea vyakula.	❏	❏	
40	Juisi zote anazouza Mama/Baba Lishe kila mteja apewe kwenye chombo kilichofunikwa, pia kwa muuzaji, juisi hiyo ihifadhiwe kwenye chombo ambacho kina mfuniko unaobana.	❏	❏	
41	Mama/Baba Lishe aepuke kushika fedha, kama	❏	❏	

Kipengele kinachohusu vifaa anavyotumia Mama/Baba Lishe ambavyo Msahili ataviwekeaalama ya [✓] kama vipo sehemu ya kutolea huduma			
Na	**Swali**	**Majibu**	
		Ndio = 1	**Hapana = 2**	**Ushauri =3**
	haiepukiki inambidi anawe mikono baada ya kupokea fedha na kabla ya kutoa huduma ya vyakula kwa mteja			
42	Vyakula ambavyo vinaendelea kuuzwa na Mama/Baba Lishe viwe katika joto lisilopungua digrii 63°C au zaidi.	❏	❏	
43	Vyakula ambavyo vinaliwa vikiwa katika hali ya ubaridi, ubaridi usiwe zaidi ya digrii7°C.	❏	❏	
44	Vyakula ambavyo vinahifadhiwa vikiwa vimegada kwenye[friji] viwe na ubaridi wa digrii -18°Cau chini ya hapo.	❏	❏	
45	Vyakula ambavyo vinaharibika kwa muda mfupi viwekwe kwenye vyombo safi na kuhifadhiwa.ndani ya boksi lenye barafu/friji yenye joto chini ya digrii10°C.	❏	❏	
46	Vifaa vyote vinavyohifadhi vyakula, viwe hali ya kuwa rahisi kuvifanyia usafi, pia viwe vina uwezo wa kuzuia wadudu kama vile inzi, mende, panya n.k.	❏	❏	
47	Utumiaji wa kanuni za vyakula vinavyoingia kwanza vitumike kwanza, pia tarehe ziwekwe ili iwe rahisi kuvichambua.	❏	❏	
48	Vyakula vilivyoisha muda wake vinatenganishwa na pia viziuzwe au kutumika katika kutayarisha vyakula vingine.	❏	❏	
49	Angalia kama mhusika anaosha matunda, na mboga mboga za kupika au za kula mbichi kwa maji ya bomba yanayotiririka na salama katika kuondoa uambukizo wa magonjwa.	❏	❏	

Kipengele kinachohusu vifaa anavyotumia Mama/Baba Lishe ambavyo Msahili ataviwekeaalama ya [✓] kama vipo sehemu ya kutolea huduma				
Na	Swali	Majibu		
		Ndio = 1	Hapana = 2	Ushauri =3
50	Angalia kama Mama/Baba Lishe ana dalili ya maambukizi wakati anatoa huduma kwa wateja.	❏	❏	
51	Je? kuna mwa/wanafunzi wenye nguo za shule wanasaidia shughuli za Mama/Baba Lishe.	❏	❏	
Chanzo: Imetayarishwa na mwandikaji wa rasimu hii, (2019).				

Appendix 4: The Open University of Tanzania Clearance Certificate

THE OPEN UNIVERSITY OF TANZANIA

DIRECTORATE OF RESEARCH, PUBLICATIONS, AND POSTGRADUATE STUDIES

P.O. Box 23409 Fax: 255-22-2668759Dar es Salaam, Tanzania, http://www.out.ac.tz

Tel: 255-22-2666752/2668445 ext.2101
Fax: 255-22-2668759,
E-mail: dvpc@out.ac.tz

20th June 2014

TO WHOM IT MAY CONCERN

RE: RESEARCH CLEARANCE

The Open University of Tanzania was established by an act of Parliament no. 17 of 1992. The act became operational on the 1st March 1993 by public notes No. 55 in the official Gazette. Act number 7 of 1992 has now been replaced by the Open University of Tanzania charter which is in line the university act of 2005. The charter became operational on 1st January 2007. One of the mission objectives of the university is to generate and apply knowledge through research. For this reason the staffs and students undertake research activities from time to time.

To facilitate the research function, the vice chancellor of the Open University of Tanzania was empowered to issue research clearance to both staffs and students of the university on behalf of the government of Tanzania and the Tanzania Commission of Science and Technology.

The purpose of this letter is to introduce to you **Peter Ludovic Meleki Reg. No. HD/S/020/T.11** is a PhD Candidate at the Open University of Tanzania. By this letter Mr. Meleki has been granted clearance to conduct research in the country. The title of his research is "**Analysis of Factors Influencing Compliance to WHO Keys to Safe Food with Reference to Diarrhoeal Diseases in Mbeya Tanzania**".

The period which this permission has been granted is from the 20th June to 31st December, 2014.

In case you need any further information, please contact:

The Deputy Vice Chancellor (Academic)
The Open University of Tanzania
P.O. Box 23409
Dar es Salaam
Tel: 022-2-2668820

We thank you in advance for your cooperation and facilitation of this research activity.
Yours sincerely,

Prof. Shaban Mbogo

For: VICE CHANCELLOR

THE OPEN UNIVERSITY OF TANZANIA

Appendix 4: The National Institute for Medical ResearchClearance Certificate

THE UNITED REPUBLIC OF
TANZANIA

National Institute for Medical Research
P.O. Box 9653
Dar es Salaam
Tel: 255 22 2121400/390
Fax: 255 22 2121380/2121360
E-mail: headquarters@nimr.or.tz
NIMR/HQ/R.8a/Vol. IX/1728

Ministry of Health and Social Welfare
P.O. Box 9083
Dar es Salaam
Tel: 255 22 2120262-7
Fax: 255 22 2110986

20th May 2014

Mr Peter Ludoviki Meleki
The Open University of Tanzania
P O Box 3625 MBEYA

CLEARANCE CERTIFICATE FOR CONDUCTING
MEDICAL RESEARCH IN TANZANIA

This is to certify that the research entitled: Analysis of Factors Influencing Compliance to WHO Keys to Food with Inference to Diarrheal Diseases in Mbeya City Council, Mbeya Region, Tanzania (Meleki P L *et al*), has been granted ethical clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is submitted to the Ministry of Health and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health & Social Welfare and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine. NIMR Act No. 23 of 1979, PART III Section 10(2).
5. Site: Mbeya City Council, Mbeya

Approval is for one year: 20th May 2014 to 19th May 2015.

Name: Dr Mwelecele N Malecela

Signature
CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Dr Donan Mmbando

Signature
CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH, SOCIAL
WELFARE

CC: RMO
        DED
        DMO

Appendix 5: Introduction letter to the study area from the Mbeya City Council

JAMHURI YA MUUNGANO WA TANZANIA
OFISI YA WAZIRI MKUU
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHAURI YA JIJI MBEYA

Barua zote ziandikwe kwa:

Simu:	+255 25 2502372 (Simu Maalum)	MKURUGENZI WA JI
	+255 25 2502563 (Idara Zote)	S.L.P. 14
Nukushi:	+255 25 2502488	MBEY
Tovuti:	http://www.	e-mail: jijimbeya2010@yahoo.cc

Unapojibu Tafadhali Taja:

Kumb . Na.: MCC / R.50 / I / VOL.XVIII/   Tarehe: 24/03/2014

Maafisa Watendaji wa Kata,
za Sisimba, Ruanda, Uyole na Igawilo,
Halmashauri ya Jiji,
MBEYA

YAH; KUMTAMBULISHA NDG. PETER LUDOVIC MELEKI MWANACHUO WA CHUO KIKUU HURIA MWENYE NAMBA YA USAJILI NO. HD/S/020/T.11

Tafadhali husikeni na somo tajwa hapo juu.

Napenda kuwatambulisha kwenu ndugu Peter L. Meleki ni Mwanachuo wa Chuo Kikuu Huria cha Tanzania, anategemea kufanya Utafiti (Research) wake katika Kata tajwa hapo juu katika Jiji la Mbeya kuanzia tarehe 01/02/2014 hadi tarehe 31/06/2014. Atafanya utafiti kuhusu "Uchambuzi wa Kanuni za Chakula salama na uhusiano dhidi ya magonjwa ya kuharisha". (**Analysis of factors Influencing compliance to who keys to safe Food with Reference to Diarrhoeal Diseases in Mbeya Tanzania**).

Hivyo mnatakiwa kumpokea na kumpa ushirikiano wa kila hali ili aweze kufanya utafiti wake kwa ufanisi.

Naomba kuwasilisha.

W.M. Lindi
Kny: MKURUGENZI WA JIJI
MBEYA

Nakala: Mkurugenzi wa Jiji – (aione kwenye jalada)

"   Ndg. Peter L. Meleki,
Mwanachuo,
Chuo Kikuu Huria,
S.L.P. 23409,
DAR ES SALAAM

Appendix 6: Published table for determining sample size

Sample size for ±5%, ±7% and ±10% Precision Levels where Confidence Level is 95% and P= 0.05

SN	Size of Population	Sample Size (n) for Precision /Standard error (e) of		
		±5%	±7%	±10%
1	100	81	67	51
2	125	96	78	56
3	150	110	86	61
4	175	122	94	64
5	200	134	101	67
6	225	144	107	70
7	250	154	112	72
8	275	163	117	74
9	300	172	121	76
10	325	180	125	77
11	350	187	129	78
12	375	194	132	80
13	400	201	135	81
14	425	207	138	82
15	450	212	140	82
16	500	222	145	83
17	600	240	152	86
18	700	255	158	88
19	800	267	163	89
20	900	277	166	90
21	1000	286	169	91
22	2000	333	185	95
23	3000	353	191	97
24	4000	364	194	98
25	5000	370	196	98
26	6000	375	197	98
27	7000	378	198	99
28	8000	381	199	99
29	9000	383	200	99
30	10,000	385	200	99
31	15,000	390	201	99
32	20,000	392	204	100
33	25,000	394	204	100
34	50,000	397	204	100
35	100,000	398	204	100
36	>100,000	400	204	100

Source: The sample size published table adopted from (Singh and Masuku, 2014)