

**DETERMINATION OF HYGIENIC PRACTICE AND STATUS OF FOOD
HANDLERS IN CATERING PREMISES: A CASE STUDY OF ILALA
MUNICIPAL COUNCIL**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF
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CERTIFICATION

The undersigned certifies that he has read and hereby recommend for acceptance by the Open University Tanzania a dissertation titled: *“Determination of Hygienic Practice and Status of Food Handlers in Catering Premises: A Case Study of Ilala Municipal Council,”* in partial fulfillment of the requirements for the Degree of Master of Environmental Studies–Health Stream of the Open University of Tanzania.

.....
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.....
Date

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DECLARATION

I, **Sophia Swalehe Ntomola**, do hereby declare that this dissertation submitted is my own original work and that it has not been presented and will not be presented to any other university or higher institution of learning for a similar degree or any other degree award.

.....

Signature

.....

Date

DEDICATION

This study is sincerely dedicated to my dear family members; my lovely children Baraka R. Ntomollah and Judith R. Chidosa, my young sisters Asia, Batuli and Fikky A. Ntomola, and my mother Hawa Ndwata Ntomola for their reassurance and support during the whole period of this course.

Might Almighty God bless them!!

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ABSTRACT

This study assessed the adherence to food handlers hygienic practice in relation to Microbial prevalence in catering premises at Ilala Municipal Council. The magnitude of the problem in the study area is estimated to be significantly high due to nature of the city. Two hundred and six individuals participated in the study. 200 (97.1%) were food handlers and 6 (2.9%) of the respondents were Health officials. The sex distribution of the respondents was almost the same, female were 102 (49.5%) and male were 104 (50.5%). The Microorganisms of interest which are mostly causatives of diarrhoea diseases isolated during this study among food handles were *Staphylococcus aureus* 26 (13.0%); *Escherichia. coli* 7 (3.5%); and *Staphylococcus spp.* 120 (60.0%); However are other species isolated that are *Proteus spp.* 8 (4.0%); *Klebsiella spp.* 32 (16.0%); *Pseudomonas aeruginosa spp.* 6 (3.0%); *Streptococcus pneumonia* 1 (0.5%). These findings were somehow similar with study findings by Omemu *et al.*, (2014) in Nigeria; Andargie *et al.*, (2008) in Ethiopia and Mensah *et al.*, (2002) in Accra. Majority of respondents 185 (92.5%) who had hand washing facilities in their working premises were found contaminated with microbes as compared to 15 (7.5) respondents with no hand washing facilities. The study findings revealed that there is an existence of poor food hygiene practice among food handlers. The study recommends development of training/orientation programs for food handlers, develop training manuals on food hygiene and safety practices including strengthening of supervision and regular monitoring of food premises. Findings of this study may help in planning health intervention programs for food handlers.

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LIST OF ABBREVIATIONS

AMREF	African Medical and Research Foundation
CCHP	Comprehensive Council Health Plan
CDC	Centre for Disease Control
CHMT	Council Health Management Team
FBD	Food Borne Diseases
FDA	Food and Drug Authority
FSTES	Faculty of Science Technology and Environmental Studies
HMIS	Health Management Information System
IMC	Ilala Municipal Council
MOHSW	Ministry of Health and Social Welfare
OECD	Organization for Economic Cooperation Development
OUT	Open University of Tanzania
TFDA	Tanzania Food and Drug Authority
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Cross Sectional Study

Is a study that examines the relationship between health and health related characteristics and other variables of interest as they exist at a particular point at a specific time.

A food handler

With reference to this study a food handler is any person who handles food, regardless of whether he actually prepares or serves it.

Microorganisms

Microorganisms are a collection of organisms that share the characteristic of being visible only with a microscope. They constitute the subject matter of Microbiology. Members of the microbial world are very diverse and include the bacteria, cyanobacteria, rickettsiae, chlamydiae, fungi, unicellular (single-celled) algae, protozoa, and viruses.

The majority of microorganisms contribute to the quality of human life by maintaining the balance of natural environment, breaking down the remains of all that dies, recycling elements while some species of Microorganisms cause infectious disease. They produce powerful toxins that interfere with body physiology. Viruses inflict damage by replicating within tissue cells, thereby causing tissue degeneration.

Food hygiene

Food hygiene is the set of basic principles employed in the systematic control of the environmental conditions during production, packaging, delivery/transportation, storage, processing, preparation, selling and serving of food in such a manner as to ensure that food is safe to consume and is of good keeping quality.

Food safety

Food safety has been defined as the conditions and measures that are necessary during the production, processing, storage, distribution and preparation of food to ensure that it is safe, sound, wholesome and fit for human consumption WHO (1984).

Food borne illness

Foodborne illnesses/diseases are diseases which are either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. Every person is at risk of foodborne illness.

Staphylococcus

Is a group of bacteria that cause a multitude of diseases, under a microscope, *staphylococcus* bacteria are round and bunched together. They can cause illness directly by infection or indirectly through their products such as the toxins responsible for food poisoning and toxic shock syndrome. The best-known member of the *Staphylococcus* family is *Staphylococcus aureus*. *Staphylococci* are the main culprits in hospital-acquired infections, and they cause thousands of deaths every year.

Escherichia Colli

Escherichiacoli commonly abbreviated as *E. colli* is a Gram-negative, facultatively anaerobic, rod-shapedbacterium of the genus *Escherichia* that is commonly found in the lower intestine of warm-blooded organisms (endotherms). Most of *E. colistrains* are harmless, but some serotypes such as *E. coli* O157:H7 can cause severe abdominal cramps, bloody diarrhea and vomiting causing a serious food poisoning in their hosts.

CHAPTER ONE

1.0 INTRODUCTION

1.1 General Introduction

Food being the basic human needs sometimes can be harmful to human; it becomes a source of illnesses arising from pathogens and toxin ingested or contaminated with live microorganisms World Health Organization (WHO 2011). Foodborne illnesses/diseases are diseases which are either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. Every person is at risk of food borne illness (WHO 2002). Diseases spread through food are common and persistent problems that result in appreciable morbidity and occasionally in death across the globe WHO (2004). The main diseases which are caused by contaminated foods are typhoid, cholera, Hepatitis A, food poisoning and dysentery (WHO 2004).

Food borne illnesses are a growing public health problem worldwide. It is estimated that about 9.4m people suffer yearly globally and 2.1 million people die of food borne diseases. Many of which are acquired from eating contaminated food and water (WHO 2011). In industrialized countries, up to 30% of the population has been reported to suffer from food borne diseases every year, WHO (2011). For example in the United State (U.S), around 76 million cases of food borne diseases, which resulted in 325,000 hospitalizations and 5,000 deaths, were estimated to occur yearly (WHO 2011). In developing countries particularly African Countries the situation is more worse due to wide range of diseases causing microorganisms (food borne illnesses) WHO (2002). Example diarrheal diseases are a leading cause of child mortality. It kills 1.9 million children globally every year, this contribute to more

than two-thirds of the children deaths that occur in Africa and Southeast Asia (WHO 2002).

Boschi *et al.*, (2008) and Black *et al.*, (2003), mentioned the reasons behind these high incidences of diarrheal diseases in poor countries are due to high exposure to the contaminated environments. In developing countries, up to an estimated 70% of cases of diarrheal diseases are associated with the consumption of contaminated foods (WHO 1979; WHO 2008). According to Zain and Naing (2002), approximately 10 to 20% of food-borne disease outbreaks are due to contamination by the food handler. Investigations of outbreaks of food-borne disease throughout the world show that, in nearly all instances, they are caused by the failure to observe satisfactory standards in the preparation, processing, cooking, storing or retailing of food (Zain and Naing, 2002).

In Tanzania, it is reported that about 30,000 children under five years die each year due to diarrheal diseases WHO (2011). Ministry of Health and Social Welfare (MOHSW) (2011) for three years, 2009, 2010 and 2011 reports indicated that diarrheal cases for children below five years of age were 1,486, 1,570 and 1,885 respectively while cases to above five years of age, cholera cases were 12,959 and 208 deaths. In addition, the dysentery cases were 247,301 and 412 deaths while reported typhoid cases being 106,858 and 270 deaths respectively. Dar-es Salaam Region was among the Regions in the country that also experience episodes of food borne diseases. MOHSW (2011) on his report indicates that the Region had the occurrence of diarrheal, cholera, dysentery and typhoid cases. For example year

2009, 2010 and 2011, the total numbers of cases reported were 608,416, 595,575 and 649,597 and 819, 527 and 829 deaths respectively (MOHSW, 2011).

In Ilala Municipal Council (IMC), a Health Management Information System (HMIS) (2012) report shows that diarrheal diseases including cholera, dysentery, typhoid, gastrointestinal was among the top ten diseases. It ranks between second and third after Malaria and Upper Respiratory Infection (URI). Reported cases for the year 2009, 2010 and 2011 were 88,617, 254,795, and 125,876 respectively (IMC, HMIS 2012).

These cases are associated with ingestion of contaminated food and water. Laboratory diagnosis in 2009, showed that out of 267 samples investigated 21% was identified as *Vibrio cholera*, ogawa type (IMC, HMIS 2012). Therefore, this study intends to assess the situation of food safety with regards to microbiological incidences related to food handling practices.

1.2 Statement of a Research Problem

Foods prepared without following hygienic rules result primarily in food poisoning and many other diseases including diarrheal that have negative effects on human health Pauline and Susan (1991). The burden of food borne illnesses is transmitted from poor hygienic practices, either by food handlers or during food production, (Choffness *et al.*, and Mack, 2012). Food and Drug Authority (FDA) (2003), indicate that during food processing, some foodborne microbes can be introduced from infected food handlers, or by cross contamination from some other raw food

products. For example, *Shigella* bacteria and *Hepatitis A* virus can be introduced by unwashed hands of infected food handlers.

Cross-contamination can also happen if food handlers who work with raw food fail to wash their hands before handling cooked food and proper cleaning of equipment and utensils such as knives or chopping boards used during the preparation of raw and cooked food (WHO, 2002). The magnitude of the problem in the study area is estimated to be significantly high due to nature of the city and presence of high number of registered food premises, the situation therefore is alarming, that need attention by conducting a study to find out the level of microbes incidences among food handlers within the Municipality.

Furthermore, inadequate research has been done to show the level of microbiological incidences, among food handlers in catering premises. The study findings will create awareness among implementers hence encourage the Ilala Municipal Council to well address the food safety and hygiene practices among food handlers in order to prevent the occurrences of food borne diseases within the area.

1.3 Rationale of the Study

Food borne illnesses are the diseases contracted from eating contaminated food or beverages WHO (2012). It is important to promote hygienic and food safety rules in order to prevent diseases. Food handlers habits such as touching serving food utensils, preparing food with unwashed hands, not washing hands after visiting toilet, using food preparation sinks for washing hands are among the causes of food borne illness outbreaks (Adaams and Moss 2009).

It has been reported that is not only the ignorance of food hygiene that causes food poisoning, but also the lack of applying the acquired knowledge Bryan (1988); Ehiri and Morris (1994). A major challenge in the food industry is to motivate food handlers to apply what they have learnt regarding food hygiene (Ehiri and Morris 1994).

Due to this gap, therefore, this study aimed at assessing the personal and hygiene practices of food handlers by screening the hands of healthy food handlers in order to isolate the microbial contamination on food handler's hands within the catering premises in Ilala an urban area of Dar-es Salaam City. The study results are expected to guide the Ilala Municipal Council on how to improve the food hygiene and safety practices among food handlers in catering premises. Lastly, the study will generate useful information that will be used as a reference material for future studies, planning and evaluation process.

1.4 Study Objectives

1.4.1 Broad Objective

Determination of Hygienic Practice and Status of Food Handler's in Catering Premises

1.4.2 Specific Objectives

- (i) To assess the state of *Staphylococcus aureus* and *E. coli* isolates to food handlers hands in catering premises.
- (ii) To evaluate Ilala municipal Council food safety precaution measures in place.

1.4 Research Question

- (i) What is the magnitude of *Staphylococcus aureus* and *E. coli* in food handler's hands?
- (ii) What measures carried by Ilala Municipal Council to address food safety practices?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Food safety is public health issue that creates attention to Governments all over the world due to increasing number of food safety problems (WHO, 2002). Food safety is defined as the conditions and measures necessary to be observed during the production, processing, storage, and distribution to ensure that it is safe, sound, wholesome, and fit for human consumption (Prescott, Harley and Klein, 1999).

Foods that we eat are rarely sterile. They carry microbial which composition depends upon which organisms gain access and how they grow, survival, and interaction in food over time Talaro and Talaro (1996). The Microorganisms present originate from the natural microflora of the raw material and those organisms introduced in the course of harvesting/slaughter, processing, storage and distribution (Talaro and Talaro 1996).

Food has a long association with the transmission of diseases. Regulation governing food hygiene can be traced back in numerous early sources such as the old Testament, writing of Confucius, Hinduism and Islam. Even today, food borne diseases is perhaps the most wide spread health problem in the contemporary world and an important cause of reduced economic productivity (Adaams and Moss 2009).

Food borne diseases are widespread and growing public health problems. Incidences are recorded in all countries from the most developed to the least developed ones.

Each year 9.4 million people suffer from food-borne diseases throughout the world (FAO/WHO, 2013). In industrialized countries, the percentage of people suffering from food borne diseases each year has been reported to be up to 30%.

In the United States of America (USA), for example, around 76 million cases of food borne diseases, resulting in 325,000 hospitalizations and 5,000 deaths, are estimated to occur each year while in England and Wales the cases reported are 2,366,000, hospitalizations 21,138 and 718 deaths (CDC, 2005).

In developing countries, the burden of the problem is estimated to be higher due to presence of favorable environment for growth of wide range of food borne diseases microbes WHO (2002). For example in the year 2000 alone 2.1 million people died from diarrhoeal diseases. World Health Organization (2002), reports that 90% of the annual deaths from diarrhoea are among children particularly in developing countries.

A great proportion of these cases are attributed to contamination of food and drinking water FAO/WHO (2013). The high prevalence of diarrhoeal diseases in many developing countries suggests major underlying food safety problems (WHO 2002). World Health Organization (2008), reported incidence of food borne diseases in the African Region including; anthrax in Zimbabwe; typhoid fever in Uganda; chemical poisoning due to consumption of seed beans and maize in Nigeria and Kenya; cholera from several countries e.g. Mozambique, Nigeria, Congo, Zambia, DRC, Kenya, Tanzania, South Africa, Zimbabwe; pesticide poisoning from cabbage and other vegetables in Senegal; fish mouse in Mauritius; mushroom poisoning in

Algeria; *Botulism* and *Hepatitis A* in Uganda; Gala Night Dinner Meal, Nigeria (WHO, 2008).

Recruitment from lower socio-economic classes with low educational levels, rapid staff turnover, high level of seasonal staff literacy, language problems and poor motivation due to low pay and job status are some of the proposed reasons for the lack of applying the acquired knowledge especially in small food businesses Travis (1986); Burch & Sawyer (1991); Taylor, (1996). According to WHO (2011), of all human pathogens, bacteria cause the greatest number of human diseases, closely followed by viruses.

The numbers of microorganisms live on and in us, most of them are essential to our health while others become pathogens if circumstances change and cause infections and diseases Rukunga, (2001). Disease causing microorganisms are found almost everywhere such as in air, food, water, soil, plants, animals and human body. If food is not hygienically prepared, it can be contaminated from unwashed hands, dirty water, flies carrying pathogenic organisms, or septic wounds, coughing and sneezing. Rukunga, (2001). Bacterial such as *Salmonella*, causing typhoid, paratyphoid and food poisoning, *Clostridium* causing botulism an often fatal (WHO, 2011).

When food poisoning outbreaks are investigated it has been established that small and medium sized businesses are often important locations in the transmission of food borne illness Walker *et al.* (2003). Food contamination creates an enormous social and economic burden on communities and their health systems. Citing an

example In the USA, diseases caused by the major pathogens alone are estimated to cost up to US \$35 billion annually (1997) in medical costs and lost productivity WHO (2011). The re-emergence of cholera in Peru in 1991 resulted in the loss of US \$500 million in fish and fishery product exports that year (WHO, 2011). Example of diseases causing microorganisms mentioned as *Staphylococcus aureus*, *Lactobacillus*, *Salmonella*, *Clostridium*, *Bacillus cereus*, *Escherichia. coli*, *Vibrio* and so many others that lead to diarrheal diseases and food poisoning. Food borne illness can be fatal and therefore requires rapid response (Pauline and Susan, 1991).

A study on the microbial quality of street foods in Accra, Ghana showed among others the significance of proper hand washing practices, use of soap and environmental hygiene. Among the reported risk factors was exposure of food to flies, and contamination by hands of food handlers (Mensah *et al.*, 2013). Tanzania reported that about 30,000 under fives years children die each year due to diarrheal diseases WHO (1989).

According to MOHSW (2012) Example, reported cases for diarrheal to children below five years of age was 529,309 with 488 deaths, cholera cases was 1,149 with 32 deaths, dysentery 77,648 with 226 deaths and typhoid 41,491 with 83 deaths. In Ilala municipality Communicable diseases such as cholera outbreaks and other diarrheal diseases are reported as the second health problems. Diarrhoeal cases of age below five years were 113,568 out 130,071 and above five years were 121,277 out of 120,051 (IMC, HMIS, 2012). World Health Organization (WHO) explained that the global incidence of food-borne diseases is difficult to estimate, but it has been reported that in 2008 alone 1.8 million people died from diarrheal diseases. In

developing countries, up to an estimated 70% of cases of diarrheal diseases are associated with the consumption of contaminated foods (WHO 1979; 2008). Food-borne disease outbreaks 10 to 20% estimated to be due to contamination by the food handler. Investigations of outbreaks of food-borne disease throughout the world show that, in nearly all instances, they are caused by the failure to observe satisfactory standards in the preparation, processing, cooking, storing or retailing of food (Zain and Naing 2002).

It has been reported that is not only the ignorance of food hygiene that causes food poisoning, but also the lack of applying the acquired knowledge Bryan (1988); Ehiri and Morris (1994). A major challenge in the food industry is to motivate food handlers to apply what they have learnt regarding food hygiene (Ehiri and Morris 1994). Health problems associated with food borne illness differ in severity from minor which does not require medical treatment to the more serious illness requiring hospitalization, long-term disability and/or death Rocourt *et al.*, (2003). Diseases spread through food are common and persistent problems that result in morbidity and occasionally in death across the globe WHO (2004). The main diseases which are caused by contaminated foods are typhoid, cholera, hepatitis A, food poisoning and dysentery (WHO 2004).

Worldwide reports explain that, despite efforts made to educate the public on healthy foods and safety practices, Countries continues to suffer with the challenge of implementing food safety, evident by the number of gastroenteritis cases, food related incidences. For example, in China 180 food manufacturing plants were closed after toxins were discovered CDC (2011). Mostly of food borne diseases are

preventable, though there is no simple one-step prevention measure like a vaccine. Instead, measures are needed to prevent or limit contamination all the way from the farm to the table (WHO 2012). In order to prevent food borne illness, food handlers must follow procedures for good personal hygiene. Everyone has bacteria on their skin, hair, eyes, nose, mouth, and hands. Some bacteria cause food borne illnesses. Food handler's personnel can contaminate food and food contact surfaces and cause food borne illnesses when does not wash hands after using the restroom, coughs or sneezes on food (NFSMI, 2009).

To ensure that food is safe for human consumption it must be carefully processed, stored and prepared. Food when not properly handled can sometimes cause a number of illnesses either infections such as *Salmonella* or intoxications such as *Staphylococci* and *Clostridia* which find their way into food through contamination or spoilage hence cause food borne illness (Pelozar, Reid and Chan 1993). WHO (2002), Food handlers have a major role in the prevention of food borne diseases throughout the food production, processing, storage and preparation chain. Example food-borne diseases recorded in catering firms 97% of such cases are associated with inappropriate practices adopted in the food preparation process. For instance, in England 22% of the food borne diseases found in foods served by catering firms, in the USA 45% of the food borne diseases and in 50% of the food-borne diseases in Ireland (CDC 2011; Black *et al.*, 2003).

National Food Service Management Institute (NFSMTI), (2009), suggest some ways to ensure food safety as to empower employees with the knowledge and skills they need to prepare and serve foods safely and food handlers should be aware that a food

borne illness could occur in any operation. Therefore the danger of food borne diseases can be minimized by strict adherence to personal sanitation practice such as hand washing by food handlers and enforcement of state and local health regulations (Curtis and Cairncross, 2003).

American Center for Microbiology (2012), recommends for adequate personal hygiene practices which are essential in reducing the risks of a food borne illness. Hand washing with water and soap is one of the most effective and cheapest measures against infections and food borne diseases that significantly reduce bacterial contamination and risk of food borne illness.

For example, the simple act of washing hands with soap and water reduces incidents of diarrhoea from *Shigella* and others by 35%, WHO (2012). WHO (2012) suggest proper hand washing with soap as the most single important thing that prevent spreading of food borne diseases microbes. Bacterial such as *Salmonella*, that cause food poisoning resulting to typhoid, paratyphoid while *Clostridium botulinum* causing *Botulism* an often fatal food poisoning are able to multiply in foods rich in protein such as milk, meat, eggs (Pelozar, Reid and Chan, 1993).

The Centers for Disease Control and Prevention cited five food borne pathogens, also known as the 'Big 5,' that includes *Norovirus*, the *Hepatitis A* virus, *Salmonella* Typhi, *Shigella* spp. and *Escherichia coli* O157:H7 or other *Enterohemorrhagic* or Shiga toxin-producing *Escherichia coli*. Other, less infectious pathogens that can also be transmitted by food employees to consumers through contaminated food include *Staphylococcus aureus*, *Salmonella* spp and *Streptococcus pyogenes*. These

are infective pathogens that can easily be transmitted by food workers and cause severe illness (CDC and FDA 2011).

We live in a microbial world, and there are many ways for food to become contaminated as it is produced and prepared for consumption. During food processing other food borne microbes can be introduced from infected food handlers, or by cross contamination from some other raw food products. For example, *Shigella* bacteria, *Hepatitis A* virus can be introduced by the unwashed hands of food handlers who are themselves infected (FDA 2003). Foodborne disease outbreaks are attributable to poor hygienic practices and improper handling of food WHO (2002). Most of pathogenic microorganisms are spread by contaminated hands. Pathogens, such as, *Salmonellosis*, *Shigellosis*, *Hepatitis A*, *Giardiasis* and *Campylobacteriosis* are transmitted via the faecal-oral route. These contribute to a number of disease outbreaks in developing countries WHO (2002). These diseases occur unnecessarily, since the faecal-oral routes of disease transmission can be easily prevented.

Equipment and utensils used in the preparation of food are mentioned as sources of contamination. For instance, knives or chopping boards used with uncooked products such as raw meat or poultry can become contaminated with pathogens. Re-using without being adequately cleaned, particularly if they are then used in a cooked product, the pathogens can be transferred, posing a very serious threat to food safety. Cross-contamination can also happen if food handlers who work with raw food fail to wash their hands before handling cooked food WHO (2002). Similarly, fresh fruits and vegetables can be contaminated if they are washed or irrigated with water that is contaminated with animal manure or human sewage (WHO, 2002).

Transmission of intestinal parasites and *Enteropathogenic* bacteria is affected directly or indirectly through objects contaminated with faeces. These include food, water, nails, and fingers, all of them which are indicating the importance of faeco-oral human-to-human transmission. Food-handlers with poor personal hygiene working in public food-serving establishments could be potential sources of infections of many intestinal helminthes, protozoa and *Enteropathogenic* bacteria, Andargie *et al.*, (2008). Many of the Infectious diseases are spread by unclean hands that remain the leading cause of death and disease worldwide and the third-leading cause of death in the United States (FDA 2003).

A study in the USA suggested that improper food handler practices contributed to approximately 97% of food borne illnesses in food service establishments and homes Howeset *al.*,(1996). Several studies have indicated that various bacteria, amongst others *Staphylococcus aureus*, *E. colli* and *Salmonella* ssp. survive on hands and surfaces for hours or even days after initial contact with the microorganisms (Jiang and Doyle (1999); Kusumaningrum *et al.*, (2002); Scott and Bloom Weld, 1990).

Every person who works in or around food has the potential of contaminating a food with bacteria and viruses that are present on our bodies. Not only are bacteria on our bodies, they are present on common items that we handle regularly, such as money, pens, pencils, and doorknobs. These bacteria can easily be spread to food. The personal hygiene, dress, and general good health habits of foodservice employees play a crucial role in keeping these bacteria away from the food they prepare and serve (NFSMI, 2009).

Increasing urbanization, industrialization and the increased population of cities leads to increased consumption of food in collective eating-places. This increases the importance of these places for public health. Ilala is the business city center of Dar-es-Salaam city accommodating people within and outside the country, who create high population density that increases the demand of food supply and water. In the process of delivering and servicing of big quantities of food and water to city dwellers may contribute to poor food hygiene practice among food handlers hence a challenge that increases the risk of food borne illnesses in the community if not well handled (IMC profile, 2011).

According to IMC (HMIS, 2012) report, diarrhea diseases are among the top ten diseases but there is inadequate study done in the Municipality to assess the microbial incidences among food handlers. Therefore the study was conducted to assess the personal and hygienic status of food handlers within the area in order to examine the level of the microbial incidences among food handlers within the Municipality and measures in place to safeguard the public since the food borne illness can be fatal and hence requires rapid response in preventing its occurrences.

Food safety hazards are always in existence, if food is not hygienically prepared, it is prone to contamination through unwashed hands, dirty water, flies carrying pathogenic organisms, or septic wounds, coughing and sneezing (WHO, 1989). All this can be prevented or minimized if food handlers understand how food can be contaminated and how to prevent its occurrence.

CHAPTER THREE

3.0 METHOD AND MATERIALS

3.1 Introduction

This chapter explains the geographical and demographic data of the study area, the study design, sample size, and how sampling procedures were conducted. Also the chapter elaborates tools that used in data collection and analysis.

3.1.1 The Study Area

Ilala Municipal Council is one of the three Municipalities in Dar es Salaam City. The Municipality covers an area of 210 km² with an estimated population of 1,799,000 with an annual increase rate of 4.6% as projected from Population projection 2012 census IMC (2013) (Figure 3.1).

The council is bordered by Indian Ocean on the East, Coast Region on the West, Kinondoni Municipality on the North and Temeke Municipality to the South. Administratively, it is divided into 3 Divisions, 22 Wards with 101 sub streets. It has a sandy beach, loamy and gently rising flat lands of Pugu hills that reach the altitude of 900 ft. above sea level and low level of Msimbazi river valley with hot and humid atmosphere, temperatures range between 24⁰C – 28⁰C in June to October and 29⁰C – 35⁰C during November to May IMC (2013).

The Municipal Council experiences two periods of rainy season. A short rainy period from October to December with an average of 75 – 100mm of rain per month and a long rainy period from March to June with an average between 150 – 300 mm of rain per month.



Figure 3.1: Map of Republic of Tanzania and below a Map of Ilala Municipal Council

Source: Researcher (2014)

During rain season, the Municipal council experiences frequent diarrhea diseases and cholera outbreaks as a result of water contamination as most of the areas lack proper drainage and sewage systems IMC (2013). Economic activities conducted within the area is productive sectors such fishing, industries and natural resources and business activities including formal and informal ones such as market places, employment, and a wide range of business that attracts a larger population who create high demand of food supplies and wastes generation that affect environmental sanitation IMC (2013).

3.2 Sampling Procedure

This study was conducted in Ilala Municipal Council in Dar-es-Salaam City to determine hygienic practices and status of food handler's in catering premises. Ilala Municipal Council is purposively selected, because it is a business City center in the large city of Dar-es-Salaam having heterogenic population with high number of catering premises of different status. Also it is a convenient area to researcher due to time and financial limitation. The study population was food handlers found in catering/food premises within the Ilala Municipal Council. The design was cross sectional descriptive study where both quantitative and qualitative data was generated.

In abiding with ethical consideration the study was conducted after the permission from Ilala authorities after submission of an introduction letter from OUT. The researcher with the help of the Ilala Municipal Council Officials from the department of health obtained the list of 22 Wards (Figure 1). Random sampling method was used to select the study population where three Wards out of 22 was picked after the

names of the Wards written in a piece of papers and cut into pieces for the researchers to select a sample size. Then the list of catering/ food premises was generated according to Wards. The sample size was then divided according to number of food premises found in each Ward to ensure equal distribution of respondent's representation Jangwani was 60, Kisutu 60 and Kariakoo 80.

The sample size from the generated list of food premises was selected systematically where by every 3rd of food premises was chosen from the list, then 3 to 6 respondents was obtained a food premises. Pre testing of tools was done in a Ward different from the selected study Wards in order to ensure the feasibility of the study.

3.3 Sample Size Determination

The total sample size was estimated using fisher's formula as following:-

$$N = Z^2 PQ / d^2$$

Where

N = Desired sample size of the total premises which is greater than 10,000

Z = Standard normal deviation (1.96) at a 95% confidence interval

P = Proportional of the target population estimated to have particular Characteristic.

40% of the population will be reached.

$$Q = 1 - P (1 - 0.4) = 0.6$$

d = Type 1 error level (or significance level or confidence coefficient at 95% confidence level of 0.05.

$$\text{Therefore, } n = (1.96)^2 * 0.4 * 0.6 / (0.05)^2 = 368.7 = 369$$

3.4 Data Collection Procedures

Data collection from the respondent was then conducted. Six (6) research assistants were purposely selected from Health department due to their professionals. Researcher assistants from the study area was selected and trained to equip them with data collection skills related to the study. In addition clarifications on how to conduct interview, premises entry techniques and ethical consideration was elaborated.

The data collection on hygienic practice and status of food handler's in catering premises in Ilala Municipal Council was categorized into two major aspects basing on the study objectives that include: (1) Assessment of *Staphylococcus aureus* and *Escherichia coli* in food handler's hands in catering premises. (2) Assessment of roles of the authorities in ensuring hygiene practices in food premises.

3.4.1 Assessing the *Staphylococcus aureus* and *E. coli* of Food Handlers Hands

In the selected food premises, the qualified laboratory staffs were able to take swabs of the inner surface of a food handler's hand parts for microbial analysis and transport it to Amana Regional Hospital laboratory for microbial analysis.

3.4.2 Specimen Collection and Analysis Procedures

Sterile cotton swabs sticks and sterile normal saline was used to swab the inner palm, nails and in between fingers of food handlers. Specimen obtained was placed into Blood Agar media then after the specimen was transported to the Amana Regional Hospital laboratory for analysis.

3.4.3 There After the Laboratory Procedures Followed as Following

Collected specimen and associated buffer were thoroughly mixed using a vortex mixer. Collected sample for analysis was inoculated into Culture media Blood Agar (BA) for a night (18 -24 hrs) at 37⁰C.

3.4.4 Identification Test was Followed After Inoculation

Gram stain procedures were done using normal saline. Sterile wire loop was used to pick colony from the media, prepared smear was then dried into air dry for few seconds then specimen fixed for 3 times in flame. Gram Staining involving 4 reagents. Crystol violet, Logos' iodine, acetone 10%, Basic carbon Fuschin was used to stain. Results of gram positive (purple) or gram negative (red or pink) were recorded.

Biochemical test according to gram stain results was followed. Chemicals used were Catalase test, coagulase in order to identify the type of and *E. colli*. Catalase reagents that is hydrogen peroxide 3% was mixed with colony of organisms into slide, bubbles appearance confirm positive. Coagulate test was used to confirm *Staphylococcus aureus*.

In case of negative results another biochemical test that is SIM media (Sulphide Indo Motility) was used. In enumeration of *Staphylococcus aureus*, Coagulase - positive *Staphylococci* and *E. colli*, interpretation were performed in accordance with MOHSW Laboratory Standards, AMREF (2008).

3.5 Operating Procedures Guideline

In additional information of the samples taken was obtained by observation, enquiry and then recorded on a Microbiological test questionnaire form (Annex 2).

3.6 Learning Ilala Municipal Council Food Safety Precaution Measures

In depth researcher to Ilala Municipal Council officials in the department of Health to get information on how food safety are practiced conducted interview. In addition, researcher and researcher assistant in each food premises to support information gathered by other data collection tools also deployed the observation checklist.

3.7 Data Analysis

All daily collected data were edited daily and transferred to a master sheet every evening. Data was transferred to SPSS computer Program for processing and analysis. The results from the study (quantitative data) were analyzed by using the Statistical Package for Social Sciences (SPSS, Version 16.0) using descriptive statistics such as frequencies, tables and percentages.

Comparative analysis to determine associations between study parameters were carried out with the chi square (χ^2) test at 5% significance level as summarized in the table below:

Objective	Research Question	Analytical Tool
To assess the state of <i>Staphylococcus aureus</i> and <i>Escherichia coli</i> to food handlers hands in catering premises.	What is the magnitude of <i>Staphylococcus aureus</i> and <i>Escherichia coli</i> in food handler's hands?	Frequency test was used to determine occurrences and P value test to determine association.
To learn Ilala Municipal Council food safety precaution measures in catering premises.	What measures carried by Ilala Municipal Council to address food safety?	Tallying due to lack of software (VIVO)/ and also questionnaires were few

Source: Field Data (2014)

3.8 Protocol/Ethical Consideration

The written Letter by OUT for asking permission to conduct the study at Ilala Municipal Council was presented to the Ilala Municipal Director to introduce the researcher. Formalization of the ethical procedures from the council to the Ward was done before the study. Respondents were introduced to the study before interview.

3.9 Minimization of Errors

Minimization of errors done by doing the following:

Pre- testing the structured interview questionnaire before carrying out the survey.
 Training the researcher assistants on the study purpose with clear instruction for substitute and separation of the respondents during interview and other procedures.
 Checking all completed schedules for errors, omissions, and discrepancies soon after the interview. Translating structured interview questionnaire in local language (Kiswahili). Ensuring close supervision of interviewers, Selection of committed researcher assistants and Use of qualified and competent staff especially laboratory to assist the researcher

3.10 Study Limitation

Study Time limited

Availability of financial assistance

Willingness of respondents

High cost of laboratory apparatus and reagents

Some respondents wash their hands with soap before collection of specimen.

CHAPTER FOUR

4.0 STUDY RESULTS

4.1 General Characteristics of the Study Participants

In general 206 individuals participated to address the objectives of this study. Among this 200 (97.1%) were food handlers who were involved in all aspects of food production (i.e. cooking, preparation, serving and cleaning) and 6 (2.9%) of the respondents were officers from the department of health responsible for food quality and safety control at Municipal level, these were involved in in-depth interview to assess measures in place regarding the quality of food premises and food hygiene practices.

The proportion of sex distribution of the respondents in this study was almost the same, female were 102 (49.5%) and male were 104 (50.5%). However majority of the respondents 181 (88 %) ages ranged between 18 – 45 years, few 21 (10.2%) were above 45 years while only 4 (2.0%) were aged below 18 years (Figure 4.1).

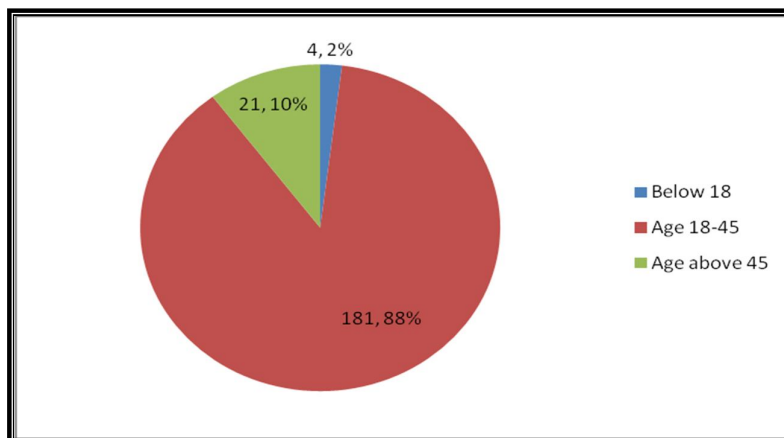


Figure 4.1: Age Groups of Respondents

Source: Research Data (Ntomola, 2014)

4.1.1 Level of Education of Respondents

In respect to the level of education, Most of the respondents 112 (54.%) had attained primary school education and below, followed by secondary school education 86 (42.%) while only 8 (4%) had attained high learning institution (college and university) level of education (Figure 4.2).

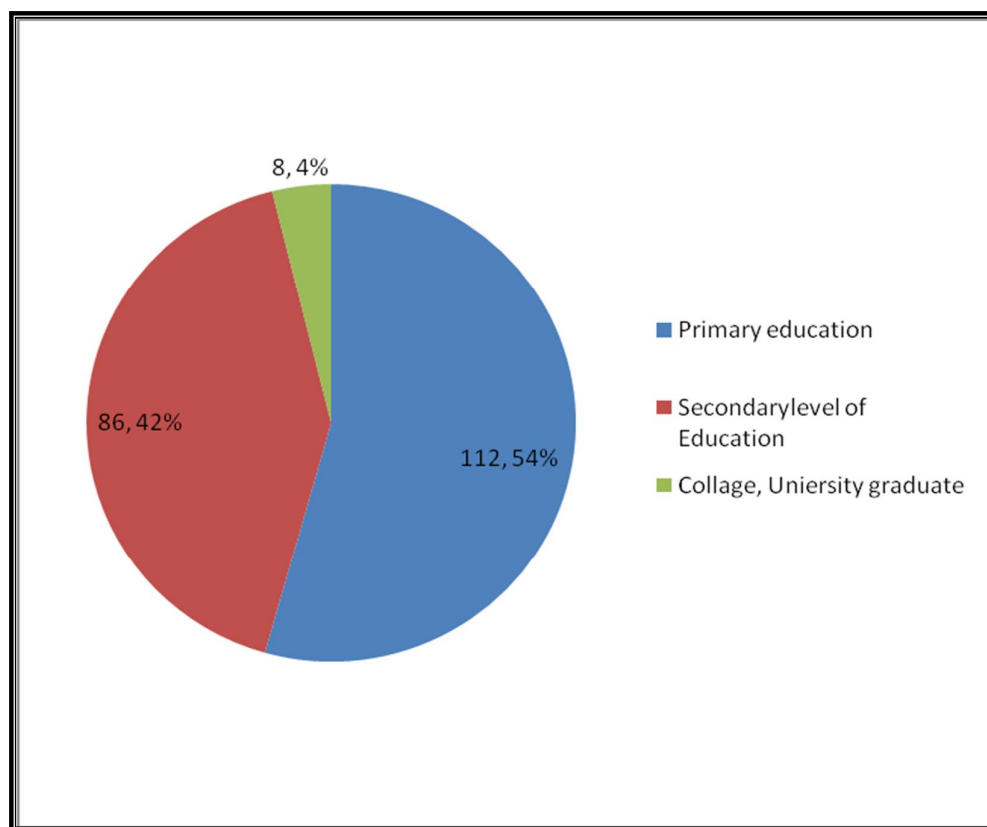


Figure 4.2: Education Level of Respondents

Source: Research Data (Ntomola, 2014)

4.1.2 Working Experience of Respondents

Eight three (41%) of the respondents had been working as food handlers for 1 to 5 years while 63 (32%) had over five years experience in food handling and 54 (27.0%) had experience of less than a year (Figure 4.3).

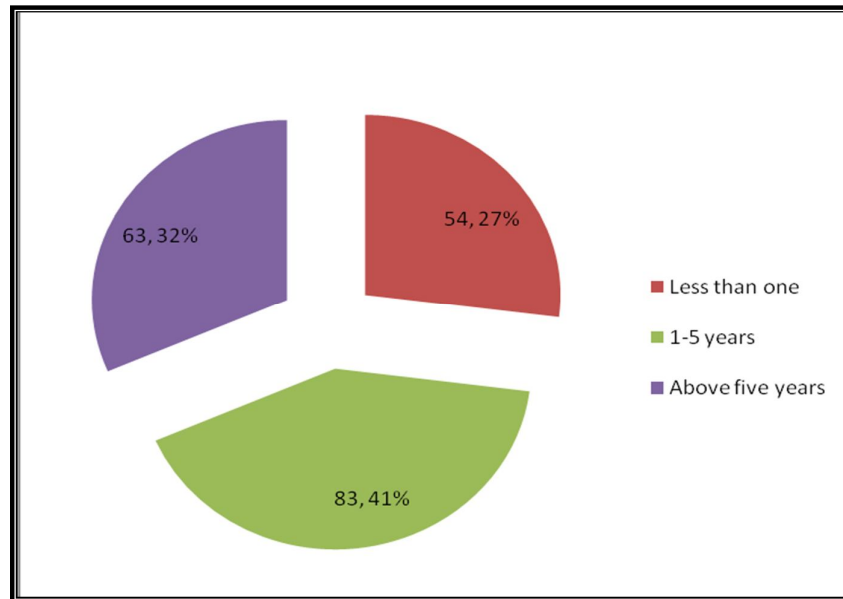


Figure 4.3: Working Experience of Respondents

Source: Research Data (Ntomola, 2014)

4.2 Training on Food Safety and Isolation of Enteric Microorganisms

More than half 101 (50.5%) of the respondents who are working as food handlers had not been trained on food safety as compared to 99 (49.5%) who had been trained. The Microorganisms of interest which are mostly causatives of diarrhoea diseases isolated during the study among food handlers were *Staphylococcus aureus* 26 (13.0%), *E. colli* 7 (3.5%), and *Staphylococcus spp.* 120 (60.0%).

Other species isolated were *Proteus spp.* 8 (4.0%), *Klebsiella spp.* 32 (16.0%), *Pseudomonas aeruginosa spp.* 6 (3.0%), *Streptococcus pneumonia* 1 (0.5%). (Table 1). Almost half 101 (50.5) of respondents who were trained their hands were contaminated by microorganisms as compared to 99 (49.5%) of respondents who had not trained (Table 4.1). The number of microorganism's isolates was not statistically significant associated with status of training. $P = 0.2$.

Table 4.1: Microbes Isolates Between Trained and Untrained Food Handlers

Microorganisms isolated	Status of training among food handlers on food safety			
	Yes		No	
	Frequency	Percentage	Frequency	Percentage
<i>S. aureus</i>	11	10.9%	15	15.2%
<i>E. coli</i>	6	5.9%	1	1.0%
<i>S. species</i>	62	61.4%	58	58.6%
Other species	22	21.8%	25	25.3%
Total	101	50.5%	99	49.5%

Source: Researcher (2014)

4.3 Microorganisms isolated by level of education

One hundred and twelve (56.0%) of respondents with Primary level of education and below their hands were contaminated with microorganisms as compared to 86 (43.0%) of those with secondary level of education (Table 4.2). Educational level is inversely proportional to number of microorganisms isolated; however the association is not statistically significant. $P = 0.3$.

Table 4.2: Microorganisms Isolates by Level Education

Microorganisms isolated	Level of Education					
	Primary and below		Secondary level		College and University graduates	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
<i>S. aureus</i>	15	13.4%	11	12.3%	0	.0%
<i>E. coli</i>	3	2.7%	4	4.7%	0	0%
<i>S.s species</i>	61	54.5%	58	67.4%	1	50.0%
Other species	33	29.5%	13	15.1%	1	50.0%
Total	112	56.0%	86	43.0%	2	1.0%

Source: Researcher (2014)

4.4 Microorganisms Isolated According to Working Experience of Respondents

Most of respondents 83 (41.5%) had experience of working as food handlers for 1 to 5 years while 54 (27.0%) had experience of less than a 1 year and 63 (31.5%) had experience of more than 5 years (Table 4.3). From the findings above, the number of microorganism's isolates was higher 146 (73.0%) among food handlers with working experience of more than a year as compared to 54 (27.0%) with experience of less than a year. The study was statistically significant ($p \leq 0.004$).

Table 4.3: Working Experience of Food Handlers

Microorganisms isolated	Duration of Work					
	Less than a year		1 – 5 years		Above 5 years	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
<i>S. aureus</i>	11	20.4%	7	8.4%	8	12.7%
<i>E. coli</i>	0	.0%	4	4.8%	3	4.8%
<i>S. species</i>	34	63.0%	56	67.5%	30	47.6%
Other species	9	16.7%	16	19.3%	22	34.9%
Total	54	27.0%	83	41.5%	63	31.5%

Source: Researcher (2014)

4.5 Microorganisms Isolated in Different Departments

Almost 180 (90.0%) microbial isolates were found in department of cooking and serving, whereas *E. coli* and *S. aureus*, the main causatives of diarrhea diseases were more isolated 5 (71.4), 8 (30.8%) and 2 (28.6%) and 13 (50.0%) respectively while 0 (0.0%) and few 5 (25.0%) were isolated among staff in preparation/cleaning department (Table 4.4). The study was not statistically significant. $P = 0.4$.

Table 4.4: Isolates of Microbial in Working Departments

Microorganisms isolated	Department					
	Cooking		Serving		Preparation/cleaning	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
<i>S. aureus</i>	8	8.9%	13	14.4%	5	25.0%
<i>E. coli</i>	5	5.6%	2	2.2%	0	0%
<i>S. species</i>	57	63.3%	52	57.8%	11	55.0%
Other species	20	22.2%	23	25.6%	4	20.0%
Total	90	45.0%	90	45.0%	20	10%

Source: Researcher (2014)

4.6 Microorganisms Isolated in Food Premises with Hand Washing Basin

Majority of respondents 185 (92.5%) who had hand washing facilities in their working premises were found contaminated with microbes as compared to 15 (7.5%) respondents with no hand washing facilities in their working food premises (Table 4.5). The number of microbes isolated was statistically associated with presence of hand washing facilities $P \leq 0.02$.

Table 4.5: Food Handlers with Accessible to Hand Washing Facilities and Isolation of Microbial

Microorganisms isolated	Availability of Hand Washing Basin			
	Yes		No	
	Frequency	Percentage	Frequency	Percentage
<i>S. aureus</i>	24	13.0%	2	13.3%
<i>E. coli</i>	5	2.7%	2	13.3%
<i>S. species</i>	117	63.2%	3	20.0%
Other species	39	21.1%	8	53.3%
Total	185	92.5%	15	7.5%

Source: Researcher (2014)

This may be explained by the facts that food handlers lack knowledge on importance of hand washing or may be is due to workload that make them disobey hand washing or probably their have used a contaminated water source or do not adhere to personal hygiene practices.

4.7 In-depth Interview Findings

In depth interview was conducted to Ilala municipal Council staff from the department of health in order to assess food safety precaution measures in place. 6 members (85.7) out of 7 were interviewed: Respondents explained that, the department has mandate to supervise, educate, monitor and carryout legal proceedings to those who violet public health rules and Municipal bylaws in order to safe guard the health of the public.

Partners within the Municipal council who are responsible for food safety and hygiene activities mentioned other than health department there are agriculture and livestock who safeguard the quality and safety of cereals, fruits, vegetables and meat product while TFDA are the organ within the country which monitor both food and drug quality and safety.

The department of Health mentioned the objectives in place to safeguard public health on regards to food hygiene and safety are monitoring of Standard by providing National food standards to food dealers, quality and safety control of food premises to food processors and sellers by conducting routine inspection of food and food premises, quality assurance of food and foods products by issuing certificates of food quality, medical examination to food handlers, follow-up, monitoring, supervise to

prevent unsound food and food products to be supplied for human consumption and take legal proceedings where necessary to those who do not adhere to National food standards.

The strength of health department in ensuring food hygiene and safety is presence of qualified health staff that carry out regular food and food premises inspection, monitoring, supervision and follow-up of food safety in the Municipality. Availability of stakeholders such as TFDA, good collaboration among department and stake holders in conducting routine inspection of food and food products such as Agriculture and livestock department, legal and jurisdiction. Availability of guidelines and regulations related to food hygiene and safety from MOHSW such as food and drugs quality control, standards of operations (SOP's).

Despite of these strength the department has, still the department encounter several challenges in ensuring food safety in the Municipality mentioned as inadequate knowledge and skill among food handlers on food hygiene and safety, mushrooming of food vendors (mama/babalishe) who don't have permanent food premises/structures, low income among food premises owners and food handlers that hinder adherence of standards in food premises, inadequate resources such as qualified staffs, finance, transport, food sampling equipment, disease outbreaks/adhock activities and inadequate political support that hinder implementation of planned food safety activities. This together has constrained the efficiency in regulating, monitoring and supervising the food hygiene and safety activities that lead to occurrences of food borne diseases within the Municipality.

4.8 Observations Made by Researcher During the Study in Food Premises

Most of food premises studied showed fair general cleanliness of the surroundings that is availability of toilets, means of waste management and disposal, hand washing facilities with soap. The study observed that some of food handlers normally work with long and dirty fingernails, wear jewelry and had fungal infection on their hands while handling food. Also, do not wear apron and they do not cover their hair when handling food. Few of the food handlers wash their hands after touching other things such as money, table cleaning towel, hair, nose or mouth.

Therefore, there is a need for intensive trainings/education to food handler in order to create awareness on regards to safe food handling practices.

CHAPTER FIVE

5.0 DISCUSSION

5.1 Introduction

These cross sectional descriptive studies were carried out to determine the hygienic practices and status of food handlers in catering premises at Ilala Municipal Council.

5.2 Respondents Sex, Age and Education Level

The analysis found that sex characteristics of the respondents were almost equal 104 (50.5%) were males and 102 (49.5%) were female. These findings are inconsistency with findings by Muinde and Kuria (2005) in their study in Nairobi, Kenya who found 60% of the vendors were male while 40% were female. Our findings were also inconsistency with the study by Nigusse and Kumie (2012) in Ethiopia where their results showed that (97.5%) of the respondents were female while only (2.5%) were male. Our analysis on equal representation of sex may be explained by the fact that, due to employment crisis everyone is fighting for an employment opportunity hence no gender differences. The analysis revealed that majority of food handlers 181 (90.5%) ages ranged between 18 – 45 years and only 4 (2.0%) of the food handlers aged below 18 years. These findings agreed with the study done by Andargie *et al.*, (2008) in Ethiopia and other study by Siow and Sani (2010) in Malaysia which found majority (72.4%) and (83.1%) respectively of the food-handlers were young adults aged between 20-40 years and those who were below 20 years old were (3.1%). Our findings disagree with study findings done by Omemu *et al.*, (2014) in Nigeria who found that Most (54.7%) of the respondent are in the 22-30 years age range and only 5% are above 40 years of age. This may be due to facts that the age groups

mentioned are the ages with family responsibilities therefore work to earn income. The ages below 18 years are few probably due to being mostly a school aged group; that most of them might be in schools. In respect to the level of education, Most of food handlers 112 (54.4%) had primary level of education and below followed by 94 (45.6%) who had attained secondary school education and above.

These findings agreed with Study done by Abdalla *et. al.* (2009) in Sudan where 48% of respondents had primary school education while 42% were illiterates and other findings by Muinde and Kuria (2005) in Kenya who found that 62% of respondents had primary education and below, 38% had secondary education and above. Although our findings disagree with a study done by Ifeadike *et al.*, (2014) in Nigeria; Chukuezi *et al.*, (2010) in Ghana whereby Majority of the respondents 122 (72.7%), (80.9%) had secondary education and above, whereas 46 (27.3%), (19.1%) respectively had primary education and below.

The reasons regarding our findings may be due to facts that most of the food premises visited were restaurants and food vendors (mama/babalishe) who do not consider the level of education during employment. Owners of these food premises aimed on more income, they might be doing this purposely because of cheap labour. The other reason may be due to small sample size of the food premises selected because of time limitation.

5.3 Microorganisms of Interest Isolated

The Microorganisms of interest which are mostly causatives of diarrhea diseases isolated during this study among food handles were *Staphylococcus aureus* 26

(13.0%); *E. coli* 7 (3.5%); and *Staphylococcus spp.* 120 (60.0%); However are other species isolated were *Proteus spp.* 8 (4.0%); *Klebsiella spp.* 32 (16.0%); *Pseudomonas aeruginosa spp.* 6 (3.0%); *Streptococcus pneumonia* 1.(0.5%). This was also confirmed by health department officials during in-depth interview as diarrhoea diseases ranked third among ten top diseases in the Municipality. These findings were somehow similar with study findings by Omemu *et al.*, (2014) in Nigeria; Andargie *et al.*, (2008) in Ethiopia whereby over half (50.9 %), (63.9%) respectively of food handlers sampled had tested positive for bacteria.

The enteric bacteria isolates and their frequency of occurrence were: *E. coli* (17.7%); (3.1%); *Klebsiella oxytoca* (7.7%); (5.5%); *Salmonella spp.* (5.5%); *Citrobacter freundii* (4.4%), (0.8%); *Enterobacter spp.* (2.8%); (0.8%); *Pseudomonas aeruginosa* (8.3%), and *Proteus mirabilis* (4.4%); *Serratia spp.* (1.58%), *Coagulase negative Staphylococci spp.* (41.7%). Mensah *et al.*, (2002) in Accra, reported that out of 511 street food items examined 69.7% contained *Mesophilic* bacteria, 5.5% contained *Bacillus cereus*, and 31.9% contained *Salmonella*, *Staphylococcus aureus*, while 33.7% contained *Enterobacteriaceae*. Health statistics clearly indicate that microbial contamination is the greatest risk to food safety. Food poisoning bacteria can be found on the hands, in cuts, boils, sores and spots, in the stomach, in the hair, ears, nose and mouth, and on clothes. Food handlers are an important source of food poisoning bacteria (WHO, 1989).

5.4 Microorganisms Isolation by Level of Education

Isolation of Microorganisms among respondents with lower level of education, that is Primary level of education and below 112 (56.0) found that their hands were more

contaminated as compared to respondents who had secondary level of education and above. These findings resemble with study done by Kitagwa *et al.*, (2006). Lower level of education among food handlers have been linked to poor hygiene practices leading to food contamination during food handling, storage, food preparation and serving, Kitagwa *et al.*, (2006). This implies that if some efforts will not be taken by the authority the prevalence of food borne illness will exist in the area.

5.5 Microorganisms Isolated in Different Working Department

In working environments, individual employees can make a big difference in positive as well as negative ways. This is especially true in food handlers where an employee can introduce a food safety hazard at any point in the food production process. Food handler's personnel are the single most critical element in keeping the food handler's operation safe and sanitary National Food Service Management Institute (NFSMI, 2009).

Our study findings show that majority of food handlers 146 (73.0%) who had experience of more than a year had more contaminated with microorganisms as compared to 54 (27.0%) who had working experience of less than a year. These findings were different from the study done by Siow and Sani (2010) Malaysia; Isara and Isah (2014) in Benin City who explained that food handlers who had worked for longer years in food restaurants had better practices of food hygiene and safety than those inexperienced food handlers who acquired the lowest knowledge and practice of food hygiene and safety respectively.

Our Study found out that 180 (90.0%) of respondents in cooking and serving departments were mostly contaminated with microorganisms as compared to

preparation/cleaning department 20 (10.0%). These agreed with Pether and Gilbert, (1971); Andargie *et al.*, (2008) in Ethiopia who explained that Studies in Epidemiology have confirmed that bacteria such as *Salmonella typhi*, *E. coli*, *Staphylococcus aureus* can survive for varying periods on the fingers and other parts of the body. Our findings can be explained as cooking and serving department are at more risk of contamination due to nature of their work; preparation/cleaning department have accessibility to hand washing with soap as when washing utensils since the study was carried out during work time.

5.6 Microorganisms Isolated between Trained and Untrained Food Handlers

Regarding to training more than half 117 (58.5%) of respondents had not been trained on food hygiene and safety as compared to 83 (41.5%) who had trained. Majority of trained 61 (73.5%) had a training for less than 6 months. These findings tally with the study done by Omemu *et.al.*, (2008) in Nigeria; Siow and Sani (2010) in Malaysia; Chukuezi *et.al.*, (2010) in Ghana; Omemu and Oloyede (2014) in Nigeria; where 88%; 72.3%; 95.24; 86.7%; of the food handlers had not trained on food handling practices, acquired skills from observation, parents, trial and error as compared to 12%; 27.7%; 4.76%; 13.3%; who had formal training.

However Martins (2006) in South Africa; and Isara and Isah (2014) in Benin City, observed differently, found that there was good knowledge and practice of food hygiene and safety among food handlers. Knowledge was significantly influenced by previous training in food hygiene and safety. However; more respondents (50.5%) who had trained had their hands contaminated by microorganisms as compared to 99 (49.5%) who were not trained. These results concurred with the study by Angelillo *et*

al., (2001); Askarian *et al.*, (2004), who showed that in some previous studies no differences were detected between the staff who attended a training course with those who did not. The explanation of our findings may be due to facts that those trained on food safety and hygiene, do not practice personal hygiene. Training may increase the knowledge of food safety practice but this does not always produce a positive change behavior in food handling attitudes.

Howes *et al.* (1996); Powell *et al.* (1997). Therefore, alternative educational strategies, such as those based on motivational health education and promotion models are required for improving food safety and hygiene practice Angelillo *et al.* (2001); Askarian *et al.* (2004); Clayton *et al.* (2002).

5.7 Microorganisms Isolated in Food Premises with Hand Washing Facilities

Availability of hand washing facilities within the area does not determine the utilization of facilities. This was supported by observation during the study where by almost 76.8% of food premises visited had hand washing facilities. Despite the availability of hand washing facilities within food premises, yet (90.5%) of the respondents who said have hand washing facilities found contaminated with microorganisms.

These findings were supported by our observation during study where food handlers were able to touch their nose, hair, visiting toilets, touching money, cleaning towels hence handling food without washing their hands before touching food. This shows that food handlers do not practice hygiene principles during food handling such as hand washing at critical moments. This concurred with study done by Omemu and

Oloyede (2014) in Ghana revealed that many of the food handlers do not wash hands at the commencement of the day's work, few wash hands after every visit to the toilet and after touching their hair, nose or mouth Omemu and Oloyede (2014).

This means that the health education on provision of hand washing facilities within food premises given to food premises owners is not well perceived or not producing attitude change. Hand-washing is very important because the hands are considered as the most important vehicle for transfer of micro-organisms from faeces, nose, skin or other sites to food WHO (1989). Organisms such as *Salmonella typhi*, non-typhi *Salmonella*, *Compylobacter spp.* and *E. colli* can survive on fingers tips and other surfaces for varying periods of time and some cases after hand washing Pether and Gilbert (1971); WHO (2002). Hygiene practices especially hand washing before handling of food is very important since human beings represent the largest contamination sources of food Marriot (1985).

5.8 Health Department Views

The department of health in the Municipality in collaboration with other departments and Organ has mandate to supervise, educate, monitor and carryout legal proceedings to those who violet public health rules and Municipal bylaws in order to safe guard the health of the public even though it encounter several challenges such mushrooming of food vendors (mama/babalishe) who don't have permanent food premises/structures, inadequate knowledge and skill among food handlers on food hygiene and safety, inadequate resources such as qualified staffs, finance, transport, food sampling equipment, disease outbreaks/adhock activities that has constrained the efficiency in regulating, monitoring and supervising the food hygiene and safety

activities that lead to occurrences of food borne diseases within the Municipality. This study concurred with the study done by Monney, Agyei and Owusu (2013) in Ghana where by the department responsible for monitoring, supervision and safeguard of public failed to do so due to inadequate resources.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The study findings revealed that there is an existence of poor food hygiene practice among food handlers in the studied food premises. In level of education and learned behavior through trainings did not match with the intended hygienic practice. Hand washing practice by food handlers' after or during critical moments is determinants of isolation of enteric bacteria. The study found out that the prevalence of enteric bacteria from hands of food handlers studied was high which does not match with the presences of hand washing facilities within their food premises.

An effective means of preventing the transmission of pathogens from food handling personnel through food to consumers is by adherence to hygienic food-handling practices. However, formal education is important for food handlers. Lower educational levels of food handlers have been linked to poor hygiene practices leading to food contamination during food storage, handling, and food preparation.

In view of the mode of Training of food handlers on food hygiene and safety practices, more than half of food handlers (58.5) had no formal training. Food and safety practices such as personal hygiene practices (hand washing with soap at critical moments) is crucial.

Regardless the availability of hygiene facilities in most of the food premises most of food handlers do not practice hand washing as study isolated microorganisms among

food handlers hands where their food premises were equipped with hand washing facilities and soap. This gives an emphasis to the importance of conducting regular trainings among food handlers on food hygiene practices to ensure upholding of practicing personal hygiene in so doing will ensure public health safety.

The Environmental Health and Sanitation Departments in all districts in Tanzania are legally mandated by the Tanzania Food and Drugs Authority (TFDA) cap 10 Amendment Act of 2012 of the Republic of Tanzania; Township rules no 101; Local Government Authorities, communicable disease control cap 96, Criminal codes and other councils bye-laws to among others, conduct regular inspection of food and food premises, supervise, monitor and prosecute food vendors who sell food under unhygienic conditions.

Despite of these mandates, during an interview with the Municipal Environmental Health Officer of the Ilala Municipal Council, it was pointed out that department has inadequate capacity (human resource, transport facilities and funds) to efficiently monitor, supervise and take actions on the activities of food vendors within its authority.

6.2 Recommendations

Microorganisms are associated with contamination from faecal matters due to poor personal hygiene. The hands are the most important vehicles for the transfer of organisms from faeces, nose, skin, or other sites to food. This can pose a serious threat to food safety hence cause food borne illness to the public. Therefore awareness creation among food handlers regarding on personal hygiene practices during food processing is paramount.

Development of training/orientation programs for food handlers is therefore highly recommended to Ilala Municipal Council, health department. This should be carried out regularly to all food handlers before employment in food premises with some cost sharing from food premises owners and a certificate should be awarded at the end of each training program of not less than two weeks (14 days).

MOHSW through TFDA should develop training manuals on food hygiene and safety practices for councils trainers to serve as a guide and ensure uniformity of subject matter all over the country. Ilala Municipal Council in collaboration with TFDA should conduct regular at least annually impact evaluation assessment of the training programs in order to achieve and sustain behavioural change among food handlers.

Ilala Municipality, health department should strengthen supervision and regular monitoring of food premises to ensure adequate food hygiene and practices among food handlers. This can be done by adequately resourcing the Environmental Health and Sanitation Departments. Food premises owners should be sensitized on the importance of employing a trained food handlers and also to be sensitive in ensuring their staff adheres to food hygiene practices such as hand washing with soap after visiting toilet and before handling food and provision of adequate functioning hygiene facilities on their food premises such as hand wash basin with running water and soap.

For baba and mama lishe it is advisable to formulate food vendor groups that will ensure adherence to appropriate food hygienic codes of practice, also will serve as a

vehicle to efficiently training and conveying information and also grant of loans to improve standards of their food premises.

Food hygiene and safety training come out as a strong forward planner for change of attitude and food hygiene practices among food handlers. Continuous monitoring and periodic training incorporating basic principles of food safety and microbial surveillance in foods is essential to optimizing food hygiene and safety practices into food premises. This aspect is very essential for programme implementation and policy implication. Further studies on food safety knowledge, and practices in the study area are recommended among food handlers.

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APPENDICES

Appendix 1: Questionnaire Used to Collect Data from Food Handlers

Instruction

- Do not write your name on the questionnaire
- Please answer all questions
- Use a pencil to fill in
- Keep your questionnaire clean and your hand writing should be legible
- Tick in appropriate box ☐ or write in specified cases.

Please fill free to respond as your answers will not be revealed anywhere as a single information rather, findings will be compiled and reported as general.

A: introduction of Premises Locality and Sample Collection

Local Authority/.....

Research Assistant No

Tel. No.....

Time of sample collection..... am/pm

Laboratory Ref.

Date of sample collection/...../ 20.....

Location/ward:.....

Type of premises:

Hotel { }

Restaurant { }

Canteen	{ }
Fast food	{ }
Mama/babalishe	{ }
Registered by Local Authority:	
Yes	{ }
No	{ }

(B) Demographic Information of catering staff

1. What is your sex
 - (i) Male { }
 - (ii) Female { }

2. What is your age (years)
 - (i) Below 18 yrs { }
 - (ii) 18 – 25 { }
 - (iii) 26 – 35 { }
 - (iv) 36 – 45 { }
 - (v) 46 – 55 { }
 - (vi) 56 and above { }

3. What is your education level
 - (i) Primary school and below { }
 - (ii) Secondary school education { }
 - (iii) Collage/University graduate { }

4. Working experience (years)

- (i) Less than one year { }
- (ii) 1 to 5 { }
- (iii) 5 years and above { }

5. Which department/Section of work

- (i) Preparation/Cleaning staff, { }
- (ii) Cooking staff { }
- (iii) Serving staff { }

6. Have you attended any training on food safety practices?

- (i) Yes { }
- (ii) No { }

7. If yes in Q.6 for how long, no skip Q. 7

- (i) Less than one month { }
- (ii) Three to six months { }
- (iii) Six months and above { }

8. Ratio of people served in a day at your food premises

- (i) Less than 99 { }
- (ii) 100 to 250 { }
- (iii) 251 to 450 { }
- (iv) More than 450 { }

C: Environmental swab: Hands of food handler

1. Does the food premise have a permanent hand wash sink?

- (i) Yes { }
- (ii) No { }

2. Is the sink used for hand washing separate from that used to supply water for the preparation of beverages and/or food for sale or other services?

- (i) Yes { }
- (ii) No { }

3. What is available for workers to dry their hands after washing?

- (i) Single use paper towels? { }
- (ii) Cloth re-useable towel? { }
- (iii) Electric hand dryer? { }
- (iv) No any means { }
- (v) Other(specify)

4. Is antibacterial soap/sanitizer/detergents available and used by food handlers?

- (i) Yes { }
- (ii) No { }

Appendix 2: Questionnaire form for In Depth Interview Checklist

Ilala Municipal Council Health department officer's

Data from this research will only be used for educational purposes; all data will be kept confidential and anonymous. Participation is completely voluntary and you may stop at any point. The aim of the current study is to assess food safety precautions, measures in catering premises.

1. Is there any department or partners within the Municipal council who are responsible for food safety and hygiene activities?

- a. Yes ☐
- b. No ☐
- c. Not sure ☐

If yes which of them

IS the department or partners having food safety objectives in place?

- a. Yes ☐
- b. No ☐
- c. Not sure ☐

If Yes please mention them

- a. _____
- b. _____
- c. _____

2. Is the community involved in food safety and hygiene?

a. Yes

☐

b. No

☐

c. Not sure

☐

3. How is the community involved in food safety and hygienic practices?

.....

.....

.....

4. Which is the community health problems associated with food safety practices found at your area?

.....

.....

.....

5. Are there any strategies to prevent/control health problems related to food borne illness?

a. Yes

☐

b. No

☐

c. Not sure

☐

If yes what are the strategies

.....

.....

6. Do you have any plan to ensure food hygiene/safety in the municipality?

a. Yes ☐

b. No ☐

c. Not sure ☐

If yes, what are the plans?

7. What are the strengths and constraints in ensuring food safety in the municipality?

Strengths _____

Constraints _____

8. What are your recommendations/suggestions to attain sustainable food safety and hygiene among food handlers within the Municipality?

Appendix 3: Food Premises Observation Checklist

Food Premises No

NO	Area	Clean/Available and Satisfactory	Clean/Available but not satisfactory	Not clean/Available and not satisfactory	Not Applicable
1	Check the general cleanliness of the premises For example dust on the table, cooking and serving utensils if well washed, tables well cleaned and arranged in a proper way.				
2	Observe means of refuse collection and storage facilities				
3	Observe wear of nail polish when handling food stuffs?				
4	Observe availability of hand wash basin separate from sink for washing salads				
5	Observe if food handlers have wearing uniform				
6	Observe availability of soap /detergents/sanitizer for hand washing				
7	Observe signs of communicable diseases				
8	Observe latrines situation				

Appendix 4: Photos



Specimen collection in one of the food handler



Picture showing main laboratory



One of hot air oven used for sterilization



One of culture plate with specimen showing microorganisms isolated after
Catalase test.