FOOD SAFETY AND HYGIENE PRACTICES IN THE INFORMAL OUTLETS:
(A CASE STUDY OF FOOD KIOSKS IN KIBERA SLUMS, NAIROBI)

By

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University or any other Award.

Date: 26/06/2008

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We confirm that the candidate under our supervision carried out the work reported in this thesis.

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DEDICATION

I dedicate this thesis to God Almighty for his guidance, my family and to those who, in one way or another, supported me during the research and write up of this study.
ACKNOWLEDGEMENT

My gratitude goes to all individuals and institutions who have contributed towards this thesis. To the Almighty God who gave me good health, strength and ability to work on this paper.

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My sincere gratitude goes to my family, especially my children Iddah, Christine and Edward whose moral support, dedication and commitment prodded me to continue despite the many challenges. May God richly reward you for your support and encouragement?

Thank you all.
ABSTRACT

This study was undertaken to investigate the food safety and hygiene practices in the kiosks in Nairobi. Kiosks play a major role of creating employment opportunities to many people owing to the high demand for cheap and reliable, food especially in the slums. However, health hazards from the un-abated mushrooming of these outlets in the urban centers should not be ignored. Kiosk owners concentrate on profit making at the expense of the health of consumers thus creating challenges such as lack of portable water, inadequate structures and poor sanitary conditions among others. This has led to outbreaks of food borne diseases like Typhoid and Cholera in the slums. The objective of this study was to isolate and identify Salmonella typhi and E. coli in order to determine the risk factors in selected beans and sukumawiki. It also highlighted the predisposing factors that lead to food contamination. A descriptive cross-sectional study was therefore carried out in Kibera slums in Nairobi area. A total of 204 kiosks in the area were used as a sample population. Questionnaires and interview guides were used to assess the respondent’s perception and knowledge of food safety in relation to hygiene practices. Respondents were selected using purposive and random sampling. An observation checklist was used to assess good hygiene practices (GHP). The study also used experimental design where about 50 samples each of beans and sukumawiki were analysed in the laboratory for coliform, E. coli, salmonella and aerobic plate count. Predisposing factors were surveyed and quantitative analysis done with the aid of SPS Computer package. Quantitative research used ANOVA at 95% level of confidence. The T-Test and Chi-Square were used to analyze the differences in micro-organism levels in the two food samples. Observation findings revealed that possible contamination could occur due to insufficient food hygiene practices such as not covering food, improper storage and, poor personal hygiene practices by food handlers such as use of dirty hands and sneezing over food, inadequate environmental hygiene such as open drainages, dilapidated structures, unhealthy waste disposal methods and use of dirty equipment and water. The lab results indicated that both beans and sukumawiki had E. coli and coliform present to a level of concern while Salmonella typhi was not isolated. S. typhi was used to confirm the prevalence of the endemic typhoid fever in the slum areas. E. coli was used to confirm whether food contamination is a result of faecal pollution and poor waste disposal practices. This was to confirm whether the theory of wrap and throw (flying toilets) poses a risk to foods in the kiosks within the slums. In conclusion, the presence of E. coli at 44° C was an indication of recent human faecal contamination, an indication of poor sanitation. The study therefore recommends that the Government through the Ministry of health take affirmative approach to ensure that kiosk vendors comply with the safety measures and consumer ethics as stipulated by the Codex Alimentarius guidelines to facilitate the provision of clean food that is less contaminated.
### ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
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<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
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<td>APC</td>
<td>Aerobic Plate Count</td>
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<td>CCF</td>
<td>Codex Committee of Food</td>
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<td>DCA</td>
<td>Deoxycholate Citrate Agar</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<td>FSU</td>
<td>Food Safety Unit</td>
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<td>GHP</td>
<td>Good Hygiene Practices</td>
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<td>NDPSP</td>
<td>National Development Plan Sessional Paper</td>
</tr>
<tr>
<td>NLF</td>
<td>Non Lactose Fermenter</td>
</tr>
<tr>
<td>TSI</td>
<td>Triple Sugar Iron Agar</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<td>WTO</td>
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CHAPTER ONE

INTRODUCTION

1.1 Background Information

Informal food outlets have become indispensable components of food distribution systems all over the world. However, illnesses associated with the consumption of contaminated foods are increasingly making food safety and hygiene practices a contentious issue globally. Millions of people around the world die as a result of consuming contaminated food and water annually making food borne diseases the most widespread health problem in the contemporary world (Brutland, 1999).

Recently, the risk of food borne diseases has increased significantly both locally and internationally due to changing food consumption patterns, increase in population, consumer demand and globalization of food trade industry (Brutland, 1999). This has raised the concern of the World Health Assembly who view the phenomenon as a collective responsibility for all food producers and handlers at all stages of the food chain. A recommendation to adopt a directive 93/43/ECC guideline based on the recommended International Code of Practice by the European Community and the application of HACCP has been given as a solution to the problem (WHO, 2002). This is to protect the life of consumers and to ensure that standards and guidelines are followed.

Although the magnitude of food borne diseases is difficult to estimate in developed countries, reported cases account for less than 10% (WHO, 2002). In developing countries, the number of unreported cases is much higher and only less than 1% cases are reported (WHO, 2002). Worldwide the total percentage of people suffering from food borne diseases each year is estimated to be up to 30% (Fact, sheet 2000). In addition, other reports indicate that in the year 2000 alone, 2.1 million people died from food related illnesses around the world (WHO, 2002).

In USA for example, 6 million cases of food born diseases are reported annually while in Germany the reported cases of infections rose by 100% between 1965 and 1990 (WHO, 2000). This significant increase was attributed to urbanization, change of lifestyle and increase of micro-organisms from one location to another.
Rapid urbanization and poverty crisis in Latin American, Asian and African countries have led to the development of informal food systems estimated to cater for about 2.5 billion people annually (FAO, 2001). These systems generate a large volume of business and capital thus boosting the economy. Subsequently, many countries, Kenya included, experience population increase and rural-urban migration in search of jobs resulting in the high demand for food. This in turn has led to the creation of informal food systems, referred to as ‘food kiosks’ to meet the demand. Kiosks offer delicious and affordable meals but are seen as potential avenues for serious food poisoning because foods are normally prepared in conditions that are not hygienically conducive. Apart from being viewed as illegal structures, kiosks are faced with many challenges, which include lack of portable water, poor waste disposal methods and inadequate equipment and facilities among others. These pose a challenge to the Government, Local Authority and Public Health concerning the quality of foods produced and served from these outlets.

1.2 Problem Statement and Justification

The recent outbreak of cholera in some parts of Nairobi and subsequent closure of food kiosks due to poor sanitation is an indication that there is need to look into the hygiene and safety practices of food from the source to the point of consumption. Although food safety regulations are clearly spelt out, the vendors do not comply. In addition public health officers carry out little surveillance to ensure that the vendors adhere to the health regulations as stated in the Public Health Act 242 and the Food Drugs and Chemical Substance Act 254 Laws of Kenya.

Food safety and hygiene practice in kiosks is an issue that could jeopardize consumers' health if not addressed. Lack of sanitary facilities, poor storage and poor hygiene practices are viewed as some of the contributing factors that lead to contamination of food by microorganisms such as E.coli and Salmonella typhi. The location of kiosks near garbage dumps, opens sewers and drainages raise a lot of concern as to how vendors can prepare safe food in such a polluted environment Although foods served in kiosks may be cheap and affordable to many low-level income earners, the dangers that go with eating these foods are higher and more costly as people do not know the source of water used for cooking and worse still the hygienic practices observed during preparation and selling the foods may be questionable. The confirmation of diarrhea related diseases from a local dispensary as a result of eating food
contaminated by micro-organisms is evidence that there is a problem in the food sector. In addition, the recent demolition of kiosks by the City Council was an indication that emerging problems have overstretched the City Council resources and the only solution is to reduce the number through demolition.

This study was therefore conducted to identify the level of microbial contamination in the preferred foods sampled from the kiosks in a bid to establish how hygienic practices and lack thereof have contributed to presence of organisms in food. The findings are aimed at confirming the assumption that food safety and hygienic practices are compromised in the kiosks.

**Research Questions**

1. Are foods cooked and served in kiosks safe for human consumption?
2. What are the factors influencing the safety of foods sold in the kiosks?
3. Are the foods cooked and served in safe and hygienic conditions?

**1.4 Hypothesis**

This is stated in the null hypothesis which states that Poor food safety and hygiene practices in the kiosks are the main factors that trigger food borne diseases.

**1.5 Objectives**

The main objective of the study was to investigate the food safety and hygiene practices in Kiosks and to assess the conditions in which they operate within Kibera slums.

**1.6 Specific Objectives**

1. To investigate the socio- economic role of food kiosks.
2. To investigate the hygiene practices of the kiosk vendors.
3. To investigate factors predisposing food served in kiosks to microbial contamination.
4. To assess microbiological safety of foods prepared and served in kiosks with particular reference to *Salmonella typhi* and *E.coli* contamination.
1.7 Operational Definition of Terms

**Control Measure** - Any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

**Cross contamination** - Contamination of clean, wholesome food with illness producing bacteria adhering to raw food, soiled hands, soiled work surfaces, soiled equipment, utensils, clothing et

**Food borne illness** - Condition, infectious or toxic in nature caused by agents that enter the body through the ingestion of food.

**Formal sector** - Business activities, which are legally operated.

**Hazard** - A biological, chemical or physical agent in food or condition of food with the potential to cause adverse health effects.

**Household** - Group of people each with different needs and abilities who contribute to a common economy

**Household Economy** - The ways in which a household gets its income either through savings, assets and consumptions of food and non-food items.

**Informal sector** - Small economic activity operated for the purpose of creating self-employment. The policy makers do not recognize them and may operate illegally.

**Kiosks** - Temporary structures made of iron sheets, wire mesh, wood and cement used for the purpose of food production and service.

**Relative Poverty** - Poverty of a household as compared to other households in the same community.

**Safe Food** - Food that will not cause any harm to consumers when it is prepared and consumed according to its intended use.

**Slum** - densely populated area of city characterized by poverty, poor housing and poor infrastructure.
1.9 Conceptual Framework on food safety.

Food borne diseases e.g. typhoid

Food contamination and poisoning

Food Exposure to pathogenic microorganism e.g. *E. coli*, *Salmonella typhi*

Improper Public Health regulations e.g. medical examination

Lack of basic skills in simple hygiene e.g. food not covered, inadequate heating.

Improper food handling practices e.g. dirty hands, utensils, open wound, Sneezing, coughing over food.

Environmental factors to food safety and hygiene e.g. rodents, open sewers, sludge, garbage heaps, cracked crevices, chipped floors, walls.

When cooked food is improperly handled by unhealthy persons, prepared in untidy environments and not handled hygienically, it may lead to contamination and growth of pathogenic microorganisms. This could result to food poisoning.
CHAPTER TWO

LITERATURE REVIEW

The literature was reviewed in line with the objectives of the study. This chapter has therefore looked at the socio-economic contribution of kiosks; food borne diseases and microorganisms; factors contributing to food borne diseases and the hygiene practices of the vendors; the predisposing factors of food served in the kiosks in relation to microbial contamination and the challenges facing the food kiosks.

2.1 Socio-economic roles of food kiosks

International food trade is playing an important role in the provision of meals and nutritious diets to the world's population. Rapid urbanization has led to mass food production as the numbers of people eating out in the informal food stalls seem to be on the increase. This is attributed to urban lifestyle, limited time available to prepare a meal, distance from home to place of work and the cost of fuel. The food trade plays an important role not only in the provision of food but also in promoting culture, tourism and identity of individual countries. For example, Germans are identified to be specialists of pork products, while French cuisines and recipes are learnt all over the world by any chef seeking recognition in gastronomy. The Kenyan “nyama choma” is a specialty known by many Kenyans. Food trade also boosts the economy of many countries by creating job opportunities thus contributing to the financial independence of many individuals. It is estimated that two and a half million people worldwide consume foods from informal food outlets in search of alternative cheap and reliable food. For example in Malaysia, it is estimated that informal food stalls provide employment to about 100,000 vendors with an annual turnover of about 2 billion (Draper, 1996). Further studies found that the total annual volume of trade rose from 67 million in a city of Bogar of about a quarter million people to 2 million in a provincial town of Manikganji (FAO, 2001). On the other hand in Calcutta, 130,000 food vendors made an estimated annual profit of US$ 100 million, while in Thailand food from the stalls are distributed to institutions of learning. Across Asia, informal food outlets are found to be cheaper and more reliable than formal hotels and restaurants and even much cheaper than homemade foods (Davis, 1999). Informal food outlets in Thailand are among the most organized and recognized in the world. About 20,000 food stall vendors prepare about 40% of the foods consumed in the city of Bangkok. Apart from the food vendors, many people are also involved in income generation activities
involving the trade. These include the suppliers who supply the food items to the vendors and even the farmers, transporters and carriers forming a complete chain of beneficiaries of the sector. This in turn provides income to many people.

In African countries like Togo, Ghana and Benin, it is estimated that 70-90% of the employees are in the food trade (Andrew et al, 2003). A mini census and survey carried out on 334 street vendors in Ghana indicated that the informal food systems employ over 60,000 people and has an estimated annual turnover of over US$100 million with an annual profit of US$ 24 Million (Andrew et al, 2003). In Lesotho and Democratic Republic of Congo, 80% of the employees are in the food trade. Most of these traders sell food primarily to improve food security of their household and to have some financial independence (Tomlinson, 2002). Moreover, the informal stalls offer a wider variety of foods in the market. Besides providing consumers with better choices of the product, the sector is a significant source of employment for many people particularly women, who are often victims of poverty. In Nigeria for example it is estimated that 96% of the school children buy their first meal (breakfast) from the food stalls (Davis, 1999). While in South Africa, an estimated total of 7$ million was spent on food stalls in the town of Guatang.

Despite the significant contribution, the food trade has also realized some negative impact across the board. Many countries have experienced some serious constraints on socio-economic development in terms of cost, loss of income and manpower (Mortajemi et al, 1995). For example in United States in 1980, imported food worth US$ 20 million was rejected on account of contamination with moulds and aflatoxins Consequently, in Nigeria, Food and Drug Administration (NFDA) destroyed millions of tons of contaminated cereals worth more than 1million dollars in 1977, and in Peru it was reported that the epidemic of cholera cost the country over US $7000 in 1991 due to loss of food exports, loss of tourism and medical costs. Despite the fact that the informal street food is considered illegal in Zambia and Zimbabwe, the food trade is reported to be on the increase due to economic decline, high unemployment rate, rapid urbanization and the HIV/AIDS pandemic. Besides, lack of support unlicensed vendors are excluded from government and are chased away from vending sites (National Research Institute, 2002) Ultimately, the governments of both countries have realized the need to apply different approaches to improve the safety of foods consumed by the low-income groups in Lusaka and Harare (National Development Paper, 2003).
In many countries the dramatic growth of urban population is posing a risk to the environment (Mortajemi et al, 1995). It is estimated that by the year 2020, the global population will reach 7.6 billion and 98% of the projected growth will take place in developing countries. This increase in the urban population poses a great challenge to food systems and how they are managed. Already, this phenomenon has stretched urban services beyond their limits resulting in insufficient supplies of water, inadequate waste disposal methods and other sanitary services.

In Kenya, according to the Ministry of Planning, the informal sector has been marked by strong growth in terms of number of employees constituting from about 10% of the workforce in 1987 to some 70% in 2000 (National Development Paper No. 4, 2000). Similar reports indicate that in 1997 alone, 1.7 million people were engaged in the informal sector, an indication that the sector has become an increasing feature in the Kenyan economy (Economic Survey, 2003). The projection of the development plan indicated that small-scale enterprises would lead this country towards industrialization by the year 2020 (Sessional Paper, No 2, 1992). Although the details on the extent of informal stalls referred to as kiosks are not known, it is a major employer. Apart from offering food, kiosks also provide quick meals that are palatable, thus contributing significantly to the growth of the food sector in the last decade. Like any other country the growth of this sector is also attributed to poverty, rural-urban migration, declining economic performance, massive retrenchment and lack of formal employment (National Development paper, 2000).

Food kiosks provide a livelihood for a large number of workers by providing ready to eat meals, which are accessible and affordable even for the poorest citizens. According to WHO there was a remarkable increase of employment in 1994 in the food sector (Mwangi, 2002). The study revealed that kiosks provide better income per month compared to those in formal employment. It was also observed that most women integrate household and childcare duties with food vending activities comfortably (Mwangi, 2002). Further reports indicate that many households in Nairobi and especially in the slums depend a lot on the foods bought from kiosks including breakfast and snacks (Mwangi, 2002). The advantages kiosks have over hotels or restaurants are that they produce a wide variety of dishes that include traditional foods. Apart from being cheap and nutritious, the food is easily accessible and is relatively cost effective. In addition the households of the vendors and neighbors feed from the left over food.
daily. As such, no food is wasted. *Kiosks* in the slums have special menus, which are tailor made to suit the pockets of the market they cater for. For example, a plate of *githeri* (maize and beans) is sold for as little as Ksh.5 a cup thus the consumers are able to take a balanced diet. (All nutrient included). Although the costs of preparing *githeri* is higher in terms of fuel and time, most kiosks cook it overnight as the dish is a preference to many.

### 2.2 Food Borne Diseases and Microorganisms

Food borne illnesses occur daily in all countries from the most to the least developed (WHO, 2000). Diseases caused by contaminated food constitute one of the most widespread problems and is considered an important cause of reduced economic productivity. Although food safety is considered an important public health issue and a human right, the outbreak of diseases raises a lot of concern to consumers (Bryan, 1988). While the magnitude of the problem is unknown due to lack of reliable data, the food borne burden has been on the increase as some old organisms are recognized and other new ones have emerged because of the role food plays in their transmission (WHO Fact Sheet No.124, Jan 2002). For example outbreaks of *Salmonellosis* have been reported for decades, but within the past 25 years, the disease has increased in many continents. As a result the food borne illnesses are said to be on the increase due to increase in *micro-organisms*. The reasons for the rise are not known (Abdulsalam, 1986). The International conference held in Rome reported that millions of people still suffer from communicable and non communicable diseases annually, despite many rules and recommendations advocated to protect them against food borne diseases and infections (Singh WHO 2002). In industrialized countries, the outbreak of food borne diseases is attributed to relatively new pathogens such as *Campylobacter jejune, Listeria monocytogen* and *E.coli 0125:H7* (Del Rosario et al, 1995). In developing countries, however, *Salmonella* and *shigella* are considered the main pathogens responsible for most food borne diseases and is transmitted by foods such as poultry and their products, meat and meat products and milk (Mortajemi et al, 1999).

In Europe and other Western countries for example, *Salmonella* serotype entiritidis (*SE*) has become the predominant strain (Boyce et al, 1995). Investigations of (*SE*) outbreaks indicate that its emergence is also largely related to consumption of poultry, meat and their products. In Australia, Canada, United States, European countries and South Africa, Infections with *E. coli* serotype 0157:H7 have been reported. *E. coli* has emerged rapidly as a major
cause of bloody diarrhoea and acute renal failure (Mortajemi et al, 2002). The outbreaks of these infections are associated with beef consumption and are said to be fatal particularly in children. In Japan for example, in 1996 an outbreak of *E. coli* 0157:H7, affected over 6300 school children and resulted in two deaths (WHO fact sheet No. 124, 2002).

This was considered the largest outbreak ever recorded for this pathogen. (Fact sheet no. 124 (WHO, 2002). In Canada, in the town of Walkerton, Ontario, an outbreak of *E. coli* D157 which claimed 5 lives and left 27 hospitalized was reported (WHO, 2002). Laboratory tests confirmed that *E.coli* contamination was in the water supply system. As a result, the Public health Unit issued a “Boil Water Order” to the residents of Walkerton, which is still in effect (WHO, 2000).

It was also reported that Governments all over the world are intensifying their efforts to improve food safety (Breuer et al, 2001). The efforts are in response to an increasing number of food safety problems and the rising consumer concerns. The global incidences of food borne diseases are difficult to estimate but it has been reported that in the year 2000 alone 2.1 Million people died from diarrhoeal diseases. These cases were attributed to the contamination of food and water for drinking (Fact Sheet, Jan, 2002). In the United States of America for example, around 76 million cases of food borne diseases were reported which resulted in hospitalization of 325,000 people. It is also estimated that approximately 5000 deaths occur each year (Mead et al, 2002).

In developing countries such as Latin America, Asia and Africa, the rate of infection is less documented yet these countries bear the brunt of the problem due to the presence of a wide range of food borne diseases, which are caused by biological agents that include bacteria, viruses and parasites. Other infections are caused by bacterial pathogens such as *Vibrio cholerae, Escherichia coli, Campylobacter jejuni, Salmonella sp shigella spp, Entamoeba histolytica, Cryptosporidium spp, and vibrio species*. These illnesses have diarrhoea as their major clinical symptom and maybe watery, bloody and persistent. Other symptoms include abdominal pains, nausea and vomiting (Mortajemi et al, 1995).

Although viruses will not grow in or on food, raw fruits and vegetables may serve as a vehicle for infection, for example many outbreaks of Hepatitis A have been associated with consumption of lettuce and diced tomatoes (Kaferstein et al., 1997).
In the wake of economic decline and rapid growth of urban population in developing countries in recent years, informal food outlets have increased, raising questions as to how food vendors conform to food safety regulations and standards. For example in Accra, Ghana, 94% of the vendors are women who have minimal or no education at all, 75% of them do not pay taxes. A laboratory research done by FAO on 96 samples of food indicated that hygiene on the street vended foods has deteriorated significantly (FAO, 2001). The survey carried out between 1994 and 1997 for Waakye (Rice and Beans) showed that bacteriological counts of E. coli, Staphylococcus aureaus, Bacillus cereus and Clostridium perfigens were higher than the last survey. Salmonella was not detected (National Research Institute, 2003). Further reports revealed that waakye is cooked early in the morning and then stored in a warm place for the rest the day. A similar case of githeri (Maize and beans) of Kenya. The report further revealed that other challenges which include lack of access to clean water, proper disposal of sewage and regular refuse collection were also common. To improve this commercial food company (Unilever) decided to fund training to offer four thousand venders on basic hygiene skills in return for promoting their products. The package included provision of cold storage facilities which was to be used as an example to other food venders. Like any other African country, Ghana has a wide range of food borne diseases which include cholera, salmonellosis, campylobacteriosis, shigellosis, typhoid, poliomyelitis, brucellosis, amebiosis and E. coli infections (Mortajemi et al, 1995).

However, the problem is not limited to developing countries alone. Studies in industrialized countries have estimated that each year between 5-10% of the population suffers from food borne diseases. In many countries Salmonella enteritidis is the dominant pathogen and poultry, eggs and egg products have been identified as the predominant source. In certain countries 60-80% of poultry meat was reported contaminated with Salmonella enteritidis. Many developed countries are also experiencing outbreaks of diseases due to newly recognized types of food borne pathogens such as Campylobacter jejuni, Listeria monocytogenes and E.coli 0157:H7. Campylobacter and vibrio parahaemolyticus are the most common pathogens in fish, may be transmitted in the market or, whereas vibrio cholerae is transmitted by contaminated water either used for washing or cooking (Adam & Motarjeni, 1999). Other contaminants like pesticide residues or environmental chemicals are also reported in fruits and vegetables. For example Bacillus, clostridium, listeria monocytogens are said to
be introduced from the soil, while viruses such as rotavirus and bacteria such as Shigella. Salmonella, E-coli and Vibrio cholera are said to be introduced by sewage water. The location of kiosks also affects the way in which the pathogens are transmitted, as nearer it is to the roadside the higher is the rate of contamination.

In addition, the foods prepared from cereals like maize and beans, ugali and mandazi (sweetened dough which is deep fried). Are affected by bacterial pathogen known as Bacillus cereus which also affects the gravies, soups and sauses. (Adam & Mortajemi, 1999). Proper cooking will reduce the pathogen

There are more than 2300 species of salmonella but only 200 can be associated with human illnesses. (Malik, 1997). Poor hygiene conditions during production and washing of fruits and vegetables with contaminated water is considered as one of the possible sources of contamination. One of the very first studies done by the Greek in 1912 indicated that lettuce and radishes grown in the soil containing Salmonella typhi harbored the organism on their surfaces for up to 31 days. Modern research has confirmed this finding (Adam & Mortajemi, 1999). Brucellosis is another food borne disease that is raising concern. It occurs worldwide but in North America and Western Europe the incidents were reported to have decreased due to strict surveillance and the application of HACCP. However, in the Mediterranean countries (Egypt, Greece, Italy, Morocco and Tunisia) and the Middle East (Iraq, Iran, Saudi Arabia) Mexico, Peru, some regions of China and India the disease still remains an important health problem. It was recently reported in one of the dailies that 80 people were killed through food poisoning related to typhoid and brucellosis.

Another pathogen, which causes acute gastroenteritis, is Vibrio-parahaemolyticus. In developing countries, especially in Africa, the organism constitutes another group of pathogens, the bacteria causes persistent diarrhea. This may include parasites such as Giadia lamblia, Cryptosporidium ssp, Entramoeba histolytica. These parasites mainly affect children and people with impaired immunity. Raw and undercooked meat and vegetables contaminated with feaces is the major route for their transmission. Other parasites transmitted through raw meat include Trichinella spiralis, Taechia solium and Taechia. Saginatyawhich are infested with larvae of the parasites (Mensah, 2002)

According to Francoise Legell (2006) 75% of emerging and re-emerging food borne diseases is from animals. For example Bovine Spongioform Encephalopathy BSF, a fatal
transmissible neuro degenerative disease of the cattle was first discovered in the United Kingdom in 1985. This epidemic attacked over 180,000 animals in the U.K alone (Mermin et al 1997). The disease affects the brain and the spinal cord of the animals. The disease has since spread to 19 other countries including Japan. In human populations, exposure to the BSE agent has been linked to the appearance in 1996 of a new transmissible Spongiform Encephalopathy of humans called Variant Creutzfeld-Jacob Disease (VCJD). As of January 2002, 119 people had developed human VCJD most of them from the UK and five from France.

The most recent food borne disease is the Avian Influenza. According to WHO (2002), the virus that attacks birds is highly pathogenic, the flu started in Asia, moved to Europe and has more recently moved to Africa. It is reported that the virus infects human beings through contact with infected live or dead poultry. Exposure may also occur when the virus is inhaled through dust and possibly through contact with contaminated surfaces. The strain of Avian Influenza virus is found only in the respiratory and gastrointestinal tracts of infected birds and not in the meat, however available data shows that highly pathogenic viruses such as H5N1 strain may spread to all parts of the infected bird including meat. The Avian Influenza virus is reported to survive low temperatures and therefore can be spread through marketing and distribution, since low temperatures is conducive for the virus. Available data indicated that the virus could survive in feaces for at least 35 days at low temperatures of $4^\circ$ C while at $37^\circ$ C it could survive for 6 days. (WHO, INFOSAN. 2005) Avian Influenza virus can also survive on surfaces such as those within the poultry house environment for several weeks (WHO, INFOSAN. NOV, 2005). Emerging key facts in H5N1 is that it is not killed by refrigeration. Further reports indicate that the eggs can contain H5NI virus both on the shell and on the inside (whites and yolk). As a result eggs from areas with H5N1 outbreak should not be consumed raw or partially cooked (runny yolk for breakfast). Uncooked eggs should not be used in foods that will not be cooked, baked or heat-treated. In line with this cooked poultry should be served “piping hot”. Although there is no evidence to indicate that people have been infected with H5NI virus after consumption of properly cooked poultry or eggs, the study shows that the greatest risk of exposure to the virus is through handling and slaughter of live infected poultry. Good hygiene practices are therefore essential during and post slaughter
handling to prevent cross contamination from poultry to other foods and from food preparation surfaces and equipment.

Currently the UN has declared a regional crisis in West Africa, warning that the entire region is at risk. Over the last five weeks the virus has spread to 22 countries in Europe, Africa, and Middle East. Out of the 175 people who have caught the bird flu globally, at least 96 have died. The countries that have so far been affected include Iran, Iraq, Egypt, Ethiopia and Sudan, while Kenya has set aside $1.2 million as a preventive measure. The World Health Organization has expressed fear that the bird flu could be spreading in developing countries undetected due to lack of laboratories and capacity to detect it. Similarly, the U.N experts have also warned that the Avian Influenza is moving across the world at a threatening speed, and that the virus could mutate into a strain that could spark a human pandemic with disastrous effects if the international community does not set up measures to curb the outbreak of the bird flu.

According to FAO/WHO (2005) food standard program codex committee on food hygiene, some well-known microorganisms are re-emerging, posing a big threat around the world. These include *E. coli* which is a priority item of work for the codex committee on food hygiene (CCFH). Enterohemorrhagic *E. coli* (*EHEC*) 0157:H7 sero type was first identified as a human pathogen in 1982 in USA. This was after two main outbreaks of hemorrhagic colitis (bloody diarrhoea). Since then outbreaks of this new pathogen have become a serious public health problem throughout many regions of the world (Schlundt, 2001; Clarke et al, 2002). A number of factors are attributed to the survival and growth of *E. coli* 0157:H7 in food. This includes temperature, pH, salt and water activity (Kaper and O Brien, 1993). Further studies on the thermal sensitivity of *E. coli* 0157:H7 in ground beef have revealed that heating will kill *E. coli* strains as well as *Salmonella* spp. The optimum temperature for growth of *E. coli* 0157:H7 is approximately 37° C and the organisms will not grow at a temperature below 8° C to 10° C (Doyle and Schoeni 1987); *E. coli* 0157:117 survive freezing (Ansay et al, 1999). It is also reported that *E. coli* 0157:H7 is more acid resistant than other *E. coli* strains.

Food vehicles implicated most frequently are raw or inadequately cooked foods of bovine origin especially undercooked ground or minced beef and un pasteurized milk. Similarly, a number of outbreaks are also associated with the consumption of raw or minimally processed fruits and green leafy vegetables. It was reported that between 1993-1999 beef was
the main source of 46% of food borne outbreaks in the US. Other products included improperly pasteurized cow’s milk. It was also realized that pasteurization eliminates pathogens from milk including *E. coli O157:H7*. Further research confirmed that fruits and vegetables contaminated with *E. coli O157:H7* have resulted in a number of outbreaks (Ackers et al, 1998).

Green leafy vegetables were cited as the source of 26% of food borne diseases in the US between 1998 and 1999. Although contamination of vegetables may occur in several ways, the use of manure or water contaminated with feacal matter was suspected to be the possible routes of infection (Solomon et al, 2002). Suspected manure from nearby cattle and poor sewage treatment as another source of *E. coli O157:H7* strains detected in cabbage plants.

The ingestion of *E. coli O157:H7* infection ranges from a symptomatic infection to death. The incubation period from the time of ingestion to the first symptom ranges from one to eight days. The illness begins with abdominal cramps and non-bloody diarrhoea and can progress to bloody diarrhoea within two to three days (Mead 1998). More severe manifestation of *E.coli O157:H7* infection includes hemorrhagic colitis (grossly bloody diarrhoea). The most vulnerable group are the children and the elderly. However, people from all ages may suffer from infections of *E. coli O157:H7*.

During 1994-2000 the number of cases of *E. coli* increased from 1,420 (0.8/100,000 people) in 1994 to 4410 (approximately 1.6/100, 00 people) in 2000 (CDC, 2001). In Belgium 97% of the food borne diseases in the year 2000 were associated to *E. coli O157:H7* infection (Gilbert, 2001). Many developed nations including Japan, Britain, Australia, North America and Europe realize the burden of the food borne disease.

Green leafy vegetables are said to grow low to the ground and are therefore recognized as another source of *E.coli O157:H7* outbreaks. The use of manure or water contaminated with feacal matter is considered as one possible route of contamination (Solomon et al, 2002b). When contaminated, the fact that these produce is minimally cooked and almost consumed raw increases the likelihood of *E.coli O157:H7* infection. Meat is also reported to become contaminated with *E.coli O157:H7* when beef carcasses come into contact with feaces and contaminated hide during the slaughter process (Elder et al, 2000).

Food borne *trematodes* are also emerging as a serious health problem especially in South East Asia and Latin America due to increased aqua culture productions under unsanitary conditions and consumption of raw and lightly processed fish and fishery products (Hilborn et al, 1999).
This affects an estimated 40 million people worldwide especially among the people living along the coast. It causes acute liver disease and may lead to cancer of the liver. Thus vegetables are potential vehicles for transmission of pathogenic microorganisms known to cause human disease.

In African countries, particularly in Kenya, the reported cases of food borne diseases are considered insignificant although the health facilities indicate that the numbers of cases with food borne related symptoms (diarrhoea and vomiting) are many. (FactSheet No.124, 2002).

\textit{Vibrio cholerae} is a major public health problem in developing countries. It is found in contaminated water and food that include rice; vegetables, millet, gruel and various types of fish and is associated with the disease. Its symptoms include abdominal pain, vomiting and profuse diarrhoea that may lead to severe dehydration and eventually death (Fact Sheet, 124, 2002). Recently according to a UN report, an outbreak of \textit{cholera} was confirmed in two Sudan cities where it is alleged that the disease spreads rapidly claiming 27 lives after use of unclean water, which was believed to be a carrier of the disease. In less than two weeks, 1433 cases had been reported. The disease is known to spread fast especially in closely-knit populations. Cholera has emerged to be another threat especially in developing countries.

\subsection*{2.3 Factors contributing to food borne diseases}

The food borne diseases occur for a number of reasons, which include increase in international travel and trade, microbial adoption and changes in the food production systems as well as human demographics and behavior. Other reasons may also include the globalization of the food supply. In North America for example in 1996-1997 an outbreak of \textit{Cyclosporiasis} was linked to contaminated raspberries imported from South America (Fact Sheet. No.124, 2002).

The introduction of pathogens into new geographical areas is also viewed as contributing factors to the emergence of food borne diseases (WHO, Fact Sheet. No.124, 2002). \textit{Vibrio cholerae} was introduced in waters off the coast of Southern United States when a cargo ship discharged contaminated ballast into the water in 1991. It is assumed that a similar mechanism led to the introduction of cholera in South America the same year (Fact Sheet No.124, 2002).

Travelers, refugees and immigrants exposed to unfamiliar food borne hazards while abroad is also a factor as the international travelers become infected by the pathogens that are not
common in their countries. In Sweden, for example, it is estimated that about 90% of all cases of Salmonellosis are imported (Fact sheet no 124,2002). Other factors, which are experienced by many countries, include changes in microbial population, which have lead to the evolution of new pathogens and development of new variant strains in old pathogens (E. coli and Salmonella enteritidis). This has resulted in antibiotic resistance that might make a disease more difficult to treat (Fact Sheet, No. 124, 2002). The microorganism isolated in one country may exhibit different characteristics in another, making it difficult to be identified and controlled. On the other hand, the population of highly susceptible persons is on the increase world wide because of aging, malnutrition, HIV/AIDS pandemic and other underlying medical conditions. The elderly are likely to be infected more because they have low immunity to infection as such food borne infections are likely to invade their blood streams and lead to severe illnesses. People with weak immune system also become infected with pathogens at lower doses, which may not produce adverse reactions to healthier persons. For example persons suffering from cancer or AIDS are more likely to succumb to infections with Salmonella, Campylobacter, Listeri., Toxoplasma, Cryptosporidium and other food borne pathogens. In addition, in developing countries poor nutritional status may also lead to reduced immunity particularly in infants and children who become more susceptible to food borne infections (Fact Sheet no. 124, 2002).

The other key factors include Change in lifestyles where many people go out to eat in restaurants, canteens, fast food joints and informal outlets. In many countries effective Food Safety Education and Control Measures do not match the boom in food service establishments. As a result, unhygienic preparation of food provides good opportunities for contamination, growth and survival of food borne pathogens (Fact Sheet, No. 124, 2002). Processing factors that contribute significantly to food borne diseases are related to how food handlers manage the various stages food undergoes during purchasing, preparation, up to the point of service. These may include the physical, environmental and personal hygiene.

Physical factors include the equipment used, the furniture inside and within the premises and environment. Food preparation premises should be purposely built and sited in areas that are free from objectionable odors, smoke and dust and should be located away from rubbish heaps and in an area not prone to events such as flooding (Adams et al, 1999). The working surfaces should also be clean and easy to clean. Microorganisms grow rapidly on any
food particles, which come into contact with surfaces such as tablespops. Similarly foods easily lodge in some crack or crevices on poorly maintained working surfaces and this could act as a source of contamination.

A surface may appear physically clean but may not be micro biologically clean (Adams, 1999). A study carried out indicated that contaminated equipment contributed to 47% of bacteria, 26% of viral, 6% of parasitic and 17% of chemical outbreak of food borne illness as a result of cross contamination from inadequately cleaned equipment and use of inappropriate containers (Cody and Keith, 1991). Cross contamination and inadequate cleaning of equipment are known to occur simultaneously. A recent study of cross contamination with Campylobacter jejune and Salmonella species from raw chicken products during preparation, indicated contamination rate of 50% in chopping boards and 46% in plates; 6% Salmonella and 9% C jejune respectively (Cody and Keith, 1991).

Operations involving preparation of partially cooked foods should be separated by area and worker from operations involving preparation of raw protein foods. Similarly, food preparation areas should be separate from cleaning areas (Cody and Keith, 1991). This explains why the formal kitchen is divided into different sections such as entrementier (vegetable) pattissier (pastry) saucier,(meat) gardmonger (salad chefs, and hors d’oeuvres section among others to separate the operations mostly for hygiene purposes.

Personal hygiene such, as good grooming is an important factor in controlling food borne illness. Especially because many host adapted viruses are carried to foods only by human contact. Effective hand washing especially after handling raw foods and after visiting the toilet is essential in reducing contamination of food in this way. (De Boer and Hanne, 1990) recovered C jejune from hands that held raw chicken in 73% of the samples. Contamination of food by infected food handlers during preparation is the most common mode of transmission of viruses (Cody and Keith, 1991). Healthy carriers are known to infect many people unawares and this explains the reason why some people get affected after consuming some food while others who eat the same food are not affected. Personal grooming by food handlers is important in reducing food borne disease infections through cross contamination.

Many factors are associated with food borne diseases in homes and institutional settings especially in the kiosks. The major documented factors include improper holding
temperatures, inadequate cooking, contaminated equipment and poor personal hygiene. The same factors must be controlled to keep the foods safe (Cody and Keith, 1991).

It is reported that under cooking contributed to outbreaks due to *Clostridium botulinum* (91%) *Vibrio para haemolyticus* (92%) *Clostridium perfrigens* (65%), *Salmonella species* (67%) and *Trichinella spiralis* (100%) (Boyce et al, 1995) Raw and lightly cooked high protein dishes are potentially hazardous. Raw seafoods are sources of *Vibrio parahaemolyticus* and enteric viruses. Raw and undercooked pork, game meat is potentially infected with *Trichinella larvae*. All foods must be heated to the time, temperature and values required to kill pathogens (Cody and Keith 1991)

### 2.4 Challenges of food kiosks

Despite the socio-economic contribution of the *kiosks*, this sector is faced by various challenges, which include poor infrastructure, inadequate hygiene practices and sanitary standards, lack of portable water, inappropriate waste disposal methods and poor drainage systems among others. Lack of clear policies, capacity and skilled manpower are also other threats facing this sector (WHO, 2000). Haphazard location of *kiosk* in congested areas with no room for expansion is another challenge facing this sector since no meaningful improvement can take place. Moreover, the number of *kiosks* in operation is unknown; as a result many vendors do not pay taxes and are likely to get away with any offences incase of food poisoning. Subsequently, the source of food used in the *kiosk* especially in the slums are not known, most likely the vegetables are bought from near-by gardens probably watered by raw sewage water posing a health hazard. Besides, the majority of *kiosk* workers have been trained on the job; as a result they are not aware of the most basic hygiene measures to put in practice in their operations. In view of these, *kiosks* are considered as the major route through which food borne illnesses are channeled. Among the reasons given for this is that most *kiosks* prepare food way before consumption time and since the premises are congested with no proper storage facilities, the ambient temperatures allow bacteria to easily settle on the food. This is made worse by the fact that the same food is inadequately heated before it is served. In some situations, foods are undercooked and these might possibly result in ingestion of cysts and parasites. Furthermore, personal hygiene of the vendors is compromised since they rarely go
for medical check up to ascertain their health status. Besides, most kiosk vendors lack proper education on how to hygienically handle food during preparation processes. As a result, food is handled with least caution on the safety measures.

The Public Health Officers on the other hand, do not enforce the minimum safety measures to be undertaken before the vendors operate the food kiosks. Although the officers have prosecutorial powers to enforce the laws, the long court procedures prohibit them to take affirmative action in the event of an offence. Another challenge facing this sector is the authority that is not willing to improve the facilities to enhance trade and operations. The kiosk vendors are relegated to operate with all the risks of lack of capital, poor conditions and lack of support from the Government. The end result of this is dwindling profits, negative attitude and lack of concern to improve these facilities.

According to Public Health Officers of the Nairobi City Council food kiosks in residential areas are illegal. They are not recognized and most of them are operating without licenses. The officers further warn of the dangers of cooked foods haphazardly sold within the estates and is discouraging potential customers from buying the foods. In addition, the Public Health Officers feel that food served in kiosks in residential areas may be cheap and affordable for many low-level income earners but the dangers that go with eating these foods may be higher and costly in terms of medical bills. The report further states that because of limited space, informal food sellers jostle for any space available along the roads.

The Mayor of Nairobi in a local paper claimed that recent outbreaks of diseases in some parts of the city were as a result of eating contaminated food from food kiosks with poor sanitary conditions. It is worth noting that lack of sanitary facilities; open drainages, poor garbage collection and lack of portable water play a major role in food safety, particularly in the slums.

2.5 Control of food borne diseases
Food borne diseases pose a considerable threat to human health and the economy of individuals, families and nations. The World Health Assembly has therefore identified priority areas particularly in developing countries where technical assistance should be given to improve food safety (WHO, 2002). The WHO is promoting the “Leap forward” approach
which promotes the efficient and effective development of food-safety systems, incorporating preventive and risk-based approaches which include surveillance, risk assessment and implementation of risk management strategies.

The aim of Leap forward approach is to develop and implement food safety programs based on sound scientific data that can protect public health and promote trade in food and to attain global validity of food safety measures and standards. Other risk based approaches according to WHO (2000) is to develop partnership with FAO and Codex Alimentary Commission in line with WTO Agreement on the application of Sanitary and Phytosanitary Measures (SPS) (Fact sheet 124, 2000), the aim of this partnership is to form a strong body to fight the food safety problem. On the other hand the win-win collaboration approach which aims to reduce the burden of food borne diseases by integrating food safety activities with public health activities is also highly recommended. This will improve public health and strengthening the socio economic systems particularly of developing countries.

Other factors in mitigating the food borne diseases include the preparation of food several hours prior to consumption combined with its storage at temperatures, which favor growth of bacteria. From observation, foods such as githeri (maize and beans) were cooked overnight then left covered in a warm environment for the most part of the day. This would easily lead to contamination.

Insufficient cooking was also very common especially when meat was being cooked. Vegetables in most cases was partially cooked to preserve the nutrients, however, warm conditions in the small kitchen would enhance the growth of microorganisms resulting to food poisoning. Insufficient heating is another common cause of contamination as it creates a favorable temperature for bacteria to grow. Washing food especially vegetables were done using water previously fetched and kept in open drums. Although washing of vegetables would remove a portion of microbial cells, the vegetables should be subjected to a double wash treatment to remove soil, fecal matter and other contaminants.

Cross contamination is a major source of infection, especially from the chopping boards and the knives that are rarely washed or changed after cutting meat or cutting vegetables. Utensils and working surfaces cleaned with detergents is effective in removing disease causing organisms. Versatile use of utensils such as basins used for bathroom chores and washing of hands should not be used to store temporarily shredded vegetables.
Food handlers also need to put in place good personal hygiene practices, which include maintaining a high standard of cleanliness before and during the preparation and service of the food. Personal hygiene is an important aspect in ensuring that food is safe during production and service. Personal grooming, medical check up and washing of hands before handling food may be a simple rule but plays a major role in reducing the bacterial load to some extent.

In view of these facts it is imperative that food handlers are made aware of the risks associated with cooked foods from kiosks, potential sources of contamination from the environment and specific measures to be adapted to minimize the risk of contamination. Other preventive measures which most kiosk owners might not afford to use but are very effective include the use of disinfectants such as chlorine dioxide, bromine and iodine, organic acids (acetic, lactic, citric and pexoxyacetic acids) among others. Trisodium phosphate is especially recommended for commercial setting but not advisable to use in a domestic setting as it might cause irritation of the skin due to its high alkalinity.
CHAPTER THREE

METHODOLOGY

3.1 Introduction
This chapter focuses on the methodology of the study on food kiosks in Kibera slums. The kiosks are clustered along the footpaths. The study sought information from kiosk owners, kiosk workers and customers who frequented the kiosks. Further information was obtained from clinical officers and public health officers from Kibera dispensary. The aim of this was to obtain information about hygienic practices and common illnesses associated with consumption of food. Food samples were taken from sampled kiosks within the slums in each cluster. Snowball method was used to identify the kiosks and their location (Mugenda 1999).

3.2 Research design
This study used a descriptive survey and experimental design. Qualitative method was used to obtain demographic information on vendors, clients and medical personnel while quantitative method was used after coding and tabulating numerical data obtained from the research instruments. The fieldwork was carried out for a period of three months. Snowball sampling was used to identify and to locate the kiosks within the villages. Photographing was used to support and reinforce the observations on the hygiene practices of the vendors in accordance with the Codex Alimentarius requirements for food Hygiene standards and guidelines. The questionnaires used were also translated into Kiswahili to facilitate easy communication and information.

3.3 Study area
The study was conducted at Kibera slums of Nairobi. The Kibera slums are located 12 km south of the capital city of Nairobi and covers an area of 630 acres with an estimated population of between 800,000 to 1.6 million people. It is the largest informal settlement south of the Sahara with a population density of 3,000 persons per hectare. The area is homogenous and it is estimated that there are about 21,115 informal structures (Matrix Development, 2003).
The area has been occupied since 1912 and it came under government control in 1948. Currently it is divided into 14 villages and administratively, four chiefs and 2 District Officers run it. It is estimated that 30% of Nairobi residents live in Kibera. It is the largest among the 199 slums in the city (Otieno and Wanjohi, 1998).

3.4 Study population
The study targeted an estimated population of 2000 kiosks. There being no statistical data on the number of kiosks in Kibera, 10% of the estimated number was used as the accessible population. The total sample size of vendors was therefore calculated to be 204. This figure was considered within the slums, particularly those using house extensions for the trade.

3.5 Inclusion and exclusion criteria
This included only the kiosk owners and workers (cooks/waiters) in the informal sector within the slums. Also included are males and females between ages 18-60 operating the kiosks from their house extensions, and vendors who had given confirmed consent to be interviewed. Some of the vendors have lived in the same area and location for over a decade and were the main target since they knew the history of Kibera and have spent most of their time in the food trade. The food vendors in the formal restaurants were excluded from the study. The kiosk workers who did not consent to be interviewed were also excluded. The study also excluded kiosks in the start up stage. The microorganisms isolated during analysis, which were not required in the study, were also excluded.

3.6 Ethical consideration and informed consent
The research was undertaken after the Ministry of Education Science and Technology granted permission, (appendix VIII). Ministry of Health Department of Public Health laboratories and Office of the President by the District Officers and Chiefs from Kibera (appendix X) facilitated and coordinated the movement and smooth undertaking of the project in the slums. A deliberate attempt to involve the community participation was also sought from the chiefs. Food samples picked from the kiosks were used for the purpose of this study only. Respondents' records were treated with utmost confidentiality. Kiosk owners, customers and workers were informed of the purpose of the study and requested to cooperate.

The purpose of the study was clearly explained to the subjects and confidentiality assured that it was frankly for educational purposes. The respondents were also assured of anonymity.
3.7 Sampling procedure and sample frame

To obtain the food sample size, purposive sampling was used to select ten percent of the population to be used in the study. It was estimated that Kibera has over 2000 kiosks. About 10% of the kiosks from the 14 villages giving a total (n=204) were used. Purposive and systematic random sampling methods were used to identify kiosks which served beans and sukuma wiki daily. A total of 100 prepared food samples of sukuma wiki (n= 50 ) and beans (n=50 ) each were collected and analyzed in the laboratory.

The sample frame consisted of the entire food kiosk owners in Kibera. A list of known participants was difficult to obtain since licenses that could be used to determine the numbers of the vendors were not given. For the purpose of the study the following calculation was done to arrive at a representative sample size.

Sample Size

The sample size was calculated using the formula by Dankit N. (survey sampling, 1998)

\[ n = \frac{8*p*(1-p)}{w} \]

Required information:

Primary outcome variable (P) = Presence of food contaminated.
Best guess of expected percentage (Proportion) = 50% (0.5)
Desired width of 95% confidence level =10% (i.e. +1-5% or 45%-55%)

Therefore the formula for estimation of a simple proportion was as follows at 80% power

\[ n = \frac{8*p*(1-p)}{w} \]

Where n is the required sample size
P = the expected proportion in this situation is 0.50 and width of confidence interval 0.10

Therefore \[ n = \frac{(8*0.50*0.50)}{(0.10)} \approx 204. \]

The study area consisted of 14 villages.

Applying cluster random sampling, the following were identified as the target Kiosks per village:
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<tr>
<th>VILLAGES</th>
<th>SAMPLED KIOSKS IN EACH STRATA</th>
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<tbody>
<tr>
<td>K.NDOGO</td>
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<tr>
<td>KAMBI MURU</td>
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<td>KARANJA</td>
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<td>KATWEKERA</td>
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</tbody>
</table>

After identifying the required number of kiosks in each village, a systematic random sampling method was used where every 4th kiosk within the cluster (village) was included in the sample to constitute the sampling unit for the study. For every village approximately 15 kiosks were identified to form the sampling units adding up to a total of 204 kiosks.

For the food samples in every village, approximately 4 samples were collected from each cluster (village) to form the sample for analysis adding up to 52 samples. Due to time, cost and logistical problems, only 50 samples were run at the public health laboratory services. These tested the total aerobic count of viable organism in food and isolated E. coli.

3.8 Pilot study (pre-testing)

A pre-test pilot study was carried out in kiosks within Ngara (location not used in the study). This was to test reliability, validity, and viability of the instruments (Mugenda and Mugenda, 1999). Moderation was done to weed out errors and to ensure applicability of the instruments. It also emerged that self-administered questionnaires were poorly handled and no meaningful information could be obtained. A time span of one week was given for the answers to be
collected, which yielded no fruits, subjecting the interviewer to administer face-to-face interview.

3.9 Data collection instruments

3.9.1 Establishment of the socio-economic role of kiosks
To achieve the study objectives, different methods were used as described below:
The questionnaires (Annex I) responded to the demographic information of the vendors. The information obtained included age, gender, marital status, level of education and the income performance of the business. The business trend and the background of the vendors were also captured. The questions were both close-ended to give specific responses and open-ended to provide in-depth information. The socio-economic contribution of the kiosk vendors within the slums was also obtained.

In addition, the questionnaires were used to collect information on hygiene practices, during food production and service and to establish the general knowledge of the vendors on public health in relation to licenses and illnesses associated with the consumption of food from kiosks (see Annex II).

3.9.2 Establishment of the hygiene practices of the vendors and predisposing factors of food served in kiosks in relation to microbial contamination
Observation checklist was administered to capture the hygiene practices and the predisposing factors of the vendors. The factors included the location of kiosks and proximity of sanitary facilities among others. Observations were used to study the behavior of food vendors’ practices, physical structure and facilities within and around the kiosks in order to assess the food safety in the kiosks. The observation checklist was administered during the interview without the knowledge of the vendors.

3.9.3 Micro-biological food safety assessment
Laboratory tests were used to determine the microbial safety of food. The tests sought to isolate and identify *E. coli* and *Salmonella typhi* in beans and *sukuma wiki*.

3.9.3.1 Sample collection, preparation and transportation
Food samples were collected using spoons which had been previously covered in aluminium foil and autoclaved. The foods were immediately transported in cooler box with ice-packs to the laboratory. Upon arrival at the lab, the samples were recorded in the register
and given unique lab reference codes which were later used for identification of the same samples during the analysis process.

A manual of food microbiology procedures by Dr. Mohammed Rofai (FAO 1978) was used. All the procedures were ascetically carried out, and all apparatus and the media used were accordingly sterilized.

3.9.3.2 Total Viral Count (TVC)

Aerobic Count of viable organisms in the food samples was carried out by weighing 25 grams of food sample into 250 ml of buffered peptone water in a flask bearing the sample number. The mixture was then swirled at least 10 times to dislodge the bacteria from the food sample to the media. Serial dilutions were then prepared from original dilutions (1:10 up to 1:1000000). From 1:10 dilution 1 ml each volume was taken and transferred to each of the duplicate sterile plate (Petri dish) per dilution. For each separate Petri dish 15 ml volume of plate count Agar tempered at 45°C was added to the plate and mixed well. The agar was then allowed to set (solidify). The plates were then inverted and transferred to an incubator at 30°C.

Note: The sample numbers and plates were labeled as per every dilution. Colonies were then countered on dishes of a selected dilution containing 30 – 300 colonies using a colony counter. Average counts obtained from the selected dilution were multiplied, with dilution factor to obtain the number of Colony Forming Units per gram (CFU/g of food.)

3.9.3.3 Coliform count of food

The same standards used for total viable counts were used. From the three lowest dilutions (1:10, 1:100, 1:1000) an ml was inoculated into each of the three tubes (per dilution) containing Macconkey broth (with inverted Durham tube) from the corresponding dilutions.

The Durham tubes were filled up with the contents (macconkey) then incubated at 37°C for 24-48 hours. Observation was made for lactose fermentation as was indicated by color change from purple to yellow, and gas production as was indicated by empty space at the concavity of the tube. The tubes which showed lactose fermentation and gas production were considered positive for coliforms. The most probable number of coliforms was determined by comparison with MPN chart provided by Rafai (FAO 1978). Presences of coliform indicate evidence of warm blooded animal faecal pollution, therefore evidence in unhygienic practices.

3.9.3.4 Escherichia coli Testing
From the positive tube above, sub culture was done by inoculating a loopful of the positive culture into fresh Macconkey broth (with inverted durham tubes) and peptone water respectively labeled (Setting the Eijikman’s test.) Filling was done in Durham tubes and incubated in water bath which was regulated at 44°C for 24-48 hours. Observation for lactose and gas production was done as above.

About 2-3 drops (0.05ml) of Kovacs reagent was added into the peptone water whose labeled Macconkey broth was positive. Observation was made for the formation of a red ring at the interface of peptone water (the indole test) confirming the presence of E coli. The MPN of \textit{E.coli} was determined by the use of an MPN chart as in Coliform test. The appearance of \textit{Ecoli} is an indication of poor sanitation in the environment.

3.9.3.5 \textit{Salmonella typhi} testing

From the dilutions prepared above, 10mls were added into each of the two tubes (flasks) separately containing 100mls of tetrathionate and sellanite cystein. These were incubated at 43°C (incubator) for 48 hours. Observations were made for the formation of colonies with characteristics of \textit{Salmonella} (of moderate size, pale white). Suspicious colonies were inoculated into urease broth and Triple Sugar Iron Agar (for biochemical identification.) and incubated at 37°C for 18 to 24 hours. Observation was made for the presence of a pinkish colour on the urease broth. If negative there is no presence of pinkish colour. Observation was made of the TSI reaction. If red slant and yellow butt with no gas or Hydrogen Sulphide produced, \textit{Salmonella} was suspected. Confirmation was done by the slide agglutination technique (antigen, antibody reaction) which employs \textit{salmonella typhi} specific antibodies.

3.10 Data analysis

Data was analyzed using Statistical Package of Social Science (SPSS) computer software. One way Analysis of Variance (ANOVA), at 95% confidence level was used to determine any significance in the bacterial counts in the beans and \textit{sukumawiki}. T-test was carried out to establish any statistical differences between the hypothesized mean (standard value) and the food samples. Chi –square test was used to establish any significant independence between the base line variables. Descriptive statistics such as means, percentages and frequencies were used to describe the characteristics of the \textit{kiosks}, owners, clients and workers hygiene practices. The qualitative data collected were organized and transcribed into patterns and themes that
addressed the objective of the study. Tables, graphs and pie charts were used to present the data. Some responses of the open-ended questions were grouped in categories, coded and analyzed using non-parametric tests.
CHAPTER FOUR

RESULTS AND DISCUSSION

The findings of this study are stated in line with the objectives of the research. The study, carried out using questionnaires, observation checklists and laboratory experiments determined the behavior and characteristics of respondents, ethnographic information and hygiene practices of kiosk vendors. The microbial load of selected food samples was also determined. The components under investigation included personal, food and environmental hygiene. At the end of the study the level of hygiene practices in the kiosks and the factors predisposing food to contamination had been established:

4.1. Characteristic of the study participants

Table 1 represents demographic profile of the vendors. A total of 204 participants aged between 18 and 41 years responded to semi-structured questionnaires administered to them. The respondents were spread almost equally among the 14 villages within Kibera slums. The age distribution of kiosk owners indicated that 61%, a majority is aged between 18 and 30 years, while only 38% constitute the rest. This is an indication that kiosks provide employment to many people who have no formal employment although 65% of kiosks owners are men, the majority of the workers (60%) are women who balance the kiosk activities with traditional household chores and childcare duties. This report seems to agree with reports in Ghana that the majority of the food vendors are women estimated to be between 70 – 90% (National Research Institute, 2002). It was noted that most of the respondents directly depended on kiosks for their livelihood. In their marital status 53% of the kiosk owners interviewed were single, 38% married, 5% divorced and 4% widowed. The same reports indicate that among kiosk workers, 49% were single while 41% were married, an indication that vendors across the board depended on kiosks for their livelihood. The assumption that most of the clients who eat in kiosks are young people was confirmed when the results confirmed that single clients constituted 56% of the total interviewees while 25% were married. This could be attributed to the fact that single people prefer ready to eat meals due to lack of time and cost of cooking meals. Majority of them are not financially stable owing to their state of unemployment.
Table 1: Demographic profile of the respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Kiosk Owners, n (%)</th>
<th>Kiosk Workers, n (%)</th>
<th>Clients, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>133 (65)</td>
<td>82 (40)</td>
<td>123 (60)</td>
</tr>
<tr>
<td>Female</td>
<td>71 (35)</td>
<td>122 (60)</td>
<td>81 (40)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204 (100)</td>
<td>204 (100)</td>
<td>204 (100)</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>107 (53)</td>
<td>100 (49)</td>
<td>115 (56)</td>
</tr>
<tr>
<td>Married</td>
<td>77 (38)</td>
<td>84 (41)</td>
<td>52 (25)</td>
</tr>
<tr>
<td>Divorced</td>
<td>11 (5)</td>
<td>16 (8)</td>
<td>9 (4)</td>
</tr>
<tr>
<td>Windowed</td>
<td>9 (4)</td>
<td>4 (2)</td>
<td>28 (14)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204 (100)</td>
<td>204 (100)</td>
<td>204 (100)</td>
</tr>
<tr>
<td><strong>Age Distribution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 18 Yrs</td>
<td>39 (19)</td>
<td>2 (1)</td>
<td>30 (15)</td>
</tr>
<tr>
<td>18 - 30 Yrs</td>
<td>125 (61)</td>
<td>164 (80)</td>
<td>154 (75)</td>
</tr>
<tr>
<td>31 - 40 Yrs</td>
<td>30 (15)</td>
<td>28 (14)</td>
<td>24 (12)</td>
</tr>
<tr>
<td>≥ 41 Yrs</td>
<td>10 (5)</td>
<td>10 (5)</td>
<td>21 (10)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204 (100)</td>
<td>204 (100)</td>
<td>204 (100)</td>
</tr>
<tr>
<td><strong>Level of Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>73 (36)</td>
<td>120 (59)</td>
<td>82 (40)</td>
</tr>
<tr>
<td>Secondary</td>
<td>109 (58)</td>
<td>30 (15)</td>
<td>76 (37)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>14 (7)</td>
<td>13 (6)</td>
<td>25 (12)</td>
</tr>
<tr>
<td>University</td>
<td>6 (3)</td>
<td>-</td>
<td>6 (3)</td>
</tr>
<tr>
<td>None</td>
<td>2 (1)</td>
<td>41 (20)</td>
<td>15 (7)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>204 (100)</td>
<td>204 (100)</td>
<td>204 (100)</td>
</tr>
</tbody>
</table>

Among the Kiosk workers the results show that 80% are between 18-30 years of age and they are the majority who dominate the industry. 14% are aged between 31-40 years while 5% are 41 years and above.

It also emerged that 75% of clients were between ages 18-30 years, 12% were between 31-40 years and 5% were above 40 years, an indication that a majority of clients who visit kiosks belong to the youth group. Their financial status influences the cost of food in the kiosks, hence the low cost of food items within the slums. On trying to find out why clients frequent the kiosks, (34%) indicated that it is near their home and place of work. Twenty-six percent (26%) felt that it is cheaper to buy food from kiosks than to buy ingredients and cook,
while (18%) felt that kiosks offer a variety of foods. They also give the customers an opportunity to choose what they prefer at a price they can afford.

The clients further revealed that 57% eat from kiosks daily and only 3% eat twice a week 13% revealed that they eat in the kiosks three times a week and 28% revealed that they eat occasionally from the kiosks. When asked whether they were happy with the hygiene status of the kiosks 86% said they were happy while 14% indicated that they were served with cold food. Only 4% indicated that they fell sick after eating from the kiosks and 96% said they have not experienced any sickness related to the food.

On awareness of food poisoning the client’s response showed that consumers were aware of the dangers posed by consuming food from kiosks but were not aware of the magnitude of the suffering they were exposing themselves to. A small number indicated that they were aware of the food borne diseases but did not know their names.

The findings of this study also reveal that the majority of those in the food trade have formal education. 58% of the kiosk owners claim to have reached secondary level, 36% primary level, 7% college level and above. This supports the notion that lack of formal employment is a contributing factor to the growth of many kiosks.

The study revealed that 59% of the kiosk workers had reached primary level, 15% secondary level, 6% tertiary level, and 20% had no formal education. This shows that women, who happen to be the majority of the workers, are semi-illiterate. This report is similar to the findings in other West African countries (National research Institute, 2002). This is also in agreement with studies done in Ghana, which revealed that 60% of the women working in the food industry are illiterate (Mensah et al, 2002). In trying to establish the level of education for the customers, it emerged that 40% are educated up to primary level, 37% to secondary level, 12% to tertiary level and 3% were university graduates, indicating that the majority of the customers have formal education. This shows that kiosks cater for all types and groups of people.

The overall results established that most people in the food trade, both vendors and clients have formal education and belong to the age bracket of 18-30 years. This supports the theory that lack of formal employment is a contributing factor to the increase of (micro) food entrepreneurs.
Table 2: Relationship between gender and education of the respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Respondent</th>
<th>X^2</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n (%)</td>
<td>Female, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>50 (25)</td>
<td>23 (11)</td>
<td>10.5</td>
</tr>
<tr>
<td>Secondary level</td>
<td>73 (36)</td>
<td>36 (18)</td>
<td></td>
</tr>
<tr>
<td>Tertiary education</td>
<td>5 (3)</td>
<td>9 (4)</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>5 (3)</td>
<td>2 (1)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 above shows the comparison between male and female respondents' educational level.

Gender disparity was noted in the level of education. 25% of male respondents were shown to have reached primary level of education as compared to 11% women while 36% and 18% respectively had reached secondary level. 4% of women and 3% of men had tertiary education, with 3% of men and 1% women having university education. This confirms that men are more educated than women within the slum. There was a significant statistical association between gender and education level among the kiosk owners (P<0.05).

The findings of the study revealed that 66% of the vendors earned between Ksh 201-500 a day, while 20% earned between Ksh100 – 200 a day. Those who earned more than Ksh500 constituted only 14%. This suggests that the business realizes very little income that cannot sustain the kiosk businesses and the vendors’ families adequately.

Table 3: Relationship between Gender and Income of the Respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Respondent</th>
<th>Total, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n (%)</td>
<td>Female, n (%)</td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 - 200</td>
<td>26 (13)</td>
<td>14 (7)</td>
</tr>
<tr>
<td>&gt; 200</td>
<td>107 (52)</td>
<td>57 (98)</td>
</tr>
</tbody>
</table>

This analysis was done to ascertain whether men earned more money than women earn. More than women, there is no significant difference between gender a p <0.05.
4.2 Personal hygiene practices of vendors in relation to food contamination

Food hygiene is an important aspect in reducing contamination in food kiosks. The Codex Alimentarius General requirements for food hygiene (2001) and guidelines in the Kenya Foods, Drugs and substance Act (1992), gives specific guidelines on food hygiene principles to be observed by all food handlers. However, the joint FAO/WHO Committee on food safety has also prescribed the most effective preventive system to prevent food borne diseases. The Hazard Analysis Critical Control Point (HACCP) system was developed to spot check the critical areas through the food production stages and identify the risk areas likely to cause any hazard. The findings from the kiosks reveal that hygiene standard of food, vendors and environment where food is prepared is compromised. Report on personal hygiene indicate that 62% of the vendors kept long, uncovered and uncombed hair while handling food, 69% had long nails, which were not kept clean and 55% women applied nail vanish while serving food, contrary to the stipulated regulations. Besides, 16% applied lipstick. Consequently, vendors who handled food and money without washing their hands were common at 74% for the
trained and 13% for the untrained respectively. Smoking was also relatively common among the male vendors and was observed to be 8.2%.

Table 4: Personal hygiene of the vendors in relation to food contamination within Kibera Slums.

<table>
<thead>
<tr>
<th>Basic Food Hygienic Training</th>
<th>Yes, n (%)</th>
<th>No, n (%)</th>
<th>$\chi^2$</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Examination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10 (5)</td>
<td>68 (33)</td>
<td>4.3</td>
<td>0.03</td>
</tr>
<tr>
<td>No</td>
<td>6 (3)</td>
<td>120 (59)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing of Hands before handling food</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25 (13)</td>
<td>151 (74)</td>
<td>0.38</td>
<td>0.53</td>
</tr>
<tr>
<td>No</td>
<td>9 (1)</td>
<td>19 (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handing food while smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5 (3)</td>
<td>10 (5)</td>
<td>6.56</td>
<td>0.01</td>
</tr>
<tr>
<td>No</td>
<td>15 (8)</td>
<td>160 (84)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Touching food with bare hands</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (5)</td>
<td>150 (74)</td>
<td>29.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>15 (7)</td>
<td>25 (12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of hand wash basin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16 (7)</td>
<td>60 (30)</td>
<td>6.19</td>
<td>0.01</td>
</tr>
<tr>
<td>No</td>
<td>11 (5)</td>
<td>115 (56)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The vendors practiced other bad habits such as picking the nose and scratching the body while serving food were 8% and 13% respectively. Other habits like blowing their nose without the use of a handkerchief were observed in 11% and those seen sneezing and coughing over food without covering their mouth were observed in 7.4%. It is recommended that food handlers should refrain from behavior that could result in contamination of food. In addition to hygiene practices, 68% of the vendors had not gone for routine medical examination or received vaccination against infections such as hepatitis B and C as required by the Public Health Act Cap 242. of the laws of Kenya.

Interestingly, some of the vendors had skin rashes and inadequate protective gear while handling food. Cross contamination is common if the people preparing food do not handle it carefully. It was also revealed that 85.6% of vendors had not been trained anywhere on culinary skills and that no basic qualifications were met in recruiting employees who handled food.
Some of the vendors were reported to be illiterate. The vendors who had not covered their food were 75.2%. Most food items were exposed (photo 1). About 68% of food samples picked from the exposed displays were contaminated with pathogenic organisms. *Kiosks* that served hot food accounted for 7% while 77.8% served warm food depending on the arrival of the customers.

About 56% of kiosks had no hand washbasins. Lack of hand washing facilities in most kiosks is playing a bigger role in reduced hygiene practices. Effective hand washing especially after visiting toilets is essential in reducing contamination. An observation was made where mothers who cleaned their children after defecation did not wash their hands. The same hands were used to handle food. Such practices could easily lead to cross contamination. Contamination of food by infected handle during preparation is a common mode of transmission, supporting the findings of Cody and Keith (Cody and Keith 1991). According to (WHO, 2000) disease outbreak related to contamination of food are on the increase at an alarming rate due to poor handling, which occurs during preparation and storage. Poor handling practices are potential arenas of contamination as many host-adapted viruses are carried to foods only by human contact.

### 4.3 Predisposing factors of food served in kiosks in relation to hygiene.

The food *Kiosks* lacked proper storage facilities. The study found that 87% of cooked foods were stored on the floor and only a small percentage was stored on top of cupboards or on the shelves. Owing to the size and poor ventilation of the *kiosks*, food spoilage is likely to occur within a very short time after cooking. From samples of food stored on the floor 82% were contaminated with *E. coli* and had high coliform count. Only 6% of foods kept in cupboards were not contaminated. Cooked food should be stored at a temperature of 60°C or cooled to near 10°C. The food items bought were either kept inside or outside the *kiosks* depending on the size of the *kiosk*. Some cooked foods were kept uncovered whilst some were left on the floor exposed to dust and dirt (photo 1). From the exposed food 82% *sukumawiki* and 12% of the beans which were found contaminated were also kept on the floor. Although the numerical data indicates that food stored on the floor had more contamination, there were no significant differences on the storage methods (p>0.05) A study done in Pakistan and Zambia revealed that foods that were held at a temperature of 46°C had high bacteria counts (Mosupye and Holy, 1999). Vendors kept their food for more than 6 hours and sometimes over night.
This is similar to *kiosk* where vendors cooked *githeri* (maize and beans) from the previous night and stored it for most part of the morning only to be served after six hours.

Food was transported from the point of purchase using various means, 14% transported the raw foodstuff using a bicycle, 60% used wheelbarrows, 10% used handcarts (*mkokoteni*) and 16% used public transport (*matatu*). Traders who bought the food from Kibera market used handcarts and bicycles to transport their wares to their respective *kiosks*.

The type of service varied from *kiosk* to *kiosk* due to location and type of clients that visited the outlets. From observation, 93% used trays while 7% used plastic plates for serving food. It was observed that most *kiosks* had only one chopping board. The findings revealed that 67% of the respondent used the chopping boards for multi-purpose without washing while 33% used for the same purpose but wiped with a dirty rag after use. A chopping board is one of the main sources of cross-contamination especially when used to cut raw food products such as meat then used for vegetables, which are not thoroughly cooked (Cody and Keith, 1999).
Table 5: Food Contamination and Hygienic Practices

<table>
<thead>
<tr>
<th>Training on Food Handling?</th>
<th>Contamination of Food</th>
<th>Contaminated</th>
<th>( \chi^2 )</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>3(6%)</td>
<td>1</td>
<td>1.0</td>
<td>0.32</td>
</tr>
<tr>
<td>No</td>
<td>35(70%)</td>
<td>12(24%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Check</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26(52%)</td>
<td>6(12%)</td>
<td>0.04</td>
<td>0.84</td>
</tr>
<tr>
<td>No</td>
<td>15(30%)</td>
<td>3(6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Food Stuffs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wakulima</td>
<td>15(30%)</td>
<td>4(8%)</td>
<td>0.14</td>
<td>0.70</td>
</tr>
<tr>
<td>Suppliers</td>
<td>23(46%)</td>
<td>8(16%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handcart</td>
<td>2(4%)</td>
<td>1(2%)</td>
<td>2.7</td>
<td>0.44</td>
</tr>
<tr>
<td>Bicycles</td>
<td>5(10%)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheelbarrow</td>
<td>24(48%)</td>
<td>7(14%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matatus</td>
<td>7(14%)</td>
<td>4(8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rack</td>
<td>33(66%)</td>
<td>8(16%)</td>
<td>3.7</td>
<td>0.16</td>
</tr>
<tr>
<td>Cupboard</td>
<td>1(2%)</td>
<td>2(4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shelves</td>
<td>4(8%)</td>
<td>2(4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing of Hands before Serving</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>33(67%)</td>
<td>11(22%)</td>
<td>0.06</td>
<td>0.81</td>
</tr>
<tr>
<td>No</td>
<td>4(8%)</td>
<td>1(2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of Kiosk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Near the Road</td>
<td>16(32%)</td>
<td>1(2%)</td>
<td>3.25</td>
<td>0.03</td>
</tr>
<tr>
<td>Away from Road</td>
<td>22(44%)</td>
<td>11(22%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handling Food with Bare Hands</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>27(54%)</td>
<td>9(18%)</td>
<td>0.02</td>
<td>0.89</td>
</tr>
<tr>
<td>No</td>
<td>10(20%)</td>
<td>4(8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence Flies?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28(57%)</td>
<td>9(18%)</td>
<td>0.02</td>
<td>0.96</td>
</tr>
<tr>
<td>No</td>
<td>9(18%)</td>
<td>4(8%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In checking the type of equipment and utensils used in the kiosk the findings revealed that although the utensil used in the *kiosks* looked fairly clean, 7% were not. In the process of cleaning 93% *kiosks* used cold water, which was recycled over time, 6% used plain water to wash the dishes and 75% used cold water and a small piece of soap to wash many dishes. About 19% piled up utensils instead of using drying racks.
When asked whether they had undergone any training in food handling 86.6% said no while 5.9% responded in the affirmative. On the protective clothing worn by the vendors, 22% wore aprons, 74% wore dustcoats and 4% wore lessos (wrap on) to protect themselves from burns, scalds and food spills. Among vendors who wore protective clothes and had received some training in basic food handling were only 5% who also claim to wash their hands before handling food.

Those who had not received basic food handling training and handled food with bare hands accounted for 74%, which portrayed a very strong association (P<0.05). In kiosks where the owners had basic knowledge and education, 7% had hand washbasins and 30% had none. 3% of vendors who smoked had basic knowledge of food handling skills as compared to 5% of non-smokers. This showed a strong relation between training and smoking habit among the respondents (P<0.05).
However, observations made in Kibera revealed that 84% of workers handled food with dirty hands. Improper handling was observed in foods such as *mandazis* and *chapatis* and meat, especially during service and when turning or portioning. Cross contamination is common in foods handled without caution. In conclusion, the results indicate that the difference between the trained and the non-trained *kiosk* vendors is significant with the non-trained not observing adequate food hygiene practices.

### 4.4 Hygiene practice of *kiosks* in relation to environmental contamination

The kiosks within Kibera are located mostly in areas where the potential customers would easily access them. The study found that 58% *kiosks* were located near paths and feeder roads. The premises used as food *kiosks* are mostly house extensions. Most of these buildings are dilapidated with rusty roofs and low ceilings. Inside the *kiosks* are mud chipped floors and walls with no proper ventilation and lighting. The artificial drainages polluted the surrounding areas making the paths wet and muddy most of the time. In addition, the finding revealed that 72% garbage heaps were in front or near the *kiosks* while 28% were almost 30 meters away. It also emerged that 92% of *kiosks* created garbage in damping sites next to their location and about 90% of liquid wastes were channeled mostly toward the paths or towards drainages near the *kiosks* (Picture 4). Dirty water used for washing utensils was poured all over around the *kiosks*. About 84% *kiosks* had flies and only 35% had hand washbasins.
Picture 2  A: Food on the table   B: Dog under the table   C: Open drainage

Food prepared next to an open drainage on makeshift table.

Apart from the open drainage and the environment which is not clean the surfaces used for preparing food are poorly constructed and are supported by temporary pillars as can be seen in picture 2
Picture 3: A: Food exposed. B: Cracks on the wall. C: Blocked sewer. Note the location of kiosks along the footpaths in Kibera slums

Note the blocked drainage, the diverted sludge in front of the kiosks and exposed food in the background. The food exposed and the human traffic around the foodstuffs.
4.5 Environmental predisposing factors of food served in kiosks in relation to food contamination

Table 6: Environmental Hygiene

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of Flies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>172</td>
<td>84</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Presence of Garbage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>147</td>
<td>72</td>
</tr>
<tr>
<td>No</td>
<td>57</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Hand wash Basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>77</td>
<td>38</td>
</tr>
<tr>
<td>No</td>
<td>127</td>
<td>62</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Presence of Toilets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>124</td>
<td>61</td>
</tr>
<tr>
<td>No</td>
<td>80</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Drainage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>No</td>
<td>178</td>
<td>87</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Solid Waste Disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust bin with lids</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>Garbage Damp</td>
<td>187</td>
<td>92</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Liquid Waste Disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poured any where</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>Poured at an identified sport</td>
<td>183</td>
<td>90</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cemented</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>Earthen</td>
<td>154</td>
<td>75</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
<tr>
<td>Location of the Kiosk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Near the Feeder roads</td>
<td>119</td>
<td>58</td>
</tr>
<tr>
<td>Away from the Feeder road</td>
<td>85</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>100</td>
</tr>
</tbody>
</table>

All the kiosks fetched water for cooking, drinking and for washing utensils from nearby taps positioned at strategic places. The small-scale water vendors supplied about 73% of the water
used in the *kiosks* while the rest opted to fetch water from the nearby taps and then stored them in drums.

It was found that 85% had no trading license which is an indication that most *kiosk* owners were not aware of Cap 242 of public health regulations hence they do not pay taxes. The location of *kiosks* in Kibera may be considered as a factor likely to contribute to food hazards. It was observed that 78% located on the periphery adjacent to feeder roads had 6.2% and 4.7% of *Sukuma wiki* and beans contaminated respectively.

Picture 4: A: Food sold opposite garbage dump encroaching on the road:B: Dirty water choked with Filth. C: Sugging roof of *Kiosks* located along the foot path.

The garbage heaps also flowed sludge into the already blocked drainages (Picture 4)

Food samples picked from *kiosks* near the garbage damps had 68% *E.coli* and 82% *Coliforms*. The proximity of *kiosks* to garbage damps enabled the rats and different types of flies to criss-cross inside the *kiosks*. 
A research done in Dandora and Kayole in Nairobi found that 85% of the vendors prepared their foods in areas where wastewater was very close to the food kiosk. This is similar to the situation found in Kibera. The fact that most kiosks are infested with flies is enough proof that food could easily be contaminated especially in kiosks where food is not covered. Apart from the common houseflies, vinegar flies, blowflies, and blue flies were also seen from the garbage heaps. In determining whether there was any significant difference between kiosks with many flies and those with few or no flies at all, there was no significant association between the presence of different types of flies and the contamination status of the selected samples (p>0.05).

It was also noted that kiosks that were adjacent to the open drain pipes had high plate count of bacteria. The kiosks in the interior had 5.1% sukuma wiki contaminated and 3.8% of beans. This indicated that the association between the contaminations and the location of the kiosks from the main drainage ways was relatively high (p<0.05).

On checking on the health status, approximately 16% vendors went for medical checkup over 1 year ago. In the kiosks whose owners had gone for medical check up 15% of their food samples were not contaminated, while 52% who had not received vaccination had their foods contaminated. However, there is no significant association between kiosks which had the vendors medically examined and those which had not (p>0.05). Kiosks used fairly large saucepans for cooking foods. Some of the saucepans had no lids and only 14% covered their cooked food while 86% did not.

Most of the toilets within Kibera were pit latrines with 61% located between 50-70 meters away from the kiosk. Pit latrines are shared between 20-50 people and in most cases foul smell emanates from these latrines. Also noted was that most of the toilets were full and there was no space for construction of new ones. Some toilets were leaking into already filled drainages while some flowed on the shallow tunnel already overflowing with filth thereby polluting the environment. Along the tunnels swarms of flies rest on waste from makeshift butcheries, grocery stalls all squeezed together on both sides of a winding path. (picture4)

It was realized that 62% of kiosks did not have hand wash facility in some kiosks, spoons were used and in some, little water for washing hands was given in a small basin. Other kiosks used saucepans as wash basins. This indicated a significant difference between kiosks with hand washbasin and those with none (p<0.05).
In determining whether there was any difference between those with basic training and those without any, it emerged that those with basic training who provided a hand washbasin were 70% and those without were 30%. Presence of hand washbasins is significant in reducing the rate of contamination of food. In **kiosks** where the owners had basic training the food sampled was less contaminated compared to **kiosk** owners who had no basic training. Those with basic training in food handling were only 6% and kiosks owned by owners with no basic training were 70%. Observation revealed that 25% of kiosks had cemented floors (majority of them were chipped) while 75% had earthen floors. The few-cemented floors had big potholes and cracks showing lack of maintenance. Food particles were hidden in the cracked floors and this was the main reason why flies were too many in the **kiosks**. Rats could occasionally be seen criss-crossing under the tables. Rats and mice thrive in a dirty environment where food is accessible especially food crumbs on the floors. The garbage damps within the proximity of the **kiosks** create a breeding ground for the rodents, which enter the **kiosks** through the cracks on the walls, ceilings and floors. Unless the environment is kept clean it is very difficult to get rid of the insects and rodents from the **kiosks**. The study also realized that dish clothes and kitchen rags were used many times before washing and remained wet throughout the day. Kitchen rags are known to accumulate a lot of microorganisms if not washed and can be a source of food contamination.

Protective clothing used in this study was categorized into aprons, dustcoats and **lessos** (wrap-ons). The protective clothes were checked to see how clean they were. In this study a clean protective cloth was one with no food marks or stains and was not worn for two days in a row. They should also be able to show the dirt and its original color. Most of the protective clothes worn were very dirty, stained, partly torn and discoloured.
4.6 Bacterial counts in beans and sukumawiki Samples

Table 7: Bacterial counts in Beans and Sukuma Wiki of the Sampled Food in Kibera

<table>
<thead>
<tr>
<th>Type of Food</th>
<th>TPC/gram</th>
<th>Coliform/gram</th>
<th>E.coli/gram</th>
<th>Salmonella</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bean (Mandondo)</strong> (N = 50)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2.8x10^5</td>
<td>3.6x10^3</td>
<td>13</td>
<td>NIL*</td>
</tr>
<tr>
<td>Median</td>
<td>2.8x10^4</td>
<td>2.2x10^3</td>
<td>13</td>
<td>NIL*</td>
</tr>
<tr>
<td>Range</td>
<td>1.5x10^3-1.9x10^6</td>
<td>1.5x10^1-1.9x10^4</td>
<td>3-27</td>
<td>NIL*</td>
</tr>
<tr>
<td>Std (δ)</td>
<td>5.4x10^5</td>
<td>5.9x10^3</td>
<td>7.9</td>
<td>NIL*</td>
</tr>
<tr>
<td><strong>Sukuma Wiki (Kale)</strong> (N = 50)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.3x10^5</td>
<td>2.8x10^3</td>
<td>12</td>
<td>NIL*</td>
</tr>
<tr>
<td>Median</td>
<td>2.8x10^4</td>
<td>2.1x10^2</td>
<td>11</td>
<td>NIL*</td>
</tr>
<tr>
<td>Range</td>
<td>1.4x10^3-1.7x10^6</td>
<td>1.5x10^1-2.0x10^4</td>
<td>3-28</td>
<td>NIL*</td>
</tr>
<tr>
<td>Std (δ)</td>
<td>5.6x10^5</td>
<td>5.6x10^3</td>
<td>7.3</td>
<td>NIL*</td>
</tr>
</tbody>
</table>

The results of microbiological analysis for food samples by TPC and MPN methods are presented in Table 6. The mean TPC value (CFU/g) for beans and sukumawiki were 2.8x10^5 and 3.3x10^5 respectively. E. coli per gram of beans and sukumawiki were 13 and 12 grams respectively. A slight difference was noted in coliform counts in the two food items (P<0.05) with sukumawiki showing higher count than beans, an indication that more sukumawiki were contaminated than beans. Though there was no significant difference in the mean count of E. coli in the two food samples analyzed (P>0.05), a relatively high count was also noted in beans. The TPC median for beans and sukumawiki were tallied at 2.8x10^4 showing there was no difference. However, the coliform counts by MPN methods per gram on the range of beans stood between 1.5x10^3 – 1.9 x 10^6 while the range of sukumawiki was between 1.4x10^3 and 1.7x 10^6 showing a slight difference.

This showed a slight difference in the microbial load. The E. coli range for beans and sukumawiki were between 3-27 and 3-28 respectively. The difference though minimal gave a result of the two foods analyzed at P<0.05. The coliform count on MPN per gram had a mean of 3.6x10^3 of beans and a mean of 2.8x10^3 of sukumawiki giving a difference of 0.8, which is
quite minimal. The MPN median for beans stood at $2.2 \times 10^2$ while for sukimawiki was $2.1 \times 10^2$ giving a difference of 0.1.

The MPN mean and median of Ecoli per gram stood at 13, while the mean and median of Ecoli per gram of sukimawiki stood at 12 and 11 respectively. The difference in the amount of Ecoli on the two food samples with beans having higher Ecoli per gram than sukimawiki. The range of Ecoli of beans was between 3-27 while the range of Ecoli in sukimawiki per gram was between 3-28, an indication that the range in sukimawiki is slightly higher than beans. The overall analysis of Salmonella in both beans and sukimawiki gave negative results. The presence of coliform and E.coli could be a contributing factor to the findings from the dispensary.

The medical records within Kibera indicated that patients who frequented the dispensary suffered mostly from gastrointestinal disorders, the main symptoms being diarrhoea, vomiting and acute abdominal pain.

The Health Officers suspected that the state of pollution and sanitation was the major cause of the problem. In the month of May and June alone, out of 334 patients who visited the hospital, 176 had complained of diarrhoea, vomiting and acute abdominal pain. This confirms that poor sanitation is a major contributing factor to the problem. Further reports indicate that out of 520 children who were treated in those two months 361 had diarrhoea related sicknesses. The mortality rate of children is also high though the statistics for this was not available since complicated cases are referred to Kenyatta National Hospital.

**Figure 2: comparison in rates of contamination of beans and sukimawiki**
Contamination rate of *sukumawiki* and *bean* were compared to determine which of the two food items had high levels of contamination. Results indicated that beans had lower level of *coliform* than *sukumawiki*. The study also wanted to find out whether there is any difference in the level of contamination between *kiosks* with vendors with any basic training in food handling and those without any. The result confirmed that there is a big difference. Those with basic education maintained some standard of cleanliness and observed basic regulations like covering the food among others. Out of the beans sampled 45% had a total count of >2 million *coliform*. These counts show that beans bought by clients for consumption is of poor bacteriological quality. The high number of bacteria in kales and beans is a reflection of poor food hygiene during preparation, service and storage. Non-sanitary handling of food during preparation and storage without covering added to contamination. Observation showed that beans were cooked overnight and served between 6-10 hours later.

*sukumawiki* was also cooked early and sometimes kept uncovered for between 3-4 hours before service in a warm temperature. Most *kiosks* lack food-cooling facilities. Food items go through a number of handling stages without adequate control of hygiene hence contamination and multiplication of bacteria particularly in *sukumawiki*.

**Table 8: Comparison the TPC in beans and in sukuma wiki**

<table>
<thead>
<tr>
<th>Type of Sample</th>
<th>n</th>
<th>Mean (μ)</th>
<th>Mean difference (μ₁ - μ₂)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beans</td>
<td>50</td>
<td>2.8x10⁵</td>
<td>5.0x10⁴</td>
<td>0.224</td>
</tr>
<tr>
<td><em>Sukuma wiki</em></td>
<td>50</td>
<td>3.3x10⁵</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was no significant difference between the mean of the TPC in beans and sukuma wiki (p>0.05).

**Table 9: Mean Bacteria TPC distribution by sampling villages**

<table>
<thead>
<tr>
<th>Total Plate Counts</th>
<th>Sum of Squares (SS)</th>
<th>Mean Square</th>
<th>F-statistic</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between the Villages</td>
<td>5.27x10¹²</td>
<td>5.27x10¹¹</td>
<td>1.9</td>
<td>0.056</td>
</tr>
<tr>
<td>Within the Villages</td>
<td>2.42x10¹³</td>
<td>2.78x10¹¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2.95x10¹³</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The mean total plate count did not differ significantly from one village to the other (p>0.05)

In conclusion, the general findings from observation indicated that kiosks produce a variety of food items that range from indigenous traditional foods to fast food recipes. It was noted that some special food items appear only in the slums and nowhere else. Such specialties include Boiro (small pieces of meat boiled in salty water with herbs), Mutura (African sausage made of vegetables, blood and fat stuffed into the intestine and roasted on a charcoal stove), Mutura is also a common as a snack sold for as little as five shillings per piece.

Kaff was a preference of many as it is affordable Kaff mandazi (sweetened dough) diced into small pieces and served with Mandondo (beans stew sauce), Chanjo (cow and goat soup mixed), and a mixture of the unwanted parts of slaughtered animals, such as legs, hooves, heads, tails and intestines of the chicken, pigs, cows and goats which have been disposed off at slaughter houses.

Others include chapati accompanied with either intestine or chicken soup and a little vegetable (sukumawiki) added to it, or with (Dengu) green grams. The soup available consists of a mixture of ingredients, which include bones, heads, and legs of goats, cows and pieces of meat from different animals.

Although food is available in abundance, many residents cannot afford it. The majority of food items are sold at a cost of between Ksh 2 – Ksh10. The prices target mostly low-income groups of people. Most of the food items listed above are sold in the open along the footpaths and are bound to attract dust and dirt from the environment and this poses a health hazard due to congestion within the slums.

The general findings on the socio-economic role of kiosks indicate that food kiosks provide self-employment to many people. The report further indicates that many traders find it easy to start this kind of business because of the minimal financial requirements (capital). Similarly, there is no wastage of food as left over food is recycled. However, the kiosks are faced with many challenges including inadequate capital to sustain them competitively and lack of major inputs necessary to improve production and service of food. Other challenges include lack of motivation, creativity and innovations to improve the standard of cleanliness in the trade in general. Most of the kiosks are also rented premises making it difficult to renovate especially the chipped floors and cracked walls. According to the tenants, the landlords are not cooperative when it comes to carrying out repairs or renovations on the premises.
In the slum, no specific type of business operates in a located area. All businesses such as salons, barbershops, tailoring, laundry, butchery, cobbler and many others operate within the same building and neighborhood at a close range. The houses are so close to each other with only a small alley separating them. The rooms are squeezed with two or three small tables with benches or off cuts used as seats. The location of kiosks makes it easy for flies to swarm on the food and utensils from dumping sites located less than 50 meters away. Rats from the garbage dump easily frequent these kiosks. The mountain of garbage encroaches on the road (paths) leaving very narrow dusty paths full of potholes and heaps of mud. This minimizes space for human traffic especially during the rainy season when the small paths become slippery and muddy (picture 4) In some villages, drainages cross right in front of the kiosks emitting obnoxious smell because the drains are chocked with food debris and in most cases are left open.

Low level of education among the vendors is said to limit their capacity to adapt to new technological changes. Besides, lack of adequate resources is a major impediment in implementing any meaningful change. The recent trend of demolition of kiosks, citing insecurity threatens the livelihood of many Kenyans who depend on the trade for their sustenance. The study revealed that kiosks serve a cross section of clients ranging from workers, passersby, to families who buy already cooked food.

The study revealed that 84% of kiosk owners had no trade license, an indication that the government is not aware of their existence. It was also found out that 66% of the food handlers had not gone for medical check up and therefore had no medical certificate. It revealed that 93% of food handlers had no basic training in food hygiene and had learnt the skill on the job. This is in contrast with the Public Health regulation on hygiene measures on handling of food during preparation.

Ideally, food preparation premises should be built and sited in areas that are free from objectionable odors, smoke and dust. In addition the premises should be located away from rubbish heaps (Adams, et al 1999)

The aim of this study was to isolate Salmonella typhi, which causes typhoid fever. Although the pathogen was not isolated when running the laboratory tests, report from dispensary indicates that typhoid is prevalent in the slums. Typhoid is rated among the
diarrhoeal diseases and their symptom includes high fever and vomiting. The Kenya Health Policy Framework (1994) ranked diarrhoeal diseases among the top ten causes of morbidity and mortality (WHO, 2000). This result suggests that routine medical check up for kiosk vendors should be intensified and environmental hygiene improved to prevent cross contamination.

The fact that laboratory revealed the presence of *E. coli* is also a pointer to the fact that if the situation is not controlled, it could lead to outbreak of food borne illness. According to WHO food borne illness represents the most overwhelming public health problem in the world (WHO, 2000). This is supported by the fact that most of the cases of cholera outbreak in Nairobi were attributed to consumption of water, which is not portable and eating food from kiosks. The fact that sample tests of beans and *sukumawiki* had high plate count of coliform and *E. coli* isolated was an indication of recent faecal contamination in foods. This confirms that the theory of flying toilet is a reality of poor faecal disposal and therefore has a negative impact on kiosks within Kibera slum.
CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

- The objectives of the study were to assess the food safety and hygiene practices in kiosks in Kibera slums, the socio-economic role of kiosks, the hygiene practices of food kiosk vendors, investigate factors predisposing food served in kiosks to microbial contamination and to generally ascertain the level of food safety as served by the kiosks to the consumers. The findings of the study have revealed that changes have occurred in the food industry, which has a profound effect on food marketing trends in Kenya. As a result, food kiosks are viewed as potential health hazards due to the poor sanitary conditions under which they operate. Generally, the major factors affecting the safety of food in the kiosks include handling of already cooked food with bare hands and poor methods of food preparation associated with low levels of education of the vendors as they lack sufficient knowledge on basic kitchen hygiene. Improper handling of food due to lack of facilities and the use of wrong equipment for a wrong purpose, for example, using saucepans for washing the customers' hands instead of a hand wash basin was also seen as a possible route of spreading pathogenic organisms. The location of kiosks in congested areas with inadequate infrastructure and compromised sanitary conditions may increase food borne diseases. In addition, the garbage damps near the kiosks attract flies and rodents. Other factors may include use of contaminated utensils due to inadequate methods of washing. It was learnt that one basin of cold water washes many dishes and utensils before the water is changed. This study has demonstrated the need to improve hygiene as well as food handling practices by vendors. The microbiological findings indicate that even though kiosks look dirty and are located in very untidy environment, food cooked and served immediately is free from any contamination. *Salmonella typhi* was not isolated in the food samples analyzed. However, the presence of *E. coli* and coliforms calls for intensive monitoring to ensure that the pathogen is reduced to a level that can be tolerated.

The study revealed that the most common food borne diseases in the slums include typhoid, cholera, amoebiasis, askaris and brucellosis. The symptoms mostly associated with these diseases include diarrhoea, continuous fever, profuse watery stool and vomiting. In some cases the diarrhoea may have mucus and blood.
There is need therefore to improve the informal food system and in particular food kiosks. A good marketing system may stimulate production, consumption, and create employment thus bringing about better income and improved living standards. This will eventually contribute to the overall development of the socio economic well being of the vendors. Kiosks are expanding and this call for mobilization of finances and traders to ensure that good hygiene practices are maintained. The other findings of this study indicated that:

- There is high level of laxity among the vendors who do not comply with Public Health regulation as stated by the Public Health Act since no affirmative action is taken against them in the event of error.
- There is lack of managerial skills, legal barriers and adequate finances to sustain the business in addition there is need to enlighten the consumers on their rights, and what to expect from kiosks.

All the research questions have been answered by the findings. For example, the study has found out that the food served in the kiosks is cost effective but not entirely safe for human consumption. This is as a result of the questionable preparation methods, the personal hygiene of the vendors, the unclear source of the raw food and the polluted environments finally, the hypothesis has been found true: poor food safety and hygiene practices in kiosks are the main factors that trigger food borne diseases

5.2 Recommendations

There is need for the food vendors to undergo training on good hygiene practices (GHP) carried out on site based on food handling procedures during preparation, including personal and environmental hygiene. The training should include managerial skills, and entrepreneurial skills which will enable the kiosk owners to manage finances for start up and to sustain the business adequately.

- To minimize the high microbial count the kiosks should use efficient but simple storage facilities such as glass framed cabinets for food storage on site to prevent food from dust, insects and rodents. A clean up exercise through a public Baraza(gathering of the local community) to be addressed by public health officers, the area councilors, administration officials and the Director of City Inspectorate. Use of youth organizations such as KICOSHEP self help group to mobilize the residents in cleaning drainages, collecting garbage and ensuring that the garbage collected is disposed of properly.
• A special force of the Council Askaris formed to enforce the no-dumping order along the footpaths and at any other place not allocated for the purpose.
• Establish a role model kiosk within the slum which includes water, hand wash basin and cold storage facility to be used as an example by the vendors
• The relevant authorities- Public Health Officers, Administration and Political Support should be used to enforce laws and regulations regarding food safety to ensure the laws are adhered to.
• Quality standards to be enforced through regular inspection. There is need to introduce and reinforce some measures of standard for assessing the quality of food cooked before service. Setting up inspection points within the villages.
• Relevant bodies and agencies may sponsor and provide technical support through training on good hygiene practice.
• Kiosk owners should be encouraged to form co-operative societies so that they can transport and test food products through the society to control food quality and to generate income through loans to enable them buy appropriate equipment.

5.3. Recommendations for further research

1. Identify and isolate various types of microorganisms in a similar study in the kiosks.
2. Carry out a study on raw milk, fruit salads, maize roasting and other foods sold in the kiosks and other vending sites in Kibera to establish their safety for human consumption.
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Annex 1: Questionnaire for kiosk owners

I am a Masters of Science degree student at Kenyatta University, School of Pure and Applied Sciences, in the department of Hospitality and Tourism Management. I am carrying out a research on Food Safety and Hygiene Practices in Kiosks in Kibera slums of Nairobi Province. This questionnaire is aimed at establishing the socio-demographic, economic information of the kiosk owners. The aim is to improve the safety and hygiene practices in food kiosks. You have been selected as one of the participants in the study. Kindly assist me by answering the questions as accurately as possible. Any information given will be used confidentially and for academic purposes only.

Thank you.

To establish the socio-demographic, economic information of the Kiosk Owners

Name of the kiosk

Name of the interviewee

Date

Location

Village

Education level

1. Gender
   1. Male
   2. Female

2. Marital Status
   1. Single
   2. Divorced
   3. Married
   4. Widowed

3. How many children do you have?
   1. One
   2. Three
   3. None
   4. Two
   5. Four and above

4. How old are you?
   1. Below 18
   2. Between 19-30
   3. between 30-40
   4. 40 and above

5. Level of education
   1. Primary level
   2. Secondary level
   3. Tertiary Level (Certificate/Diploma
   4. University level
(a) Personal Data

6. What are your reasons for owning a kiosk?
   1. Lack of formal employment
   2. Family business
   3. For fun/leisure
   4. Employed by someone

Has any member of your family experienced any health problems?

7. Is the business sustaining you adequately?
   1. Yes
   2. No

8. If no, do you encounter any problems?
   1. Yes
   2. No

9. Which gender consumes your food most?
   1. Male
   2. Female
   3. Both
   4. Children

10. How long have you been selling food in kiosks?
    1. One year
    2. 2-4 years
    3. 4-6 years
    4. 6-8 years
    5. 8 years and above

11. What kind of foods do you sell?
    1. Beef stew/ugali/potatoes/sukumawiki (kales)
    2. Matumbo stew/Ugali
    3. Rice/Beans/potatoes/cabbages
    4. Mukimu (maize, beans and potatoes)/kienyeji
    5. Chapati and madondo (beans)

12. Is this kiosk the only source of income?
    1. Yes
    2. No

13. What is the net income of your kiosk per day?
    1. Between Ksh 100-200
    2. Between Ksh 300-500
    3. Between Ksh 500-1000
    4. Ksh 2000 and above
14. Have you undertaken any training on food handling?
   1. Yes 2. No

15. If yes, at what level?
   1. Artisan level 2. Craft level Certificate
   3. Diploma Level

16. If no, how did you learn the skills?
   1. By trial and error
   2. Observation
   3. Parents

17. Who are your customers?
   1. Workers 2. Job seekers

18. Which gender consumes your food most?
   1. Male 2. Female
   3. Both male and female

(b) To establish the kiosk owners' awareness of Public Health and city by laws.

19. Do you have a license for selling food?
   1. Yes 2. No

20. If yes, when did you get it?
    1. I Year ago 2. 2 Years ago
    3. 3 Years ago 4. More than 4 years ago

21. If not, how do you escape the arrest by city council authority?
    1. By hiding
    2. By bribing them to allow us to sell
    3. By temporarily closing when the city council authority and within vicinity.

22. Do you have a food handlers' medical certificate?
    1. Yes 2. No

23. If yes, how often do you go for medical check up?
    1. Once after three months
    2. After six months
    3. Once a year
24. When did you last go for medical check up?
   1. A week ago
   2. A month ago
   3. Six months ago
   4. A year ago

25. Do you consider the check-up necessary?
   1. Yes
   2. No

26. If yes, why?
   1. To know my health status
   2. To allow me to do the business without fear
   3. To obey public health authority
   4. To avoid being arrested.

27. If not, why?
   1. It is expensive
   2. It is time wasting
   3. It is not necessary

Part I (c) Predisposing factors

1. Why is your kiosk located where it is?
   1. Lack of space
   2. It is near my house
   3. Extension of my house

2. Where do you buy your foodstuffs?
   1. Wakulima Market
   2. Supplier
   3. My farm

3. How do you transport the food?
   1. By Handcart
   2. By Bicycle
   3. Wheelbarrow
   4. Matatu

4. Where do you store the raw food?
   1. On a rack
   2. In a cupboard
   3. On the shelves
   4. In cartons

5. Where do you prepare the food?
   1. At home
   2. In the kiosk

6. How many assistants do you have?
   1. One
   2. Two
   3. Three
   4. Four
7. Where do you get your assistants from?
   1. Relatives
   2. Hired
   3. Hungry people who want food in exchange for work

8. Do you usually sell all the food you prepare?
   1. Yes
   2. No

9. If no, what do you do with leftovers?
   1. Give to hungry children/people around
   2. Throw away
   3. Cover it and store for re-use the next day.
   4. Carry to eat at home

10. If preserved for re-use, how do you store it?
    1. Leave it covered on top of a rack
    2. Keep it in the lockable cupboard
    3. Pack it in a polythene bag and leave it in cold water overnight.

11. Where do you get water for cooking?
    1. Water vendors
    2. Fetch from a nearby tap

12. Is the water enough for your daily use?
    1. Yes
    2. No

13. Do you boil water for drinking?
    1. Yes
    2. No

14. Do you treat water for use?
    1. Yes
    2. No

15. How do you transport the food from the market?
    1. By hand cart
    2. Using a wheelbarrow
    3. Using bicycle by a matatu

16. Where do you store the raw food?
    1. On a rack
    2. In a cupboard
    3. On the shelves
    4. In large sufurias

17. Which fuel do you use for cooking?
    1. Charcoal
    2. Kuni (firewood)
    3. Gas
18. Which type of cooking device do you use?
   1. Jiko
   2. Paraffin stoves
   3. Gas cookers [electrical cookers]

19. Do you know the names of the diseases that are transmitted through eating food from kiosks?
   1. Don’t know their names
   2. Not aware of any (don’t know.)
   3. Any other.

20. Has any member of your family experienced any health problems?
   1. Yes
   2. No

21. Do you encounter any problem with city council as far as licensing is concerned? Explain.

22. How about public health officers? How often do they visit your kiosk?
   1. Monthly
   2. After two months
   3. After three months
   4. After a long time

23. How would you like the government to assist you?

24. What improvement would you like to be made regarding kiosk operations?

25. What recommendation would you give to the government (City Council) in relation to the business?

26. What more suggestions would you recommend?
ANNEX 11: To determine the knowledge of food handlers on good hygiene practices (Questionnaire for food handlers: cooks/ waiters/waitresses)

I am a Masters of Science degree student at Kenyatta University, School of Pure and Applied Sciences, in the department of Hospitality and Tourism Management. I am carrying out a research on Food Safety and Hygiene Practices in Kiosks in Kibera slums of Nairobi Province. This questionnaire is aimed at determining the knowledge of food handlers on good hygiene practices. The aim is to improve the safety and hygiene practices in food kiosks. You have been selected as one of the participants in the study. Kindly assist me by answering the questions as accurately as possible. Any information given will be used confidentially and for academic purposes only.

Thank you.

Name of kiosk

Name of the village

Name of the interviewer

Date of the interview

Level of education

1. Gender
   1. Male
   2. Female

2. Marital Status
   1. Single
   2. Divorced
   3. Married
   4. Widowed

3. How many children do you have?
   1. One
   2. Three
   3. None
   4. Two
   5. Four and above

4. How old are you?
   1. Below 18
   2. Between 18-30
   3. Between 30-40
   4. 40 and above

5. Level of education
   1. Primary level
   2. Secondary level
   3. Tertiary Level (Certificate/Diploma
   4. University level
6. How often do you bathe?
   1. Daily
   2. Once weekly
   3. Monthly

7. How often do you cut your hair?
   1. Weekly
   2. Monthly

8. How often do you cut your fingernails?
   1. Daily
   2. Weekly
   3. Monthly

9. Do you wash your hands before serving?
   1. Yes
   2. Sometimes
   3. Never

10. Are you given uniforms/protective clothing to wear while on duty?
    1. Yes
    2. Sometimes
    3. Never

II Medical awareness for cooks/waiters/waitresses

11. Do you have a food handlers’ medical certificate?
    1. Yes
    2. No

12. When did you get it?
    1. Last year
    2. Six months ago
    3. A year ago
    4. More than a year ago
13. Do you consider a medical check-up necessary for a food handler?
   1Yes
   2No
If yes, why?
................................................................................................................
If no, why?
................................................................................................................

14. Do you know the symptoms of food borne diseases?
   1 Yes  2 No
If yes explain............................................................................................................
ANNEX III; Questionnaires for kiosk clients on hygiene awareness (customers)

I am a Masters of Science degree student at Kenyatta University, School of Pure and Applied Sciences, in the department of Hospitality and Tourism Management. I am carrying out a research on Food Safety and Hygiene Practices in Kiosks in Kibera slums of Nairobi Province. This questionnaire is aimed at establishing the perception, attitude and behavior of the clients in relation to safety of food in the kiosks. The aim is to improve the safety and hygiene practices in food kiosks. You have been selected as one of the participants in the study. Kindly assist me by answering the questions as accurately as possible. Any information given will be used confidentially and for academic purposes only.

Thank you.

To establish the perception, attitude, behavior of the clients in relation to safety of food in the kiosks

Name of kiosk.............................

Name of the village......................

Date of interview.......................

Questionnaire completed by..............

Education level.................

1. Gender
   1.Male
   2.Female

2. Marital Status
   1.Single
   2.Divorced
   3.Married
   4.Widowed

3. How many children do you have?
   1.One
   2.Three
   3.None
   4.Two
   5.Four and above

4. How old are you?
   1.Below 18
   2.Between 19-30
   3.Between 30-40
   4. 40 and above
5. Level of education
   1. Primary level  
   2. Secondary level  
   3. Tertiary Level (Certificate/Diploma)  
   4. University level

6. How often do you visit the kiosks?
   1. Daily
   2. Twice
   3. Three times a week.
   4. Occasionally

7. What attracts you to buying food from kiosks?
   1. They are near my place of work (convenience)
   2. They are cheaper compared to a formal restaurant.
   3. There is a larger variety of food available (traditional)
   4. Natural taste of food.

8. Are you happy with the state of floor, wall and equipment used?
   1. Yes  
   2. No
   If no, why? .................................................................

9. Have you been served with hot food?
   1. Yes  
   2. No

10. Have you ever suffered from diarrhoea and vomiting after eating a special dish from the kiosk?
    1. Yes  
    2. No
    If yes, did you go for treatment? .................................................................

11. What were you told by the doctor? Explain
    ..........................................................................................................

12. How do you know the illness was a result of eating food from kiosks?
    ..........................................................................................................

13. Are you happy with the physical structures of the kiosk?
    1. Yes  
    2. No
    Explain..........................................................................................................

14. Do you like the way you are always served.
    Explain..........................................................................................................

15. Do you like the way you are always served.
    Explain.............................................................................................................
16. Do you wash your hands with warm water before eating
   1. Yes  2. No

17. Is there a hand was basin?
   1. Yes  2. No

18. If yes, what is it made of?
   1. Jua Kali (metal)
   2. Jug and basin (plastic)

19. Is there soap for washing hands?
   1. Yes  2. No

20. In your opinion what do you think is the problem facing consumers food from kiosks?

   Please give suggestion and recommendations how these problems can be alleviated.

21. Have you ever had problems with food in terms of cleanliness and hygiene?

22. If yes what was the problem?
   1. Smell not acceptable
   2. Taste not normal.
   3. Food stale
   4. Any other

23. How did you deal with the problem?

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ANNEX IV: Role of public Health Officers

I am a Masters of Science degree student at Kenyatta University, School of Pure and Applied Sciences, in the department of Hospitality and Tourism Management. I am carrying out a research on Food Safety and Hygiene Practices in Kiosks in Kibera slums of Nairobi Province. This questionnaire is aimed at establishing the role of public health officers in ensuring food safety practices are enhanced in the kiosks. The aim is to improve the safety and hygiene practices in food kiosks. You have been selected as one of the participants in the study. Kindly assist me by answering the questions as accurately as possible. Any information given will be used confidentially and for academic purposes only.

Thank you.

Observation and checklist guide to establish the role of public Health Officers in ensuring food safety practices are enhanced in the kiosks.

Name of the public health officer............................................

Location of the study............................................................

Date of interview.................................................................

Questionnaire completed by..................................................

Supervised by...........................................................................

Please tick the appropriate box for the correct answer in your opinion.

1. Kiosks are temporary structures, which are not suitable for the production and service of food.
   1 Yes
   2 No
   3 Sometimes

2. Food kiosks are mainly located near garbage heaps and over drainage sights
   1 Yes
   2 No

3. Foods served in kiosks are not hygienically prepared.
   1 Yes
   2 No
4. Food *kiosk* workers have no knowledge of good hygiene practice.
   1Yes
   2No

5. Do you carry out routine inspection of the premises?
   1Yes
   2No

   If yes, how often?
   1Monthly
   2Quarterly
   3Yearly

6. Are *kiosk* workers aware of Cap 242 of public health Act on safe food handling?
   1Yes
   2No

7. How often should the kiosk workers go for medical check up?
   1Monthly
   2Quarterly
   3Twice a year
   4Yearly

8. How do you ensure that the food kiosk owners adhere to these regulations?
   1By inspection
   2Production and medical certificate
   3By carrying out spot check

9. Is medical examination for food workers adequately covered in terms of costs?
   1Yes
   2No

10. Do many food workers avoid medical check up due to cost incurred in the process?
    1Yes
    2No

   If yes, how do you handle this?
   Explain........................................................................................................................................
........................................................................................................................................

12. Is there laxity in the execution of the good health practices as recommended by the Public
    Health Act?
    1Yes
    2No

13. Is there lack of skill and capacity to implement government regulation on food handlers?
    1Yes
    2No
14. Is there a national policy on food safety as reflected in laws and regulations?
   1. Yes
   2. No

15. Have resources been allocated to implement this policy?
   1. Yes
   2. No

16. Do you have capacity to implement and to ensure continuity of surveillance?
   1. Yes
   2. No

17. Do you train food handlers on good hygiene practice?
   1. Yes
   2. No
ANNEX V: Observation and checklist guide
I am a Masters of Science degree student at Kenyatta University, School of Pure and Applied Sciences, in the department of Hospitality and Tourism Management. I am carrying out a research on Food Safety and Hygiene Practices in Kiosks in Kibera slums of Nairobi Province. This observation checklist guide is aimed at assessing good hygiene practices in the food kiosks. The aim is to improve the safety and hygiene practices in food kiosks. You have been selected as one of the participants in the study. Kindly assist me by answering the questions as accurately as possible. Any information given will be used confidentially and for academic purposes only.
Thank you.

Observation and checklist guide to assess Good Hygiene practices in the kiosks

Name of kiosk

Name of the village

Date of observation

1. What kind of foods are prepared and served from the kiosk.
   1 Kienyeji
   2 Stew and potatoes
   3 Mukimu
   4 Ugali/Sukumawiki

2. What is the location of the kiosk?
   1 Near the road
   2 Away from the road

3. What is the make of the floor?
   1 Wooden
   2 Cemented
   3 Not cemented (Earth)

4. Which are the protective clothes used?
   1 Apron
   2 Dustcoat
   3 Uniform
   4 None
5. Are the protective clothes used dirty?
   1 Yes 2 No

6. What is the condition of fingernails?
   1 Long
   2 Short
   3 Polished
   4 Not polished

7. What is the condition of the hands?
   1 Dirty
   2 Clean
   3 With sores
   4 Without sores

8. How often are hands washed?
   1 Before handling food
   2 After visiting toilet
   3 No washing at all

9. Is food handled while smoking?
   1 Yes
   2 No

10. Are there any unhygienic practices observed, such as:
    Coughing and sneezing over food without covering the mouth
    1 Yes
    2 No

11. Picking the nose and touching food without washing hands
    1 Yes
    2 No

12. Do the food handlers scratch and touch food without washing hands?
    1 Yes
    2 No
13. Blowing the nose without a handkerchief and touching food without washing hands
   1 Yes
   2 No

14. Are hands washed after handling raw meat or vegetables?
   1 Yes
   2 No

15. Do food handlers touch food with bare hands when serving?
   1 Yes  2 No

16. How is food served?
   1 In a plate
   2 In a plate on a tray.
   3 In a serving bowl /sufuria
   4 In a basin

17. Are the foods covered?
   1 Yes
   2 No

18. Is food served piping hot or warm?

19. How is food handled after it has been cooked?

20. How are the dishes washed?
   1 In plain water
   2 In cold soapy water
   3 In hot soapy water

21. How is rinsing done?

22. How often is water for rinsing changed?
   1 Regularly
   2 After all the guests have eaten
   3 Not known
23. Are the equipment used clean?
   1 Yes
   2 No

24. Are rags for wiping surfaces clean?
   1 Yes
   2 No

25. Are dish clothes/tea towels clean?
   1 Yes
   2 No

26. Are there many rags or only one used for all purposes?
   1 Yes
   2 No

27. Are hands washed after touching raw food before touching cooked food?
   1 Yes
   2 No

28. Is the same chopping board used to cut meat used to cut vegetables before washing?
   1 Yes
   2 No

29. Are flies in the kitchen?
   1 Yes
   2 No

30. Is there a garbage dump next to the kiosk?
   1 Yes
   2 No

31. Is there a hand-wash basin?
   1 Yes
   2 No

32. Is it clean with a hand drying towel?
   1 Yes
   2 No
33. Are there toilet facilities?
   1Yes
   2No

34. If yes, which type?
   1 Water closet
   2 Pit latrine

35. Estimate the distance of latrine from kiosk.

36. Is there adequate drainage for liquid waste disposal (i) < 30cm (2) 30-50m (3) > 50m
   1 Yes
   2 No

37. If not, how is the wastewater disposed of?
   1 Poured anywhere
   2 Poured at an identified spot

38. How is the solid waste disposed of?
   1 Thrown anywhere
   2 Thrown in dustbin with lid
   3 Taken to garbage dump

Are the dustbins with lids?
   1 Yes
   2 No

NB.

Dirty protective clothes refer to a garment that is greasy, spotted with food marks and any other spots or marks spread in most parts of the cloth that may look disgusting to the eyes and may be a source of food contamination.

Clean protective clothes refer to a protective cloth, washed regularly with very few marks or spots.
Annex VI; Ministry of Health personnel

I am a Masters of Science degree student at Kenyatta University, School of Pure and Applied Sciences, in the department of Hospitality and Tourism Management. I am carrying out a research on Food Safety and Hygiene Practices in Kiosks in Kibera slums of Nairobi Province. This questionnaire is aimed at identifying the most common food borne illnesses in the slum, to ascertain whether the illnesses is as a result of consumption of food and water, to know some of the symptoms of food borne illnesses and to know the major illnesses related to food. The aim is to improve the safety and hygiene practices in food kiosks. You have been selected as one of the participants in the study. Kindly assist me by answering the questions as accurately as possible. Any information given will be used confidentially and for academic purposes only.

Thank you.

The following index was developed for the purpose of:

1. Identifying the most common food borne illnesses common in the slum.
2. To ascertain whether the illnesses is as a result of consumption of food and water.
3. To know some of the symptoms of food borne illnesses
4. To know the major illnesses related to food.
5. To know preventive measures to be taken to alleviate the problem.

1. Details
Name of M.O.H. ..............................................

Location of the study........................................

Questionnaire completed by .........................
Age ..............................................................

Sex................................................................
Level of Education.................................
1. Primary
2. Secondary
3. College / University
2. Name any three food-borne illnesses that are likely to be transmitted through food handling practices.
1. ..............................................
2. ..............................................
3. ..............................................
4. ..............................................

2. What is the cause of each of the food borne illness that you have mentioned in (1) above?
1. .............................................. ..............................................
2. .............................................. ..............................................
3. .............................................. ..............................................
4. .............................................. ..............................................

3. Mention at least two symptoms that a patient suffering from each of the diseases you have mentioned in (2) above might present with.

1. (a) ..............................................
   (b) ..............................................
2. (a) ..............................................
   (b) ..............................................
3. (a) ..............................................
   (b) ..............................................
4. (a) ..............................................
   (b) ..............................................

4. State at least one preventive measure that may be adopted for the control of each of the food borne illness you have mentioned above.

5. How can you tell whether the illness is related to the consumption of food?

Explain. ..............................................................................................................................
..............................................................................................................................

6. How many food related illnesses come to the clinic for treatment?

..............................................................................................................................
..............................................................................................................................
7. What is your attitude towards the food safety and hygiene practices in the kiosks? Explain.

8. What diseases do you think one can get due to improper excrete disposal?

1. Cholera
2. Intestinal worms
3. Stomach ache
4. Diarrhoea
5. Others (please specify)

9. What diseases do you think one can get due to poor waste disposal?

1. Cholera
2. Stomach ache
3. Pest related diseases
4. Worms
5. Others (please specify)

10. What is your overall assessment of location and structures of kiosks used for the purpose of food production and service?

11. What recommendation/advice would you give to improve the situation?
Annex VII
Maswali kwa wenye vibanda

Utafiti huu ni kwa madhumuni ya masomo. Tafadhali jin'ibu kwa uaminifu. Kazi hii itahifadhiwa kwa siri.

Jina la kibanda..............................................................
Jina la mwenye kibanda...................................................
Tarehe..............................................................................
Mtaa..............................................................................
Kijiji..............................................................................
Kiwango cha masomo......................................................

(A) Maswali ya kibinafsi
1. Jinsia..........  
   A. Mwanaume  
   B. Mwanamke

2. Umeolewa au umeoa?
   A. Ndio  
   B. Talaka  
   C. La  
   D. Nilifiwa

3. Una watoto wangapi?
   A. Sina  
   B. Mmoja  
   C. Wawili  
   D. Watatu  
   E. Zaidi ya wane

4. Una miaka mingapi?
   A. Chini ya miaka 18  
   B. Kati ya 19-30  
   C. Kati ya 30-40  
   D. 40 na zaidi

5. Kiwango cha elimu
   A. Shule ya msingi  
   B. Shule ya upili  
   C. Mafunzo ya ziada  
   D. Sina elimu yoyote
6. Ni kwanini ulianza kibanda cha chakula?
   A. Ukosefu wa kazi
   B. Ni biashara ya familia
   C. Kwa starehe tu
   D. Nimejiriwa

7. Umekuwa ukifanya kazi ya kupika na kuuza chakula kwa muda gani?
   A. Mwaka mmoja
   B. Miaka 2-4
   C. Kati ya miaka 4-6
   D. Kati ya miaka 6-8
   E. Zaidi ya miaka 8

8. Unauza vyakula vya aina gani?
   A. Nyama / ugali / viazi / sukuma wiki
   B. Matumbo / ugali
   C. Wali / maharagwe / viazi / mboga ( kabichi)
   D. Kienyeji / githeri
   E. Chapati na maharagwe

9. Je, kibanda hiki ndicho tegemeo lako la pekee kimapato?
   A. Ndio
   B. Hapana

10. Je, mapato yako ya kila siku kwenye kibanda hiki ni kama pesa ngapi?
    A. Kati ya 100-200
    B. Kati ya 300-500
    C. Kati ya 500-1000
    D. 2000 na zaidi

11. Je, una mafunzo yoyote kuhusu kushughulikia chakula?
    A. Ndio
    B. Hapana

   Kama ndio, kiwango kipi?
   Kama la, ulijuaje mbinu za upishi?
   A. Kujaribu mwenyewe
   B. Kuangalia watu wakipika
   C. Kutoka kwa wazazi

12. Wateja wako ni watu gani?
    A. Wafanyi kazi
    B. Wanaotafuta kazi
    C. Wanafunzi
    D. Wapita njia
13. Ni jinsia ipi inayokula chakula chako sana?
   A. Wanaume
   B. Wanawake
   C. Wote, wanaume kwa wanawake

   {B} Habari kuhusu afya ya jamii na sheria za mji

14. Je, uko na kibali cha kuuza vyakula?
   A. Ndio
   B. Hapana

   Kama ndio, kwa muda gani sasa?
   A. Mwaka moja
   B. Miaka miwili
   C. Miaka tatu
   D. Miaka nne na zaidi

   Kama la, unafanyaje kuepuka kunaswa na na askari wa jiji?
   A. Mimi hujificha
   B. Kuwapa hongo
   C. Mimi hufunga kwa muda

15. Uko na cheti cha afya kutoka kwa daktari kukuruhusu kupika na kuuza chakula?
   A. Ndio
   B. Hapana

   Kama ndio, unamwona daktari baada ya muda gani?
   A. Mara moja baada ya miezi mitatu
   B. Mara moja baada ya miezi sita
   C. Mara moja kwa mwaka

16. Ulienda kwa daktari kwa uchunguzi mwisho lini?
   A. Wiki moja iliyopita
   B. Mwezi moja uliopita
   C. Miezi sita iliyopita
   D. Mwaka moja uliopita

17. Je, unafikiri ni muhimu kwenda kwa uchunguzi?
   A. Ndio
   B. Hapana

   Kama ndio, kwanini?
   A. Kujua hali ya afya yangu
   B. Kuniwezesha kufanya biashara bila kuogopa
   C. Kutii sheria ya afya ya jamii
   D. Kuepukana na kukamatwa
Kama hapana, kwanini?
A. Ni bei ghali sana
B. Ni kupoteza wakati
C. Haina haja

{A}Maneno muhimu kuzingatia wakati unapotupa takataka
1. Kwa nini kibanda chako kiko mahali hapa?
   1. Ukosefu wa nafasi
   2. Ni karibu na nyumba yangu
   3. Ni upanuzi wa nyumba yangu

2. Unanunua vyakula vyako wapi?
   1. Soko ya wakulima
   2. Wanaotembeza
   3. Kutoka kwa shamba langu

3. Unasafirisha vyakula vyako kwa njia gani utokapo sokoni?
   1. Kutumia mkokoteni
   2. Baisikeli
   3. Matatu

4. Unahifadhi vyakula bichi wapi?
   1. Kwenye beseni
   2. Kwa boksi
   2. Kabati

5. Unapika chakula chako wapi
   1. Nyumbani
   2. Kibandani

6. Una wafanyi kazi wangapi
   1. Mmoja
   2. wattatu
   3. Watatu
   4. wane

7. Unapata wafanyi kazi wako wapi
   1. Watu wa jamii/famili
   2. Kuajiri
   3. Kwa wale wenye njaa wanataka chakula kubadili na kazi

8. Je kila mara unauza chakula chote una chopika
   1. Ndio
   2. Hapana

9. Kama jibu ni la, unafanya nini na mabaki?
   1. Nawapa watoto/watu wenyja njaa walio karibu.
   2. Natupa.
   3. Nakifunika na kukitumia siku inayofuata.
10. Ukihifadhi (Chakula) ili kutumia baadaye unakihifadhi vipi?
   1. Nakifunika na kukiwacha.
   2. Nakifungia kwenye kabati.
   3. Nakiweka kwenye karatasi ya nailoni na kukiweka kwenye maji baridi usiku kucha.

11. Unapata wapi maji ya kupikia?
    1. Nanunua maji.
    2. Nachota kwenye mfereji.

12. Je, maji haya yanatosha matumizi yako ya kila siku.
    1. Ndio       2. La.

13. Je, unachemsha maji ya kunywa?
    1. Ndio       2. La.

    1. Makaa       2. Kuni.       3. Gesi

15. Unatumia kifaa kipi kupika chakula?
    1. Jiko
    2. Stove
    3. Jiko la gesi / stima

16. Je biashara yako inakutosheleza kimaisha

17. Je Ni jinsia gani inakula chakula chako Sana
    1. Wanaume       2. Wanawake
    3. Wote

18. Je wewe husumbuliwa Na askari wa jiji kwa kukosa kibali?
    Fafanua.................................................................

20. Je askari wa wizara ya afya huja kwa kibanda chako kama mara ngapi?
    1. Baada ya mwezi       2. Baada ya miezi miwili

21. Je unaweza taka serikali ikusaidie aje
    Fafanua.................................................................
22. Je ungetaka kibanda chako kiimarike kivipi
Fafanua........................................................................................................
........................................................................................................

23. Je unaweza kutoa maoni/mapendekezo gani kwa serikali kuhusu biashara?
Fafanua........................................................................................................
........................................................................................................

24. Una maoni/ mapendekezo mengine?
Fafanua........................................................................................................
........................................................................................................

MASWALI KWA WAFANYI KAZI

Jina la kibanda.................................................................
Jina la kijiji.................................................................
Jina la mwenye kulizwa maswali?.................................
Tarehe.................................................................
Kiwango cha elimu..........................................................
Jinsia Mwanaume...... Mwanamke..... Miaka........

1. Je unaoga baada ya muda gani
   1. kilasiku 2. mara moja kwa wiki 3. Baada ya mwezi

2. Je unanyoa nywele baada ya muda gani
   1. Mara moja kwa wiki 2. Mara moja Kwa mwezi

3. Je unakata makucha baada ya muda gani

4. Je unaosha mikono kabla ya kuwapa wateja chakula

5. Je mnapewa nguo za kuwazuia kuchafuka kazini
6. Je, uko Na barua ya kuruhusiwa kushika chakula
   1. Ndio       2. Hapana

7. Je uliipata lini
   1. Mwaka uliopita
   2. Miezi sita iliypita
   3. Zaidi ya mwaka moja sasa

8. Je unafikiri kumwona daktari Kwa wafanyi kazi Ni muhimu
   1. Ndio
   2. Hapana

   Kama ndio, kwa nini..............................................................
   ..........................................................................................s
   Kama la, kwa nini..............................................................
   ..............................................................................................

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