FOOD SAFETY STATUS IN CHAIN AND UNCLASSIFIED FAST FOOD RESTAURANTS IN NAIROBI CITY CENTRE, KENYA.

BY

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SEPTEMBER, 2006
DECLARATION

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

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This research work is dedicated to my dear wife Petrigona Kemunto Ratemo, my children Clinton and Duke and dear parents Simon Ondara and Hellen Nyanchage.
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First and most I thank God for giving me this chance and seeing me through this wonderful experience.

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Lastly, to my dear friends Bichage and Maranga for standing by my side and encouraging me throughout this process.

To you all I say thank you with love from within.
The hospitality industry, and in particular restaurants, play an important role in the national economy. This is through the provision of employment in the formal and informal sectors hence empowering the society economically. This socio-economic contribution notwithstanding, hygiene standards if compromised can pose a public health hazard by causing food borne diseases resulting to serious economic loses. The loses include absenteeism; high costs of medical care; cost of investigating food borne diseases; legal costs and fines resulting from court cases. The purpose of this study was to investigate food safety status in chain and unclassified fast food restaurants in Nairobi centre. The objectives of the study were; to determine the bacteriological contamination of precut salads and water; to assess food safety practices in chain and unclassified restaurants; establish the degree of application of Hazard Analysis Critical Control Point (HACCP) and lastly to determine factors that influence the application of these principles. In order to achieve this goal, a total of eighteen restaurants were studied. Eighteen water samples and eighteen salad samples were collected and examined for bacteriological contamination. Qualitative data were collected using questionnaires, interview schedules, observation checklists and secondary data. The coded data were entered into excel and later exported to Statistical Programme for Social Sciences (SPSS) for in-depth analysis of variables. Quantitative data were collected and laboratory tests run. This was subjected to measures of central tendency such as mean. A p-value of less than 0.05 was considered significant. Additionally, 95% confidence interval was computed to determine the lower and upper bounds. The samples were analyzed for the presence of presumptive coliforms and later for E.coli. Salmonella, staphylococcus aureus, and bacillus cereus were not isolated. Only 5.6 % of the samples were identified with high Coliform count of 180/100ml. This implied that water samples in restaurants were portable and not a public health hazard. Salad samples analyzed, indicated low level of mean contamination of 7.1 – 8.0x10^4 from the golden mean of 10^4. This was insignificant to cause disease and implied that salads were safe for consumption. An independent T-test at 95% (-23064260- -2280985) was performed to determine whether the two means of the class of restaurants differed significantly in terms of contamination but this indicated that the two means did not differ significantly. A chi-square showed that a majority of personnel had low levels of professional training but practiced good food handling from production through to service. On the knowledge of HACCP, an average of 79% of the operational staff (restaurant managers, food production staff and food service personnel were ignorant about HACCP system of food safety and quality though they recommended that it was the best applicable system. Lack of inadequate support, and supervision from public health officers, harassment and bribery remained serious problems hindering the application of HACCP. It was therefore recommended that there was need for high level of professional training for food handlers especially those directly involved with food. An urgent retraining of government public health officers on modern food safety standards is needed. Further, government should equip their laboratories with modern technologies to support hotels and restaurants in analysis and maintenance of quality assurance.
Abbreviations and Acronyms

B.P.W - Buffered Peptone Water
C.A.C - Codex Alimenterius Commission
E.Coli - *Escherichia Coli*
H.A.C.C.P - Hazard Analysis and Critical Control Point
MPN – Most probable number
QCC - Quebec Colony Counter
S.P.S.S - Statistical Package for Social Sciences
TPC - Total Plate Count
WHO - World Health Organization
F.A.O - Food agricultural organization
W.H.O - World health organization
R.P.C - Routine plate counts
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CHAPTER ONE

INTRODUCTION

1.0 Background information

Restaurants refer to places where food is sold for consumption as well as take away services (Jones, 1995). In the recent past, restaurants have become indispensable components of food distribution systems in developed and developing countries. Restaurants play an important role in the provision of employment in the formal and informal sectors. Further, restaurants support the tourism industry by the provision of food and services and are therefore a source of foreign earnings and a means by which the society is empowered economically (Medlick and Ingram, 2000).

Despite these socio-economic contributions, hygiene standards may be compromised and can pose a potential public health risk to consumers by causing food-borne diseases (WHO, 1988; Beuchat, 1995; Rouver, 1999). Loses attributed to food-borne diseases include absenteeism, high costs of medical care, costs of investigating food-borne outbreaks, loss of economy due to closure of business, legal costs and fines resulting from court cases (WHO, 2000).

There are a number of reports indicating an increase of food and water-borne diseases. In England and Wales for example, in 1972, the cost of salmonellosis alone was estimated at US $ 350 Million and US $ 502 Million of which 73% of the cost were associated with treatment and investigations (Skinner, 1994). In 1992, a survey conducted in Hong Kong showed that up to 30% of workers take offs during the year due to illnesses caused by food-borne diseases (Fitzpatrick, 1995). In America the total cost of Salmonellosis was calculated at about US$ 4 Million with an average cost per case at US $1350 (Ames, 1994). In addition, over three million cases of diarrhoeal are caused by contaminated food

Water contaminated with disease-causing pathogens can be more deadly as no water at all. According to the WHO, (1984) 25,000,000 people die each year due to diseases caused by lack of good sanitation and dirty or inadequate water. As the population increases, the dynamics lead to insanitary conditions enabling widespread transmission and propagation of pathogens. Although public health workers in Kenya occasionally monitor water sources, there is little information about the degree of environmental contamination (Sang’, F., Gaatheru, Z., Koske, N., Mori, K., Hayashi, T., and Utsunomiya, A. (1983).

Risks associated with contaminated food include physical, chemical and microbiological hazards. The latter constitute the highest percentage of food-borne diseases (Merlle and Corlett, 1992). Bacteria, viruses, protozoa and parasites are the major organisms responsible for these diseases (Cahill, 2000; Prescott, 2002; Guenno, 1995). Bacteria of major concern include: *Salmonella, Escherichia coli, Clostridium perfringens*, *Clostridium botulinum, Bacillus cereus, Campylobacter jejuni, Listeria monocytogenes, Staphylococcus aureus* among others (Skinner, 1983).

Safe food can be attributed to a number of factors: food, people and facilities or equipment. Food may be contaminated before it arrives in the food preparation areas as well as through the use of wrong equipment, dirty surroundings, poor housekeeping and conditions that are attractive to pest infestation (Food and drug administration, 1983).
Most food-borne diseases are attributed to food contamination through unhygienic food handling practices, infected food handlers, lack of training on food safety, inadequate inspection and poor Government policy (Government of Kenya, 1997).

Government inspection authorities have failed to ensure regular food inspection in production areas, transportation, and storage conditions, exposing consumers at risk. Unfortunately in Africa and Kenya in particular the extent of this problem has not been adequately addressed. Additionally little research and surveillance has been done. Therefore this study sought to assess the food safety status in chain and unclassified fast food restaurants in Nairobi city centre.

1.2 Statement of the problem

Food-borne diseases constitute a growing public health problem worldwide and a significant cause of reduced economic activity (FAO/WHO, 1986). This problem is attributed to water and food contamination through unhygienic handling practices, lack of knowledge of food-borne diseases, infected food handlers, inadequate public health inspection, lack of surveillance and poor government policy.

Unfortunately in Africa and Kenya in particular, reporting of food-borne diseases is limited. Researchers are unable to know if there is a problem and of what magnitude (Government of Kenya, 1997). In Europe and America, food safety and quality assurance can be assessed by the use of quality standards such as HACCP (FAO/WHO, 1986). Additionally, the extent of this problem has not been adequately addressed. Furthermore, little research and surveillance of water and food- borne diseases has not been adequately researched. Therefore this study sought to investigate the current status of food safety in chain and unclassified fast food restaurants in Nairobi city centre.
1.3 Research questions

In order to achieve the overall objective of this research, the following questions guided the study.

1. What is the extent of bacterial contamination in foods served in restaurants such as salads and water?
2. How was salads and water handled in restaurants?
3. What food safety and quality standards are applied in chain and unclassified fast food restaurants in Nairobi?

1.4 Research hypothesis

H₁: The application of the Hazard Analysis and Critical Control Point (HACCP) standard is effective in both chain and unclassified fast food restaurants.

H₂: Both chain and unclassified restaurants offer safe food.

1.5 The purpose of the study

The purpose of this study was to investigate the food safety practices in restaurants and determine factors that influence the application of HACCP principles in chain and unclassified restaurants in Nairobi city centre.

1.6 Objectives

The objectives of the study were to:

1. Determine the bacteriological quality of food (pre-cut salads and water).
2. Assess the food safety practices in chain and unclassified fast food restaurants.
3. Establish the degree of application of HACCP principles.
4. Determine factors that influence the application of the HACCP principles.
1.7 Significance of the study

Information generated from this study will be used in the following ways: to formulate proper policies in line with food safety and quality in restaurants to all stakeholders, to create a better system of implementation in restaurants in Nairobi. Further, the study will create awareness among consumers, manufacturers and non-governmental organizations concerning food safety status and standards. Findings will also be used as a basis for future research in the area of food safety and quality.

1.8 Limitations

1. Findings should be generalized with caution since the study was carried in restaurants only within Nairobi.

2. The study did not investigate contamination of food in the whole food chain.

3. The food samples collected and analyzed were only pre-cut salads and water.
1.9 Operational Definitions of Variables

**Restaurant.** Refers to a place where food is prepared, bought and consumed on the premises or away from the premises.

**Hazard.** An object or material in food that is capable of causing harm because it contains micro-organisms, toxins, and chemicals of foreign bodies.

**Risk.** The probability that a hazard will cause harm.

**Hygiene.** Conditions and measures necessary to ensure the safety of food by examining practices of food handlers, gloomming, equipment and premises.

**HACCP.** (Hazard Analysis and Critical Control Point). A scientific and internationally accepted procedure in attainment of food safety through monitoring of good manufacturing and production practices, personnel, equipment in a systematic way.

**Safe food.** Food that is fit for consumption and is unlikely to cause harm according to the intended use.

**Unclassified restaurants.** Restaurants that are not star-rated in accordance with the government publications of 1997.

**Pre-cut salad.** Vegetables that are prepared and served cold or eaten raw.

**Chain restaurants.** Management with two or more outlets giving the same services.

**Kachumbari.** A mixture of vegetables such as tomatoes, green pepper, coriander and onions eaten raw.
CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The literature reviewed in this study focused on the following key areas: socio-economic role of restaurants, microbiological hazards, laboratory analysis of samples, foods prone to bacteriological contamination, characteristics of portable water, characteristics of bacteria, Hazard Analysis and Critical Control Point (HACCP), the general Principles of food safety and hygiene and finally, the role of government in ensuring safety.

2.1 Socio-economic importance of restaurants

According to Medlick and Ingram (2000), and Jones, (1995) the hospitality industry and restaurants in particular play an important role in the provision of food and other facilities for the transaction of business such as recreation and entertainment to local and international visitors. Due to the changing lifestyles, many people eat more frequently in food service establishments and this includes restaurants and canteens. In most middle-income countries, the number of fast food establishments has increased tremendously.

In France, over 6000 million meals are served annually in restaurants and other fast food outlets (Herbert, 1994). In USA from 1972-1989 the number of restaurants increased from 112,000 to 161,000 and the number of fast food restaurants doubled from 73,000 to more than 146,000 (Hedberg, 1994). Through visitors spending in restaurants, local economies are empowered by the subsequent diffusion of the visitor’s expenditure on the recipients in the community (Medlick and Ingram, 2000).

Foreign visitors are a source of foreign earnings hence a means of settling balance of payment. Further, restaurants are a major employer in the formal and informal sectors.
employing over 2.5 million people locally. Finally, Restaurants are outlets for products of other industries such as drinks, foods and other consumables (Skinner, 1983). By and large, the industry has done an excellent job of providing safe food to people. However, a number of food-borne illnesses attributed to the food industry is still significant. Food And Drug Administration (1995) argues that the food service industry is serving a public that is increasingly intolerant of any food safety risk.

Forty years after independence, typhoid remains a major killer in Kenya despite the country’s major achievement in health and medicine. Economically the disease treatment costs more than Kenya shillings 65 million in antibiotics (The leader, 2005).

2.2 Microbiological hazards

Food-borne diseases constitute a growing public problem worldwide and a significant cause of reduced economic activity. It is estimated that millions of people suffer from water and food-borne related diseases (Cahill, 2000). Most of these diseases are attributed to poor infrastructure, human factors and poor policy formulation (Harnsen, 1953; Keith, 1991). Contamination can be in the form of physical, chemical or microbial. Microbial contamination causes the highest number of cases and bacteria, viruses and parasites are major micro-organisms of great concern (Skinner, 1983).

Viral infections are transmitted to food through feacally-contaminated water that can lead to the danger of contracting Hepatitis A among other diseases (Thelma and Pawsey, 1995; Guenno, 1995). Parasites can also cause fatal illnesses, such as Trichinella spiralis, a disease caused by eating infected undercooked pork. Further, unwashed vegetables can also contain Toxoplasma gondii that causes Toxoplasmosis (Prescott, 2002).

Skinner (1983), reported that bacteria constitute the highest percentage of food-borne diseases. Bacterial diseases can be caused by either food-borne infection or intoxication
Common diseases caused by bacteria include diarrhea, abdominal pain, botulism, and abdominal cramps (Skinner, 1983).

2.3 Laboratory analysis of samples

Tayman, (2000) reports that developing methods and procedures for rapid detection of pathogens in food is an ongoing challenge and a priority for everyone involved in food industry. All those involved in the management of hotels need to monitor the outputs of various kitchens by taking samples for bacteriological examination. The samples should include water, foods, swabs or rinses of cleaned equipment, which should be examined to determine if they are of suitable standard. The results obtained can be used to interpret observations made in these outlets in terms of microbiological implications (Harrigan and Park, 1999).

2.4 Foods prone to Bacteriological contamination

FAO/WHO, (1986) reported that a number of foods contaminated by bacteria include: - processed foods, poultry, poultry products, milk, cheese, pasteurized, frozen and dried egg products, vegetables- especially those eaten raw such as Kachumbari (a fresh mixture of onions, tomatoes, green pepper and fresh coriander)- and categories of dietetic foods. The primary organisms of concern are Salmonella, Staphylococcus aureus, Bacillus cereus, and Lysteria monocytogenes. The presence of Salmonella in pre-cut salad and water is considered significant regardless of the level of contamination.

The Critical Control Point that will facilitate the growth of micro-organisms is during receiving, storage, coring operation, preparation and service of the salads. In order to ensure safety, the product must be cleaned by the use of clean running water, clean sanitary utensils and monitored at temperatures below 8°C (Merlle and Corlett, 1995). At
temperatures of between $10^0\text{C} - 65^0\text{C}$ salads are at a critical level and may contain high total bacterial counts, an indicator of high pathogenic contamination (Ceserani et al, 2000; Poelma et al, 1984).

### 2.5 Quality of potable water

Because of its universal usage, water is an excellent vehicle of enteric pathogens. WHO, (1984) reported that some 25 million people die each year due to disease caused by lack of sanitation and adequate water. Further, WHO, (1984) reported that 30,000 people die daily worldwide from water related diseases. In developing countries 80% of the health related problems are water associated. In addition, a quarter of the children born in developing countries die before the age of five years from water-borne related diseases.

Water contains a variety of organisms, which can be grouped into pathogenic *bacteria, viruses, and Metazoa* (worms and protozoa). Contamination of water can be caused by pollution of water source or pollution of water during conveyance from source to consumer or in storage tanks. The pollutants may include the excretions, feacal and urine of man or animals, sewage or sewage effluents (WHO, 1972).

Bacterial organisms that occur in water through contamination include strains of *Salmonella, Feacal Streptococi, Shigella, and Enteropathogenic Escherichia coli, Yesinia, Enterocolitica and Campylobacter jejuni* (WHO, 1984). Water quality indicator micro-organisms due to feacal contamination are *Escherichia coli* and *Feacal streptococi*. The presence of these bacteria indicates fresh contamination and a potential risk of infection to the users of this water.

The most important parameter of drinking water and water for use in domestic purposes is the microbiological quality. Standards for bacteriological quality are based on organisms
that are non-pathogenic but their presence serves as indicators of contamination. According to WHO Guidelines, (1985) chlorinated or disinfected water supplies should not contain any presumptive *coliforms* in any 100ml sample of water entering the distribution channel. At the same time, there should be no (fecal) *Escherichia coli* in 100ml. In principle, all samples taken from the distribution system, including consumer premises, should be free from *coliform* organisms (WHO, 1992). If this requirement cannot be satisfied, then the water should not be used for drinking or in food preparation areas. In addition to the above standards, water should be free from enteric bacteria, excess minerals, organic materials, toxic substances, colour, and turbidity and of good odour.

In Kenya, the Kenya Bureau of Standards (KBS, 1985) requires that treated and untreated water entering the distribution system should have 0/100ml of fecal *coliforms* and 3 *coliforms*/100ml from other sources in any one sample. Any significant increase in the expected level particularly at 37°C indicates a supply problem with possible contamination. The maximum concentration of total *coliforms* is 0/100ml (WHO, 1971).

### 2.6 Characteristics of Bacteria

The presence of bacteria can be recognized by the development of colonies on solid or liquid media or turbidity. Pathogenic bacteria require only a few hours to produce visible growth, whereas it may take weeks to produce evident mycobacterium or Mycoplasma. This can be identified by cell shape and size (Prescott, 2002). Bacterial growth on a new substrate is always characterised by initial period of adjustment (lag phase). The duration of the lag phase is largely determined by temperature and factors intrinsic with the substrate. This phase is followed by a period of exponential growth until nutrient depletion and the accumulation of toxic metabolites causes bacteria decline.
The initial identity of bacteria may be defined by microscopic appearance. Some resistant strains grow between 5°C - 7°C and are spore-forming. Others produce poisonous substances known as endotoxins or enterotoxins such as *Staphylococcus aureus* (Dufrenne, J., Soentoro, P., Van Netten, Moosdjik, 1994).

*Salmonella* genus are facultative anaerobes, gram-negative rods, able to ferment glucose but not lactose, cannot breakdown urea, cannot grow in the presence of potassium synide, can produce hydrogen sulphide and are motile. *Bacillus cereus* forms precipitation of hydrolysed lecithin and does not utilize Mannitol (Thelma and Pawsey, 1995; Claus and Berkeley, 1986). *Escherichia coli* is a lactose fermenter; positive colonies appear red and lactose negative colonies appear colourless (Prescott, 2002).

Bacteria thrive in warm, moist, protein rich environment that is neutral to low acids. Some bacteria however tolerate extremes of heat. But many strains of bacteria grow well in temperature that range from 11°C- 45°C. This temperature limits coincide closely with the range between normal room temperature and normal body temperature for humans (FDA, 1995).

2.7 Hazard Analysis and Critical Control Point (HACCP)

Hazard Analysis and Critical control Point (HACCP) refers to a systematic approach used in food production as a means of ensuring food safety and quality assurance, based on the Codex Alimenterius Principles of Food Hygiene and Safety (WHO/ FAO, 1986). This approach of microbiological safety of foodstuffs is tested at every process step in the food chain as well as the hygiene practices of the food handlers. FAO/WHO, (2000) recommends the application of HACCP system in controlling the emergency of food-borne problems. Merle and Corlett (1992), assert that as a preventive measure or system
of quality control, HACCP system, if properly applied, can be used to control hazards at any point in the food chain that could contribute to hazardous situation. These can be contaminants, pathogenic micro-organisms, physical objects or chemical substances.

When establishing an HACCP system, one of the most important steps is the technical expertise and scientific background in various domains for proper identification of all potential hazards. The knowledge of HACCP is necessary for the performance of satisfactory hazard analysis (WHO/FAO, 1986).

HACCP as a management tool can be applied during purchasing, receiving, storage, production and service of food. Further, if adopted by manufacturers, HACCP can increase confidence in food safety to consumers compared to other management tools such as Good Manufacturing Practices (GMP), Good Hygiene Practices (GHP), Microbial Risk Assessment (MRA), Total Quality Management (TQM) and ISO series (WHO/FAO, 1989; Tayman, 2000; Robert, 1995).

The success of these principles has been seen in many parts of the world including America and Europe (FAO/FAO, 1986). The implementation of HACCP can be done in the following stages: identifying the hazards, determining critical control points, establishing critical limits, taking corrective action, maintaining effective records and verification of these records.
2.8 General principles of ensuring food safety and quality

2.8.1 Training of food handlers

The prevention of food-borne diseases requires that contamination be controlled at all stages of the food chain. This includes the hygienic production of foodstuffs in farming, application of appropriate process techniques and the control of contaminants through the education of food handlers. Training is an effective option in preventing food-borne illnesses even when the other defenses fail (FAO/WHO, 2000).

Education of people involved in food handling is a powerful and practical means of improving public health both substantially and sustainably (FAO/WHO, 2000). Those who handle food must be able to know its nature, the manner in which it is stored and the expected length of time before consumption. Managers and food handlers who have knowledge in food handling have a higher merit score when inspected than those without knowledge. Staff employed require training that is relevant to food safety and this should be mandatory if desired results are to be achieved (FDA, 1995).

Tayman, (2000) recommends that all sectors involved in food should be supported with technical assistance through education and training programmes, which lead to consumer acceptance. Cody and Keith, (1991) reported that if food handlers are trained in food safety and hygiene practices and understand the mechanism of food infection, they could prevent contamination (Prescott, 2002).

2.8.2 Consumer knowledge

WHO, (1992) asserted that consumers should have knowledge of food handling in order to protect themselves and anyone intending to use that food. Consumers who are aware of food hygiene and handling become discriminating buyers and thus protect themselves
from food-borne diseases (FAO/WHO, 1995a). Health knowledge should enable consumers to understand the importance of any product information and to follow any instructions accompanying the product to enhance informed choices (FDA, 1995).

2.8.3 Good hygiene practices in food chain.

2.8.3.1 Purchasing and receiving food.
It is impossible to prepare wholesome meals with contaminated ingredients. Food purchases must be made from approved suppliers only and examined for signs of spoilage and contamination before being used. Receiving of food is a control point and for certain foods such as vegetables, can be a critical point. It is important for setting up procedures of inspecting acceptable standards of food and following them closely to prevent food-borne illnesses (FDA, 1995).

In receiving of ingredients it is important to do correct assortment and reject those foods that do not meet required standards. Specific emphasis should be paid to fresh vegetables. Only sound suitable raw materials should be used (FDA, 1995). Where necessary, laboratory tests should be carried out to establish the fitness and use before being accepted in the food production and service establishments.

2.8.3.4 Storage of ingredients
Improper storage of food is a potential source of contamination and spoilage within the food production and service establishments. Although different foods have different storage requirements, all foods should be received and kept within the shortest time possible. All foods should be stored in areas that are clean and in correct temperatures. Proper rotation of stock and use by recommended dates is important. Any expired food should be discarded (Prescott, 2002). Poorly cooled and inadequately re-heated foods are the biggest sources of food poisoning. Foods should be cooled as quickly as possible and
refrigerated. Food to be kept in refrigerators should be clean and covered. Diversey Lever (1996) suggests that kitchens should be well ventilated in order to reduce moisture levels, which provide good environment for bacterial growth.

2.8.3.5 Contamination in food preparation areas.

Micro-organisms can be transferred from food handler to food through poor personal hygiene such as dirty kitchen uniforms, unclean hands, and infected food handlers. Contamination can also be caused through using dirty kitchen equipment (Diversey Lever 1996). Therefore, strict personal, kitchen, equipment and food hygiene practices should be followed to the letter. Personal hygiene is a critical protective measure against food-borne illnesses. Although judging personal hygiene can be subjective, it remains a major ingredient in controlling food-borne diseases.

A study carried in Nigeria to assess personal hygiene and food safety practices revealed that half of the food handlers did not wash their hands adequately before preparing food. In 20% of the cases, foods were left at an ambient temperatures leading to contamination (Abidoye, 1990).

2.8.3.6 Control during service

To avoid survival of micro-organisms or production of toxins by bacteria, foods should be held hot above 66°C and if the food is to be served cold, then it should be stored at 5°C especially for vegetable salads or chilled foods.

2.8.3.7 Kitchen hygiene and Sanitation.

Kitchen hygiene concerns all activities related to the preparation of food in such way as to safeguard the health of those who eat it (Diversey, 1996).
Food may be properly prepared and be of good quality, but if poor sanitation facilities are used, food safety will be compromised. Harmsen, (1953) reported that consuming raw vegetables which are prepared in dirty environments causes numerous outbreaks. Work surfaces should be cleaned regularly to avoid any dust and dirt accumulating in those surfaces.

Good sanitation practices in food preparation and service establishments must be given a high priority throughout the whole cooking process, particularly the removal and disposal of waste. All waste must be disposed off by the use of approved disposal agents (FDA, 1995). Drainage systems should be regularly cleaned using special cleaning chemicals. This should be done at least once a week or daily, depending on the volume of production (FDA, 1995).

Adequate facilities should be provided for washing food ingredients. There should be provisions of adequate sinks for washing and facilities for drying. Hot and cold water systems should be provided to ensure proper cleaning.

2.8.4 Food hygiene regulations

Food hygiene regulations apply to everyone engaged in food trade. Graham, (1972) suggests that in order to make food safe, food hygiene regulations must be followed at all times. These rules must be followed seriously according to the guidelines of the Codex Alimentarius Commission (Alimorm, 1995). These regulations and guidelines suggest that the premises in which food is handled must be clean and in good condition. There must be no risks of contamination by dirt, germs, insects, rodents and odours in any way. The walls, ceiling, floors, doors and equipment must be properly constructed and maintained. All parts of the premises must be sufficiently lit and ventilated. Sufficient sinks must be provided to enable food and equipment to be washed. Water supply to the
premises should be clean and wholesome. Sanitary facilities must be adequate to staff and refuse should be properly handled. Staff should wear clean and suitable uniform to avoid risk of contamination. Finally, domestic animals should not be allowed in food premises (Christine and Christine, 1972).

2.8.5 Role of government in food safety

The government through the Ministry of Public Health has a crucial role to play in food safety. This is by providing food safety education to food handlers in co-operation with the government sectors and other stakeholders like municipalities and non-governmental consumer groups (FAO/WHO, 2000).

No system for safe handling practices can succeed without constant monitoring. In this regard therefore, governments must ensure that up-to-date legislation relevant to prevailing national food and water safety problems is in place and those parties concerned are properly informed (FAO/WHO, 2000).

Surveillance refers to the systematic collection and use of epidemiological information for the planning, implementation and assessment of diseases control. Pasmore and Eastwood, (1986) reported that government authorities (public health officers) have the power to inspect all premises, monitor the handling of foods in preparation areas and obtain food samples for analysis. They should investigate all complaints made by individual members of the public. However, as suggested by Harrigan (1999), official inspection of premises and samples cannot guarantee that all production of food is of a given quality but government officers should only act as audit system of management for safety and quality of food.
Section 40 of the food safety act (1990) gives guidance to authorities on enforcement of food safety regulations. The role of public health officers in maintaining a food safety condition is questionable since very little is done to ensure corrective measures.

2.8.6 Summary of literature review

The hospitality industry and restaurants in particular, play an important role in the Kenyan economy through foreign earnings and empowering the society. They also provide employment in the formal and informal sectors. Despite their importance, restaurants may pose a public health hazard by contributing to the spread of food-borne diseases. In Kenya however, little surveillance of food borne diseases has not been adequately done to assess the current status. Contamination can be through foods prone to bacteria infection and water. The need to carry out investigations to establish the level of contamination in restaurants is wanting.

To establish the indicators of bacterial contamination, understanding of biological hazards in food and water are of paramount importance. Together with this, their characteristics and environmental requirement need to be identified. In order to control food poisoning, an effective system of management is required such as the HACCP system. This system requires an in-depth understanding of the general principles of food safety and quality by all stakeholders such as food handlers, customers and public health officials. The general principles include: hygiene practices and sanitation throughout the food chain, knowledge of food borne diseases and maintenance of food standards through public health officials. This may however not be possible without government support and availability of well-trained food handlers. The study therefore sought to fill these gaps by assessing the food safety status in chain and unclassified fast food restaurants in Nairobi city centre.
CHAPTER THREE

METHODOLOGY

3.0 Introduction.

In this chapter, methodological procedures and materials that were used were discussed. They included: study design, study area, sampling procedures, sample collection and analysis, isolation and characterization of bacteria, research instruments, data collection procedures and data analysis.

3.1 Research design

The research design that was adopted was a cross sectional survey. The survey deals with the phenomena, as it exists within a particular period of time. A survey attempts to collect data from members of the population in order to determine the current status of the population in respect to one or more variables (Mugenda and Mugenda, 1999).

This study sought to investigate the food safety status in chain and unclassified fast food restaurants in Nairobi City centre. The first part of the survey collected qualitative data using questionnaires, interviews schedules, observation checklists and secondary data. The second part of the survey collected quantitative data by carrying out laboratory analysis of bacteria in food and water samples.

3.2 Study area

The study area was Nairobi City centre. The area enclosed by Uhuru highway, Haille-Sellasie Avenue, Tom Mboya Street and University Way. Many restaurants are located here and the area provided a suitable setting for selling food. The area is mainly the central business and houses many offices, hence a potential for business.
3.3 Sample size and sampling procedures

Accessible population consisted of chain and unclassified fast food restaurants within the city centre. According to the Ministry of Tourism Publication Catalogue of the licensed Restaurants (1997), a total of 150 unclassified restaurants are present in the study area. Fifteen restaurants (10%) were studied. The restaurants were stratified into three clusters based on location and five restaurants were randomly selected from each location to arrive at a representative sample size of fifteen unclassified restaurants.

Six chain restaurants are present in the study area and three of them (50 %) were included in the study. The number of respondents in the identified restaurants are as shown in table 3.1.

Table 3.1: Respondent for the study

<table>
<thead>
<tr>
<th>Respondents</th>
<th>No</th>
<th>Restaurants</th>
<th>Total respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Chefs</td>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Waiters</td>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Public health officers</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>56</strong></td>
</tr>
</tbody>
</table>

3.4. Collection of water and salad samples

Water and salads were collected from the studied restaurants in order to determine their bacteriological level (APHA, 1989). Water samples were collected from taps in the kitchens of the studied restaurants. 500ml sterilized glass bottles were used to collect samples. Before the water samples were collected, water was allowed to run to waste for at least 1 minute to clear the water within the system. Water was then collected and the stopper replaced immediately in glass bottles. After collection, the samples were labeled.
All samples were then packed in ice-cooled boxes and taken to the laboratory for analysis within a period of two hours. Because all samples were chlorinated, sodium thiosulphate was introduced to the sampling bottles so as to neutralize any traces of chlorine, which may otherwise kill the bacteria before reaching the laboratory for analysis (APHA, 1989).

Salad samples were collected from restaurants for bacteriological examination. They were collected at noontime when all the restaurants were expecting a high turnover of guests. Sterilized polythene bags were used to collect coleslaw and Kachumbari salads. They were collected from points where they were ready to be served. By the use of tong, the salads were placed into the sterilized containers sealed and labeled. They were then packed in food coolers in which ice cubes were added to maintain a cool temperature of below 5°C in order to control the growth of micro-organisms. A temperature probe was inserted into the containers containing samples. Samples were kept at 2°C until they arrived at the laboratory for analysis. There was continuous monitoring during transportation to ensure that there was no temperature variation. Immediately on arrival at laboratory they were recorded by the microbiologist and later kept in a refrigerator before being analyzed.

3.4.1 Materials used.

In order to determine the bacteriological contamination of water, a number of materials used included: sterile containers which held 200ml of water, McCartney bottles (1x 25), McCartney bottles (1x15ml), glass bottles (9 sloping bottles), Durham tubes, measuring cylinders, pipettes and syringes, MacConkey broth, incubators, Kovac’s reagent, 1P3 broth and sodium thiosulphate. These materials were available at the Kenya National Laboratory services situated at Kenyatta National Hospital.
3.4.2 Sterilization of materials and equipment

All equipment used in the study for example McCartney bottles, glass bottles, Durham bottles, pipettes; syringes among others were thoroughly washed with hot water containing detergent and rinsed with distilled water. They were then air-dried in a hot air oven at 100°C and was later sterilized at 160°C for 2 hours.

3.4.3 Media preparation

Single strength MacConkey
A 40g of broth powder was added into 1 litre of distilled water in a flask and mixed well. This was then dispensed to 5ml into each of the MaCatney bottles. This was autoclaved at 15 PSI for 15 minutes.

Double strength MacConkey broth
80g of broth powder was weighed and dissolved to 1 litre of distilled water. This was dispensed into bottles with 10ml of universal bottles (Durham bottles) and Autoclaved at 15 PSI for 15 minutes.

3.5 Laboratory analysis of water

Members of the coliforms group were recognized as important indicators of feacal pollution of water since the onset of bacteriological evolution (WHO, 1984). The presence of coliforms does not indicate the enteric pathogens but the disease causing potential is recognized. The following method was used to analyze water.

3.5.1 Presumptive coliform test

Presumptive Coliform test was done using the most probable number (multiple tube technique). A 50ml ml of double strength MacConkey broth was put into universal bottle and 50 ml of distilled water added. In addition 10 ml of the same broth was distributed into five universal bottles. 5 ml single strength MacConkey was distributed into a set of
five fermentation tubes. All the universal bottles and tubes were provided with inverted Durham tubes. The broth was sterilized in autoclave at 121°C for 15 minutes and allowed to cool.

Water samples were rapidly mixed before inoculation. Using single sterile pipettes, 50ml and 10ml of water samples were transferred into the fermentation bottles containing 50ml and 10ml respectively. 1ml was transferred into each of the five fermentation tubes containing 5ml of single strength broth. The bottles and tubes were incubated at 37°C for 48 hours and observed for sugar fermentation as indicated by colour change from purple to yellow and gas production which indicate the presence of Coliform. The number of positive tubes was noted and used to obtain the presumptive coliform count in 100ml of water from Macgrandy probability tables (APHA, 1989).

3.5.2 Presumptive E. coli test (most probable number)

The entire positive results of presumptive coliform tests were subjected to presumptive E. coli test (Eijkman tests). This was done by inoculating a loop-full of the positive tubes into fresh MacConkey broth (single strength) and peptone water, which was labeled respectively. This was inoculated at 44°C in a water bath for 48 hours. Observation was made for sugar fermentation and gas production in the MacConkey broth tubes before korvac’s reagent was added to the peptone water (indole test). The number and distribution of positive tubes (those showing fermentation and indole positive) were noted and used to obtain the presumptive E. coli count from the MacCrandy probability table.

Depending on the number of presence or absence of E. coli, the samples were classified using criterion in table 3.2. The presence of E. coli immediately placed the sample in class 4.
<table>
<thead>
<tr>
<th>Description</th>
<th>Presumptive ( Escherichia) coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Highly satisfactory</td>
</tr>
<tr>
<td>Class 2</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Class 3</td>
<td>Suspicious</td>
</tr>
<tr>
<td>Class 4</td>
<td>Unsatisfactory</td>
</tr>
</tbody>
</table>

### 3.5.3 Aerobic plate counts

Aerobic plate count technique was used to test for viable organisms in salad samples (kachumbari and coleslaw). A serial dilution of 1:10 dispersion was prepared by pipetting 1ml of the dispersion into bottles containing 9ml of diluents (buffered peptone water) to make a 1:100 ratio. This was repeated until a dilution of 1 part of the sample in 1,000,000 volumes of diluents was obtained. The mixtures were thoroughly mixed at each dilution. From each solution of the sample starting at 1:100 dilutions, two 1ml volumes were taken and transferred to a plate (Petri dish). For each petri dish, one 15 ml volume of the plate count agar was melted and tempered for 45°C. This was added to the plate and mixed well to ensure an even distribution of colonies after incubation. The agar was allowed to set and incubated at 30°C for 72 hours.

After 72 hours total aerobic count of viable organisms were examined for characteristic colonies. The colonies were then counted using a colony counter for those plates that contained between 30-300 colonies. The total count of viable organisms was calculated by averaging the counts on each plate of a given dilution and multiplying these counts by factors involved for example 1:100x 100.
3.5.4 Presumptive *coli*form test in salads.

A 1:10 dilution was introduced into three bottles containing MacConkey single broth. This was repeated for the 1:100 dilutions and 1:1000 dilutions. The Durham tubes inside the bottles containing MacConkey broth were filled before being inoculated at 37°C for 48 hours.

The inoculated MacConkey broth was examined for fermentation and gas production. Those which showed fermentation and gas production in the Durham tubes were filled with hoop-full (0.02 ml) of fresh P3 broth and MacConkey. This was then incubated at 44°C water bath for 48 hours. At this stage the results were tabulated for those that were positive. The results were recorded using most probable number (MPN) chart.

3.6 Pre testing

To enhance validity and reliability of the study the research instruments were pre-tested. The pre testing was done in one chain restaurant and one unclassified restaurant, among those that were not being studied but were within the study area. Observation checklists and questionnaires were pre-tested on the selected sample. After pre-testing the necessary revisions were done.

3.7 Data collection instruments

3.7.1 Interview schedules

Data were collected by interview schedules. The interview schedules were administered to hotel managers and public health officers. They aimed at soliciting information on demographic data, handling practices, sanitation, microbial contamination, and
application of HACCP. They were distributed to the officers who were given time to go through the questionnaires. All interviews were conducted in a convenient place.

### 3.7.2 Questionnaires

Both open ended and closed ended questions were formulated to enable every respondent to efficiently give his/her views. They were formulated to cover the study objectives and were administered to the kitchen staff, and service personnel.

### 3.7.3 Observation method

Observation method was used in this study to compliment other research instruments. The researcher observed the phenomena for a period of four hours per day in one restaurant and information recorded with the help of an observation checklist. Observations were done on the handling practices, kitchen hygiene and personal hygiene. Food production staffs were monitored on how they handled food right from receiving until food was served to the customer in accordance with Public Health Act (1990).

### 3.7.4 Secondary data

Secondary sources of data were used to compliment primary data. Reports available at the Ministry of Health were used to establish incidences of recent food-borne illnesses. Inspection reports were evaluated to determine what inspectors do during their inspection operations and whether their recommendations were implemented.

### 3.8 Data Analysis

Qualitative data were collected from questionnaires, interviews, observations and secondary data. The researcher identified relationships among these categories. This was then coded to generate variables from the items. The coded data were then entered into excel and later exported to Statistical Programme for Social Sciences (SPSS) for in-depth
analysis of variables. The variables that were analysed were food safety practices in chain and unclassified restaurants, the level of application of HACCP principles and factors that influence the application of these principles. Those statistical inferences that were not concerned with one or more parameters were logically termed as non-parametric and the non-parametric tests such as the chi-square and odds ratio were used to establish significance.

Quantitative data were collected from the laboratory testing of pre-cut salad and water samples. This was subjected to measures of central tendency such as the mean and standard deviation. Chi-square tests were used to establish whether there were significant relationships between variables. An independent t-test was used to determine whether the difference between the mean of the salad samples and the golden mean standard differed significantly in terms of contamination.

A p-value of less than 0.05 was considered significant. Additionally, 95% confidence interval was computed to determine the lower and upper bounds, which led to the rejection if the calculated statistics did not lie within the 95% confidence interval.
CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction
The purpose of this study was to investigate the food safety status in chain and unclassified fast food restaurants in Nairobi City centre. The objectives of this study were: to determine the bacteriological contamination of pre-cut salads and water, assessment of food safety practices in chain and unclassified fast food restaurants, establish the degree of application of HACCP principles and to determine the factors that hinder the application of these principles. Chi - Square tests were used to establish the association among the ordinal variables and non-parametric tests applied. The variables examined were food safety practices, application of HACCP and problems that influenced the application of HACCP principles. An independent T-test was performed to establish the level of bacterial contamination in chain and unclassified restaurants.

The results were reported under the following sub-headings: demographic characteristics, bacterial contamination of pre-cut salad and water, application of HACCP and problems hindering the application of HACCP.

4.1 SOCIO DEMOGRAPHIC CHARACTERISTICS

4.1.1 Gender distribution
As shown in table 4.1, out of the 18 managers sampled, 68% were male and 32% were female. Sixteen percent (17%) were from classified restaurants while 83% were from unclassified restaurants. Seventeen percent (17%) of the food production personnel were from chain restaurants and 83% from unclassified restaurants. On food service personnel, 11% were from classified and 89% were from unclassified restaurants.
Table 4.1: Gender distribution of respondents from classified and unclassified restaurants

<table>
<thead>
<tr>
<th>N=52</th>
<th>Classified</th>
<th></th>
<th>Unclassified</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranking</td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>Male</td>
</tr>
<tr>
<td>Managers</td>
<td>2(11.1%)</td>
<td>1(5.6%)</td>
<td>3(16.7%)</td>
<td>10(55.6%)</td>
</tr>
<tr>
<td>Food</td>
<td>2(11.1%)</td>
<td>1(5.6%)</td>
<td>3(16.7%)</td>
<td>9(50.0%)</td>
</tr>
<tr>
<td>production</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>2(11.1%)</td>
<td>-</td>
<td>2(11.1%)</td>
<td>12(66.7%)</td>
</tr>
<tr>
<td>service</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.1.2 Marital status of the respondents

Table 4.2 shows the marital status of respondents. The results showed that a majority of managers (83.3%) were married and 16.7% were unmarried. On food production personnel, there was a wide disparity in marital status. Out of the 18 service personnel analyzed, 51% were married and 44.4% were unmarried. Of the food service personnel, 77.7% were married and only 22.2% were unmarried. This implied that a majority of the workforce in restaurants were married people.
### Table 4.2: Marital status of the respondents.

<table>
<thead>
<tr>
<th>N=52</th>
<th>Classified Marital status</th>
<th>Unclassified Marital status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Married</td>
<td>Unmarried</td>
</tr>
<tr>
<td>Manager</td>
<td>3(16.7%)</td>
<td>-</td>
</tr>
<tr>
<td>Food Production</td>
<td>2(11.1%)</td>
<td>1(5.6%)</td>
</tr>
<tr>
<td>Food service</td>
<td>2(11.1%)</td>
<td>-</td>
</tr>
</tbody>
</table>

### 4.1.3 Age category

The distribution indicated that there was no manager, food production, or food service personnel who were below the age 18 years. About 66.7% of the managers were between the ages of 26-35 years, 27% were between ages above 35 years and only 5.6% of the managers were between 19-25 yrs. On food production personnel surveyed, 38.8% were between ages of 26-35 years and also 33% between 19-25 years and those above 35 years being 27.8%. Out of the 18 food service personnel sampled, 44.4% were between the ages of 26-35 years followed by 38.9% of ages between 19-25 yrs and only 17% being above 35 years (table 4.3).
Table 4.3: Age distribution of the study population

<table>
<thead>
<tr>
<th>N = 52 Ranking</th>
<th>Below 18yrs</th>
<th>19-25yrs</th>
<th>26-35yrs</th>
<th>Above 35 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>-</td>
<td>1(5.6%)</td>
<td>12(66.7%)</td>
<td>5(27.8%)</td>
</tr>
<tr>
<td>F/production</td>
<td>-</td>
<td>6(33.3%)</td>
<td>7(38.8%)</td>
<td>5(27.8%)</td>
</tr>
<tr>
<td>F/ service</td>
<td>-</td>
<td>7(38.9%)</td>
<td>8(44.4%)</td>
<td>3(16.7%)</td>
</tr>
</tbody>
</table>

4.1.4 Level of professional training

As can be seen from table 4.4, survey showed that there was a wide distribution of professionalism in the fast food workforce ranging from those without training; refresher, certificate, diploma and degree levels. A majority of the managers assessed, 33% were trained on refresher courses, 27% trained up to degree levels and 22% attained certificate levels.

Taylor, (1996) suggests that managers and food handlers need to have high levels of professional training as this is an effective way of preventing food-borne illnesses. From this observation, managers may not effectively understand the principles and the control systems used in food safety and quality.

On food production personnel analyzed, 55.6% had attained refresher courses, 38.8% had no training and a small number 5.6% attained Diploma level. On food service personnel, the distribution indicated that 28.8% had trained refresher courses and certificate courses respectively. No personnel had attained a degree or higher National Diploma. Given that personnel were not highly trained, there was a possibility of this workforce not to comprehensively understand the principles of food safety and hygiene (table 4.4)
Table 4.4: level of professional training

<table>
<thead>
<tr>
<th>N=52</th>
<th>Level of training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranking</td>
<td>No Training</td>
</tr>
<tr>
<td>Manager</td>
<td>1(5.6%)</td>
</tr>
<tr>
<td>Food production</td>
<td>7(38.9%)</td>
</tr>
<tr>
<td>Food service</td>
<td>-</td>
</tr>
</tbody>
</table>

4.1.5: Professional training by gender

A cross tabulation was performed between professional training and gender (table 4.5). The results showed that a higher percentage of managers (77.8%) were male while 33.3% were female. However a majority of trained male 22.2% had attained refresher courses and 11.1% have attained certificate courses. Similarly, 11.1% of female had attained refresher courses and certificate courses respectively. Given that this is the position implies that a majority of managers were male.
Table 4.5 A cross tabulation of professional training and gender.

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Male</th>
<th>Gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>No training</td>
<td>-</td>
<td>1(5.6%)</td>
<td>1(5.6%)</td>
</tr>
<tr>
<td>Refresher</td>
<td>2(11.1%)</td>
<td>4(22.2%)</td>
<td>6(33.3%)</td>
</tr>
<tr>
<td>Certificate</td>
<td>2(11.1%)</td>
<td>2(11.1%)</td>
<td>4(22.2%)</td>
</tr>
<tr>
<td>Diploma</td>
<td>-</td>
<td>2(11.1%)</td>
<td>2(11.1%)</td>
</tr>
<tr>
<td>HND</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Degree</td>
<td>2(11.1%)</td>
<td>3(16.7%)</td>
<td>5(27.8%)</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>6(33.3%)</td>
<td>14(77.8%)</td>
<td>18(100%)</td>
</tr>
</tbody>
</table>

4.1.6 Working experience.

The result (figure 4.1) indicated that 66.7% of managers had worked in their present employment for a period of less than 4 years and 22% had worked between 5-9 years and only 11.1 % had worked more than 10 years. On food production personnel 20% of the staff had worked for less than 4 years and the same 20% had worked between 5- 9 years. On the food service personnel, 50% had worked for less than 4 years. This indicated that the number continued to decrease as the number of years increased. No staff was therefore maintained for long and staff kept moving from one restaurant to another. This had serious implications in achieving set objectives and targets especially those related to safety and quality.
A chi-square test was performed to find out whether there existed statistical association between professional training and gender. The result showed that ($X^2 = 0.03$ and P value $= 1.00$), there was no significant relationship between professional training and gender.
### Table 4.6: Gender against level of professional training

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>$X^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diplomas and below</td>
<td>4 (22.2%)</td>
<td>9 (50.0%)</td>
<td>13 (72.1%)</td>
<td>0.03</td>
<td>1.00</td>
</tr>
<tr>
<td>HND and above</td>
<td>2 (11.1%)</td>
<td>3 (16.7%)</td>
<td>5 (27.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6 (33.3%)</td>
<td>12 (50.7%)</td>
<td>18 (100%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 4.1.7 Professional training and age

The responses showed that 27.8% of the food production personnel who had trained were between the ages of 26-35 years. A further, 22.2% of the trained personnel were between the ages 19-25 years and 5.6% of those trained were over 35 years. This distribution implied that many of the staffs were not properly trained at ages between 19-25 years.

A Chi-square test was performed to establish any statistical association between professional training and age. The result showed ($X^2 = 0.78$ and P-value = 0.68). It was then inferred that there was no significant association between age and professional training.
Table 4.7 professional training and age

<table>
<thead>
<tr>
<th>Age</th>
<th>Professional training</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>Total</td>
<td>X²</td>
<td>P- value</td>
</tr>
<tr>
<td>19 – 25 yrs</td>
<td>3(16.7%)</td>
<td>4(22.2%)</td>
<td>7(38.9%)</td>
<td>0.76</td>
<td>0.68</td>
</tr>
<tr>
<td>26 - 35 yrs</td>
<td>3(16.7%)</td>
<td>5(27.8%)</td>
<td>8(44.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 35 yrs</td>
<td>2(11.1%)</td>
<td>1(5.6%)</td>
<td>3(16.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8(44.4%)</td>
<td>10(55.6%)</td>
<td>18(100%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.1.8 Association between professional training and marital status The results obtained showed that 38.9% of the married couples were trained while 27.8% of the married couples were untrained. The result also shows that an equal percentage of 16.7% were trained and the same percentage untrained (table 4.8).

A chi-square test was carried out performed to establish if there was any statistical significant association between marital status and professional training with ($X^2 = 0.03$ and a p-value of 1.00) This showed that there was no significant association between marital status and professional training.
Table 4.8: Professional training and marital status (food production personnel)

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Professional training</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO (X)</td>
<td>YES</td>
<td>Total</td>
<td>X²</td>
<td>P-value</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>5(27.8%)</td>
<td>7(38.9%)</td>
<td>12(66.7%)</td>
<td>0.03</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Not married</td>
<td>3(16.7%)</td>
<td>3(16.7%)</td>
<td>6(33.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>8(44.4%)</td>
<td>10(55.6%)</td>
<td>18(100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.1.9 Time worked against gender (food production personnel)

The results showed that a majority of female 33.3% worked in the studied restaurants for a period of less than 4 years while 27.8% worked in the hotels for 10-14 years and 16.7% for 5-9 years. For male, 16.7% had worked for less than 4 years and only 5.6% worked over 15 years.

At the same time, results obtained from food service personnel indicated that 50% had worked less than four years. However, 27% worked between 10-14 years and a smaller percentage, 16.7% worked between 5-9 years. Only 5.6% worked over 15 years. This variance between managers and food service personnel may be due to the challenging nature of the managerial responsibilities that make the staff to move looking for greener pastures.

4.1.10 Age of restaurants

Out of the 18 restaurants analyzed, 33.9% were established between 1991- 2000 and 27% beyond 2000. A smaller percentage 22.2% was established between 1981 and 1990. This indicated that there was an ever increasing number of restaurants in each decade and was expected to increase almost double in the year 2000-2010 thus a serious challenge on the
part of food and beverage providers in terms of hygiene and safety. WHO, (1994) reported that as the population increases the dynamics lead to unsanitary conditions enabling an increase in pathogen transmission. There was need for governments to plan in advance to meet these challenges.

4.2 BACTERIOLOGICAL ANALYSIS

4.2.1 Bacteriological water analysis

A total of 18 water samples were collected from the kitchen taps and examined for the presence of presumptive coliforms as an indicator of contamination. Enrichment method was used to isolate and identify enteric pathogens.

The result showed that only 5.6% of the samples were having high coliform count with a most probable number (MPN) of 180/100ml and this was determined by the production of gas. Other micro-organisms were not isolated. The absence of coliforms in the 94.4% of samples was encouraging and indicated that water in Nairobi was safe. Although only one
sample indicated a high level of *coliform* count, *E. coli* presence was zero. This met the WHO (1985) requirement of not containing any presumptive *coliforms* in 100ml. This concurs with the Kenya bureau of standards (KBS, 1995) which requires that treated water entering the distribution system should have 0 /100ml of *coliforms* in any two consecutive samples. Reports from the Ministry of Health indicated that stringent measures were adopted by the government to ensure that water was treated before being distributed to consumers.
Table 4.9: Bacteriological water analysis

<table>
<thead>
<tr>
<th>Lab sample no</th>
<th>Ch/not Ch</th>
<th>C.C</th>
<th>E. COLI</th>
<th>P/absence</th>
<th>Satisfactory/ Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1020</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1021</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1022</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1023</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1026</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1027</td>
<td>C</td>
<td>180</td>
<td>0</td>
<td>+VE</td>
<td>Unsatis.</td>
</tr>
<tr>
<td>1028</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1029</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1031</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1032</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1033</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1034</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1047</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1048</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1049</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1050</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1058</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>1059</td>
<td>C</td>
<td>0</td>
<td>0</td>
<td>-VE</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>

KEY

E. coli - *Escherichia Coli*  
C. C - *Coli form count*

Ch - chlorinated water  
Sat. - Satisfactory  
Unsat. - Unsatisfactory

4.2.2 Microbiological quality of pre-cut salads (*kachumbari* and coleslaw)

Of the vegetable samples analyzed, (table 4.10) 27.7% were contaminated with *E. coli*.

The mean range was $2.1 \times 10^4$ and standard deviation of $9.0 \times 10^4$ with a range of $3.7 \times 10^4$.

The golden standard was $10^4$. This result indicated that although *E. coli* was identified in
the 27.7% cases, the count was not significant to cause an infection. The variance from the standard mean might have been attributed to cleaning procedures undertaken in each restaurant. There was however a need to set a microbiological specification of coleslaw sufficiently high enough to allow observed variability.

Table 4.10: Microbiological quality of pre-cut salads (kachumbari and coleslaw)

<table>
<thead>
<tr>
<th>Source</th>
<th>R.p.c/g</th>
<th>M.p.n</th>
<th>E.coli</th>
<th>G.Std</th>
<th>+ve/-ve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleslaw</td>
<td>1.25x10^3</td>
<td>23/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>+Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>3.0x10^2</td>
<td>240/gm</td>
<td>24/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>5.6x10^1</td>
<td>240/gm</td>
<td>150/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>2.8x10^3</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>3.2x10^3</td>
<td>18/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>2.8x10^2</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>4.2x10^1</td>
<td>43/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>3.3x10^2</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Coleslaw</td>
<td>3.0x10^2</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>3.8x10^4</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>3.0x10^4</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>3.0x10^4</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>3.8x10^4</td>
<td>2400/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>+Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>6.0x10^4</td>
<td>40/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>+Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>2.1x10^3</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>3.4x10^4</td>
<td>41/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>+Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>3.1x10^4</td>
<td>500/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>+Ve</td>
</tr>
<tr>
<td>Kachumbari</td>
<td>3.0x10^4</td>
<td>0/gm</td>
<td>0/gm</td>
<td>10^4</td>
<td>-Ve</td>
</tr>
</tbody>
</table>

Key

APC - Aerobic plate count

MPN - Most probable number

E. coli - Escherichia Coli

G. STD - golden standard

Mean = 2.1x10^4

STD = 8.9x10^4

Range = 3.7x10^4
A cross tabulation was performed to establish the relationship between classified and unclassified restaurants in terms of contamination. The result showed that many of the food samples obtained from classified restaurants had bacterial content between the ranges of $7.1 - 8.0 \times 10^4$ and $7.1 - 8.0 \times 10^4$.

Although this was seen, there was no much deviation from the golden standard of $10^4$ and the difference was not significant. This therefore meant that the salads prepared in chain and unclassified restaurants were not contaminated to a level that can cause a serious infection.

<table>
<thead>
<tr>
<th>Difference</th>
<th>Results</th>
<th>Total</th>
<th>$X^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Classified</td>
<td>Unclassified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\geq 7.0 \times 10^4$</td>
<td>3(16.7%)</td>
<td>1(5.6%)</td>
<td>4(22.2%)</td>
<td>0.04</td>
</tr>
<tr>
<td>7.1-8.0 $\times 10^4$</td>
<td>12(33.3%)</td>
<td>1(5.6%)</td>
<td>13(72.2%)</td>
<td></td>
</tr>
<tr>
<td>$\geq 10.0 \times 10^4$</td>
<td>-</td>
<td>1(5.6%)</td>
<td>1(5.6%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15(83.3%)</td>
<td>3(16.7%)</td>
<td>18(100%)</td>
<td></td>
</tr>
</tbody>
</table>

A chi-square test was performed to establish whether there existed any statistical association between the restaurant categories and the difference in mean contamination. The result showed ($x^2 = 0.04$ and a p-value = 0.53). This implied that there was no significant difference between classified and unclassified restaurants in terms of contamination.

An independent T-test was also performed to determine whether the mean contamination between the two classes of restaurants differed significantly at 95% confidence level with the golden standard of $10^4$ ($-2.3 \times 10^4 \leq \bar{u}_1 - \bar{u}_2 \leq -2.2 \times 10^4$) where

$\bar{u}_1$ = mean of the classified restaurants

$\bar{u}_2$ = mean of the unclassified restaurants
The result showed that the two means did not differ significantly. This implied that there was no significant difference in contamination between chain and unclassified restaurants.

### Table 4.12: independent t-test of mean contamination between chain and unclassified

<table>
<thead>
<tr>
<th>T</th>
<th>Df</th>
<th>Sig. (2-tailed)</th>
<th>Mean diff.</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper</td>
</tr>
<tr>
<td>-2.585</td>
<td>16</td>
<td>0.20</td>
<td>-12672623</td>
<td>-23064260</td>
</tr>
<tr>
<td>-1.001</td>
<td>2.000</td>
<td>.422</td>
<td>-12672623</td>
<td>41784485</td>
</tr>
</tbody>
</table>

### 4.2.3 Level of contamination and level of training

Out of the 18 restaurants surveyed, 87% of the samples were negative. However, their personnel were not trained. Of the staffs that had trained, 60% of the samples were negative and 40% were positive. This implied that the training of staff was not associated with contamination (table 4.13).

Despite the above scenario a chi-square was performed to establish the relationship between the level of training and contamination. The result showed (chi-square = 0.59 and p-value 0.31) that there was no relationship between level of training and contamination.
### Table 4.13: showing Professional training against Contamination

<table>
<thead>
<tr>
<th></th>
<th>Contamination</th>
<th>Total</th>
<th>X²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not trained</td>
<td>7</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>87.5%</td>
<td>12.5%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Trained</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>60.0%</td>
<td>40.0%</td>
<td>100%</td>
<td>0.31</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>5</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>72.2%</td>
<td>27.8%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

#### 4.2.4 Source of food and contamination

A cross tabulation was performed to compare the relationship between purchasing and level of contamination (table 4.14). The results showed that 50% of those food ingredients purchased from *Wakulima* market were negative while 11.1% were positive. Those ingredients purchased from recommended food supplies had 22.2% negative and 16.7% positive.

This implied that food purchased from recommended food suppliers had a slightly lower level of contamination (38.9%) compared to those purchased from *Wakulima* Market (61.1%). Despite this fact, there was no significant association between purchase of ingredients from *Wakulima* and those from approved suppliers in the level of contamination (chi – square= 0.36 and P-value =0.32)
Table 4.14: Source of food and Contamination

<table>
<thead>
<tr>
<th>Purchase of food</th>
<th>Contamination</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Positive</td>
</tr>
<tr>
<td>Wakulima market</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>50.0%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Food suppliers</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>22.2%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>72.2%</td>
<td>27.8%</td>
</tr>
</tbody>
</table>

4.2.5 A cross tabulation between type of the restaurant and Contamination

Table 4.15 shows the type of restaurant category and contamination. Out of the 18 restaurants studied, 66.7% of the samples analysed (unclassified restaurants) were not contaminated and 16.7% of the samples were contaminated. On classified restaurants, 11.1% of the samples were not contaminated and 5.6% of the samples were contaminated. This meant that 72.2% of the samples were not contaminated while only 27.8% of the samples were contaminated.

An odds ratio test was performed to establish how many times contamination differed in unclassified and classified restaurants. The result showed that there were 2.4 times cases in unclassified than in the classified cases. Odd ratio = 2.4 and a 95% confidence interval of (0.18<OR<68.46).

A chi-square test was performed to establish whether there was a significant association between the class of the restaurant category and the level of contamination. The results showed that there was no statistical difference between the type of restaurant and the level of contamination (chi-square= 0.89 and P-value= 0.17). This implied that regardless of
the type of restaurant, the level of contamination is similar despite the fact that some
chain restaurants were associated with famous brand names.

<table>
<thead>
<tr>
<th>Type of the restaurant</th>
<th>Contaminated</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Positive</td>
</tr>
<tr>
<td>Unclassified</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>66.7%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Classified</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5.6%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>72.2%</td>
<td>27.8%</td>
</tr>
</tbody>
</table>

4.3 FOOD HYGIENE PRACTICES

Merle and Corlett, (1992) reported that in order to ensure safety and quality, foodstuffs
must be tested at every process step throughout the food chain and handling practices
established within that food chain. FAO/WHO, (2000) reported that the application of the
general principles of hygiene and HACCP are key elements in controlling food-borne
diseases and therefore should be applied in food preparation areas.

4.3.1 Food purchases

Wholesome meals that have been purchased from the market and contaminated are
difficult to prepare. Food purchases must be made from approved suppliers only and
examined for signs of spoilage before being used (F.D.A, 1995).

According to the results obtained from the study, 61.1% of the managers bought their
ingredients from Wakulima Market. Only 38.9% purchased from recommended food
suppliers. Because of the poor conditions at Wakulima market, there was a possibility of
ingredients being contaminated.
A cross tabulation was performed to compare the type of restaurant and source of purchases and the result showed that all the chain restaurants 100% purchased their food from suppliers. Only 36.6% of the unclassified restaurants purchased their foods from recommended suppliers. It can be recommended that if this trend is to be averted then considerations need to be done on purchasing policy.

4.3.2 Receiving and assortment
Receiving food is a control point and for certain foods it can be a critical control point especially for raw food. Rejecting unacceptable products serves as a control and if a food item is not up to standard, it should not be accepted during sorting. The rule should be to inspect food immediately upon delivery and store them immediately not to allow microorganisms to grow (FDA, 1995).

On the observation made, many restaurants (66.7%) did the assortment of ingredients before they stored them. Only 22.2% did not do the assortment. The result was commendable and encouraging. However lack of assortment may be attributed to low level of professional training on the part of the staff.

4.3.3 Time lapse before storage
Even when ingredients have been purchased, they need to be stored as quickly as possible without leaving them for a long time. This is because the longer the ingredients take to be stored the higher the chances of being contaminated (Prescott, 2000). The results obtained on receiving of the ingredients (table 4.18) showed 38.9% of the ingredients were received and stored within a period of 16-30 minutes and 27.8% delayed in storing their ingredients up to 1 hour. This practice is commendable and should be encouraged.
4.3.4 Storage temperatures of salads

Food supplies must be stored in good hygienic environment that inhibits the growth of bacteria. Failure to adequately control food temperatures in storage areas is one of the factors commonly implicated in food-borne illnesses. Food should not be stored in temperature between 11°C – 45°C. It is a dangerous and should be avoided (Prescott, 2000).

Out of 18 responses analyzed from managers, 64.7% stored food in temperatures between 2°C - 10°C. This was commendable; however, 23.5% stored food at a danger zone. This trend was dangerous and indeed measures should be taken to ensure that this scenario is averted. Out of the 18 food service personnel sampled, 68.8% had the knowledge of storage temperature particularly after preparation. This was commendable for this group of personnel. Of the service personnel 25% kept their salads at very low temperatures of between -20°C - 1°C. This was not commendable because it destroys the vegetables and makes them unfit for consumption.

A cross tabulation was performed to compare type of restaurant and storage. The result showed that 100% of the chain restaurants stored their salads either in fridge or in the cold room while 46% of the unclassified restaurants stored their salads in an airy condition. Storage of vegetable salads in an ambient or airy condition enables bacteria to

<table>
<thead>
<tr>
<th>Timing</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-30 minutes</td>
<td>7</td>
<td>38.9</td>
</tr>
<tr>
<td>31 min-1 hour</td>
<td>4</td>
<td>22.2</td>
</tr>
<tr>
<td>More than 1 hour</td>
<td>5</td>
<td>27.8</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>88.9</td>
</tr>
</tbody>
</table>

Table 4.16: Time lapse before storage.
grow and multiply fast. Therefore this trend needed to be changed if control of bacterial growth was to be avoided.

Table 4.17: Storage temperatures of salads

<table>
<thead>
<tr>
<th>Storage temperature</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20°C -1°C</td>
<td>2</td>
<td>11.8%</td>
</tr>
<tr>
<td>2°C - 10°C</td>
<td>11</td>
<td>64.7%</td>
</tr>
<tr>
<td>11°C -45°C</td>
<td>4</td>
<td>23.5%</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.3.5 Pricing of kachumbari and coleslaw.

On pricing of vegetable salad, that is kachumbari and coleslaw, the results showed that at a price of ksh. 10- 30 kachumbari sold well compared to coleslaw but when the prices were increased, the sale of kachumbari reduced. This may probably be attributed to the fact that it is usually limited in restaurants compared to coleslaw but coleslaw maintained the sales even when the price was increased. This was probably because of it’s wide use in the service of chips and as an accompaniment to many dishes (figure 4)
4.3.6 Kitchen cleaning

In kitchen cleaning out of the 18 managers sampled, 44% suggested that the restaurant should be cleaned twice a day and 22.2% recommended that restaurants should be cleaned as soon as they got dirty, with effective use of detergents and sanitizers. From the observation made, 72% did their cleaning on daily basis.

Tiffney, (1977) reported that in order to make food safe, food sanitation and kitchen cleaning must be done at all times or as necessary and with the right detergent and sanitizers. The kitchen must be cleaned as soon as it gets dirty. This includes all the surfaces in which food comes into contact with. However, as observed from the study, 44% of the restaurants were cleaned twice per day. This was commendable in accordance with the Codex Alimenterius Commission (Alimorm, 1995) which suggests that premises in which food is handled must be clean and in good condition. There must be no dirt, insects, rodents and odours in any way; there was need to consider cleaning immediately the restaurant became dirty. The result implied that many staff did not know when it was necessary to clean their areas of work.
4.3.7 Water for cleaning vegetables

Water is an important ingredient for cleaning vegetables and if contaminated in any form, can transfer bacteria to food. No matter where food facility is located, the water used should be portable. If this requirement is not met then that water should not be used in food production and service.

The results obtained from the study indicated that 94.6% of water for cleaning of vegetables was appropriate. Only 5.6% used inappropriate water.

A cross tabulation was performed to compare the type of restaurant against water used for cleaning vegetables. The result showed that all the chain restaurants used boiled water in the cleaning of their vegetable salads. A higher percentage of staff 78.6% used boiled water for making of ice cubes. This was hygienically commendable and this implied that the restaurants used clean and portable water (table 4.20).

<table>
<thead>
<tr>
<th>Type of restaurant</th>
<th>Type of cleaning Water</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Appropriate</td>
<td>Appropriate</td>
</tr>
<tr>
<td>Chain</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Unclassified</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>3</td>
</tr>
</tbody>
</table>

4.3.8 Kitchen uniform

All staff handling food must be in clean kitchen uniform. This is a vital measure against controlling food-borne illnesses (FDA, 1995). Out of the 18 managers analyzed, 61.1% provided their staff with two pairs of clean kitchen uniform. Also 22.2% provided their staff with four pairs of clean uniform while 11.1% provided their staff with one pair of clean uniform. When an observation was made, 88.9% of the staffs were in their correct kitchen and service uniform. This concurred with FDA, (1995) requirement that every
staff handling food must be in clean and suitable uniform to avoid transferring bacteria from dirty uniform to food, causing cross contamination.

### 4.3.9 Frequency of medical checkups

Any staff handling food must be medically fit and should not have any infection capable of causing disease. According to Public Health Act, staffs need to attend medical checkup at least twice per year.

The results from the study (managers) showed that 94% attended medical checkups twice per year while a small percentage (5.6%) attended three times a year. Even if this small percentage attended three times a year, this was acceptable according to public health regulations recommended by Diversy and Lever, (1996). On food production personnel 77.8% attended medical checkups twice per year. This concurred with Matthias (1995) that any person handling food should not be infected or suffer from any contagious diseases. According to Kenya’s Public Health Act (1990), food handlers should be medically examined after every three months to determine whether they are fit to handle food for public consumption.

### 4.3.10 Food safety and sanitation training

One of the mechanisms that needs to be put in place to prevent food-borne diseases is by training of staff involved in handling food (Davis et al, 1999). However, this training should be geared towards training staff on safety standards such as HACCP (WHO/ FAO, 1999).

Out of the 18 restaurants studied, the results showed that 83% of the training undertaken by staff was through in-house, 11.1% was done through workshops and 5.6% done through vocational training.
WHO/FAO, (1989) suggested that the most important step in controlling food safety was to use technical expertise with scientific background in various domains for proper identification of hazards. In-house training was more profound in the areas studied.

A cross tabulation was done to compare the type of restaurant and food safety training and the result revealed that 66.7% of the training was done externally and 93.3% of the unclassified restaurant training was conducted through internal provisions.

An effective method for the control of food-borne illnesses is through the provision of food safety and sanitation training to the food handlers. It is up to the management to train employees in a wide range of areas that include sanitation as a key element in overall training process (FDA, 1995; WHO, 2000; Mathias, 1995).

The results obtained from demographic trends showed that a majority of managers (33.3%) had undergone refresher courses and only 22.2% had attained certificate courses.

On food production personnel, 55% attained refresher courses, 38% had no training and only 6% attained diploma level.

On food service personnel, refresher course and certificate training shared 27.8% each with a majority of them 33% having other forms of training other than those directly related to hospitality. In reference to the magnitude of the food-bone illnesses this level was low and may not be able to combat many illnesses.

Following the result that many restaurants were established between 1991-2000 and this number was expected to double between 2000-2010, serious campaigns needed to be done among stakeholders to ensure that they trained their staff in food safety and assurance.
4.3.11 Refuse handling and leftovers

Suitable provision must be made for the removal of waste from food preparation areas. Adequate facilities should be provided for removal of waste and any undesired materials from food establishments. All wastes must be disposed by approved disposal agents (FDA, 1995).

According to the results obtained from the study, 88.9% of the refuse handling was done by refuse disposal agents. This was recommendable as it did not endanger the safety of the food. Leftovers should be properly handled to avoid bacterial contamination (Alimorm, 1995). To avoid survival of micro-organisms, salads, and in particular coleslaw and kachumbari, should be stored in temperatures of 5°C. If this condition cannot be met that food should be thrown away (Abidoye, 1990).

Results obtained from the survey showed that 77.8% of the food produced (salads) was throw away whereas 16.7% was either reconstituted or stored in refrigerators for later use.
FAO/WHO, (1986) reported that leftover food should be thrown away, especially foods prone to bacteriological contamination.

4.3.12 Consumer complaints

Consumer complaints are indicators that safety of food is threatened. Consumers need to be knowledgeable on food handling if they are to protect themselves (WHO/FAO, 1995a)

Out of the 18 restaurants sampled, 66.7% showed that consumers suffered illnesses related to food. Despite this result, the researcher found out that there was poor reporting in Kenya and the magnitude of this problem wasn’t be easily measured (Government of Kenya, 1994).

4.3.13 Food poisoning incidences

Epidemiology of food-borne incidences in Kenya was inadequate due to lack of surveillance and poor reporting systems (government of Kenya, 1994)

Out of the 18 cases sampled and analyzed from managers, 72.2% indicated that there was food poisoning and only 27.8% showed that there was no poisoning.

A cross tabulation of the food poisoning and justification of the contamination revealed that out of the 72.2%, 55% of the personnel were not informed and that only 17% were either informed or partially informed. Results from food service personnel indicated that 55.6% were not conversant and only 44% were conversant. This trend was likely to endanger the safety of food. This was possibly related to low levels of training.

Lack of information was one of the biggest problems that faced the third world countries. Although Public Health officers had the power to investigate all complaints made by members of the public, there was laxity on the part of the officers who were supposed to disseminate information to the public (WHO, 2000).
In the trend of food poisoning analyzed, 93.3% showed that no information or records were available while 5.6% showed that it was decreasing. This concurred with government of Kenya, (1994) which reported that reporting of food-borne diseases in Kenya was limited, making researchers unable to know if there was a problem or not. This was discouraging and required to be remedied.

<table>
<thead>
<tr>
<th></th>
<th>Freq.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No information or records</td>
<td>14</td>
<td>93.3%</td>
</tr>
<tr>
<td>Decreasing</td>
<td>1</td>
<td>5.6%</td>
</tr>
<tr>
<td>Increasing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100%</td>
</tr>
</tbody>
</table>

### 4.3.14 Food hygiene regulations

Hygiene regulations apply to anybody handling food. Anyone handling food must be conversant with food hygiene regulations an be able to apply them(Graham, 1977).

Out of the 18 food production personnel analyzed, 66% were conversant with food hygiene regulations and 33.3 % were not conversant. Out of the 66% who were conversant, 60% were able to apply these regulations in food production and service establishments.
4.3.15 Washing hands

Washing hands is one of the critical point that has caused a number of food-borne diseases. Everyone handling food must wash hands after visiting the toilet (FDA, 1995; Matthias, 1995). On washing hands, 55.6% of the respondents washed their hands before and after handling food while 33.3% either washed their hands before or alternatively after handling food. This was commendable and needed to be encouraged.

4.3.16 Equipment usage in salad preparation

Harmsen, (1953) reported that consuming raw salads that were prepared in dirty surfaces and environments caused numerous bacterial diseases. Out of the personnel analyzed, 70.6% were able to rightly use the equipment and 29.4% unable to use the right equipment. This was commendable as it agreed with FDA (1995) who reported that using the right equipment was the first step towards controlling food-borne illnesses.

4.3.17 Rodent & vermin availability

In food preparation areas, there must be no risk of contamination by dirt, insects or rodents and odours in any way (Christine and Christine, 1972). Presence of rodents indicates potential risk of contamination. Out of the 18 restaurants sampled, 55.6% showed presence of rodents and vermin in their food production establishments. The common types of rodents found were rats 61%. This condition may have been attributed to inefficient cleaning programmes.

4.3.18 Ventilation

Ventilation is the removal of smoke, steam, and heat from food preparation areas. Ventilation reduces the accumulation of dirt in food preparation areas thus eliminating
air-borne contaminants and reduces growth of moulds. Out of the 18 cases analyzed on ventilation, 50% had good ventilation and the same percentage 50% had poor ventilation. Though this was seen, the percentage was high to cause risk to the users of the kitchen. There was need to consider improving ventilation in those areas.

4.3.19 Wall painting
According to the Public Health requirements, all surfaces in the kitchen should be clean and regularly painted. This is to discourage the presence of insects and rodents as well as being able to help in detecting any dirt in the kitchen (Mathis, 1995; Harmsen, 1953). Out of the 18 restaurants sampled, 66.7% showed that walls were regularly painted while 33.3% were not regularly painted. The frequency of wall painting was once per year. This was commendable and needed to be encouraged.

4.3.20 Availability of sinks
Sufficient sinks must be provided to enable food and equipment to be washed. Sanitary fitment must be adequate to all users (Christine and Christine 1972). On the availability of sinks, 66.7% of the restaurants sampled had adequate sinks and only 33.7% had no sinks. They used large basins and containers for washing their ingredients. There was a likelihood of this containers being inadequate to effectively carry out cleaning programmes and therefore pose a risk of contamination.

4.3.21 Cleaning of drainage systems
Sewage and wastewater are dangerous reservoirs of pathogens in food service establishments. Drainage systems should be regularly cleaned by use of special cleaning chemicals. This should be done at least once a week or done daily, depending on the volume of production (FDA, 1995). On cleaning of drainage system, 83.3% effectively
cleaned the drainage system on daily basis and only 16.7% did not clean on daily basis. This showed good cleaning programme and thus commendable.

4.3.22 Performance of public health inspectors

The role of public health inspectors is to prevent the sale of food that does not comply with the food safety requirement, according to the Public Health Act (1990). The public health office should put restrictions on disposal of hazardous waste and monitor the process during the handling and preparation of food. Pasmore and Eastwood, (1986) reported that government authorities (public health officers) were responsible for investigating all complaints made by individual members of the public and reporting them. They should provide guidance on safety of food and handling. Staff may not discharge their duties effectively if they are faced with problems even when they are highly trained.

Among the major problems encountered were harassment 50% and bribery 50%. Others included: no thorough inspection 17%, arrogance 11%, no guidance 11%, inadequate supervision 6%, lack of co-operative amongst fellow staff 6% and rudeness from public health officers 6%. This result revealed that public health officers did not perform their duties, resulting in poor standards of hygiene in food environments. If this trend continued then it will require the retraining of the existing staff for desired results.
Table 4.20: Problems faced by staff in restaurants.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harassment</td>
<td>9</td>
<td>50%</td>
</tr>
<tr>
<td>Tips or bribery</td>
<td>9</td>
<td>50%</td>
</tr>
<tr>
<td>No thorough inspection</td>
<td>3</td>
<td>17%</td>
</tr>
<tr>
<td>Arrogance</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>No advise</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>No adequate supervision</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>Not co-operative</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td>Rudeness</td>
<td>1</td>
<td>6%</td>
</tr>
</tbody>
</table>

4.4 DEGREE OF APPLICATION OF HACCP PRINCIPLES.

4.4.1 Knowledge and application of HACCP.

In establishing an HACCP system, knowledge of HACCP is fundamental. It also requires technical expertise and scientific background in various domains for proper identification of all potential hazards. The knowledge of HACCP is necessary for the performance of satisfactory hazard analysis (WHO/FAO, 1989).

Of the managers analyzed on the knowledge of HACCP, the results showed that there were only 16.7% who had knowledge of the system. Majority of the managers 83% did not understand the principles of HACCP. Managers who had knowledge 66.6% were from the chain and 33.3% from unclassified restaurants. On food service personnel, 88.9% of the personnel had no knowledge of HACCP; only a small fraction 11.1% were conversant.
On food production personnel, 77.8% personnel had no idea about HACCP and only 22.2% had knowledge of HACCP. Following an earlier presentation on the socio-demographic characteristics of professional training, many personnel had attained refresher, certificate and diploma courses respectively. There was a possibility that many respondents were uninformed about the HACCP principles. On the application, only 66.7% were able to apply the principles effectively on a daily basis. This implied that HACCP was not known or understood; there was need for more training on this subject for more efficient results.

4.4.2 Applicable system
In response to the best application system, 33.3% of food production personnel surveyed, recommended the public health supervision as the best system of food safety management, 27.8% recommended the HACCP system and 11.1% recommended food safety regulations. Despite these recommendations, there was need for public health officers to support the operating staff.

4.4.3 Support by public health team.
WHO, (2000) reported that without government support in terms of legislation, compliance, manpower and financial support, safety programmes may not effectively succeed.

On support by public health officers, 72% of the respondents showed that public health officers supported them and the remaining percentage 28% said they were not supported.

A cross tabulation of the type of restaurant against public health supervision indicated that 100% of the public health team supported chain restaurants and only 66% to unclassified restaurants. Despite this result, out of the 18 cases analyzed, 66.7% showed that the staffs were satisfied and 33.7% were unsatisfied with this kind of support. This
may be possibly attributed to the problems that were outlined by staff such as bribery and harassment.

4.4.4 Frequency of inspection

No system for controlling food safety can succeed without constant monitoring. Governments have to ensure that up-to-date legislation, relevant to prevailing national food and water safety problems is in place and those parties concerned are properly informed. With the above situation on the ground, efforts of food safety control may not then succeed.

Out of 18 restaurants surveyed, the frequency of inspection by public officers showed that 25.8% of the restaurants were inspected at least twice a year. The survey also indicated that 22.2% of the restaurants were not inspected at all. This frequency of inspection may not be sufficient to help monitor the safety of food staffs. There was need to increase the frequency in order to achieve desired or compliance programmes.

4.5: DETERMINATION OF FACTORS THAT INFLUENCE THE APPLICATION OF THE HACCP SYSTEM.

In order to control food-borne illnesses, there is need to understand those factors that hinder or influence the application of the HACCP system.

Out of the 18 cases of food service personnel interviewed, the following factors were ranked in order of priority as problems that hindered the application of HACCP.

1. Poor training
2. Lack of equipment
3. Lack of co-operation from fellow staff
4. Poor supervision
5. Lack of understanding of the principles of hygiene and food safety.
There was a big problem with training of staff since many operatives had attained refresher, certificate and a small majority in diploma and degree levels. This was an obstacle in discharging of their duties effectively.

4.5.1 Staff recommendations

On the recommendation given by managers, 16.7% recommended that more training for staff was important for ensuring proper application of the HACCP system. A smaller percentage 16.7% showed that consistent water supply was important; also 11.1% suggested that health officers should keep monitoring the performance of staff in food establishments. Among other recommendations mentioned were consistent supervision, free medical checkups, giving more powers to the Kenya bureau of standards (KBS), regular checks, having workshops and up to date reviewing of Public Health Act (1990).
CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The purpose of this study was to investigate food safety status in chain and unclassified fast food restaurants within the city centre. The research objectives were: to determine the bacteriological quality of food (pre-cut salads) and water assess the food safety practices in chain and unclassified fast food restaurants, establish the degree of application of HACCP principles and, finally, determine the factors that influence the application of the HACCP principles.

Descriptive survey was used in the study and 18 restaurants were studied. Questionnaires, interview schedules and observation checklist were used to solicit information pertaining to the qualitative data. Laboratory analysis results were carried out on quantitative data from sampled restaurants. Data analysis was conducted using descriptive statistics such as means, frequencies and standard deviation. Chi-Square tests were used to compare relationships between variables and also used to determine the upper and lower bound of level of contamination. Independent T-test was run to determine whether the difference of the mean of chain and unclassified restaurant salads differed significantly.

5.1 Summary of findings

Over 50% of the restaurant workforces were male, aged between 26-35 years. A majority of the food production staff 65.1% and service personnel 27.8% were professionally qualified in levels of refresher, certificate and diploma courses respectively. A small percentage of managers 27.8% managed to train up to degree level. There were a fast growing number of restaurants 38% in the year between 1991-2000 and this required more staff to provide quality services.
On the time worked in the present employment, majority of personnel, managers 33%, food production staff 20% and food service 50% had worked in the present employment for a period of less than 4 years and after this period moved to new employments.

Water used in sampled restaurants (94.4%) was potable and was free from contamination indicated by low levels of *coliform* counts. There was no significant difference between chain and unclassified fast food restaurants in terms of extent of contamination in food. The mean ranges of $7.1-8.0 \times 10^4$ and $7.1-8.0 \times 10^4$ indicated low level of deviation from the golden mean of $10^4$ in salad samples. The variance in terms of contamination was minimal to cause a serious infection or intoxication. A chi-square test performed ($X^2 = 0.04$ and a p-value = 0.53) revealed that there was no significant difference between classified and unclassified restaurants in terms of contamination.

Most of the ingredients purchased in fast food outlets 64% were obtained from *Wakulima* market and only 38.9% were purchased from recommended foods suppliers. Coleslaw was widely used in restaurants compared to *Kachumbari* due to its wide usage in service of items such as chips and various snacks.

Out of the 18 managers analyzed, 64% and food service personnel 68% had good knowledge on storage of ingredients and the cleaning process in restaurant. Further, 83.3% of the water used for cleaning equipment in the restaurants was portable and free from fecal contamination. The staffs working in those restaurants 78.6% had knowledge on the quality of water required for use especially when there were water shortages.

The level of food safety training ranged from in-house, workshops and vocational training, but many restaurants 83% used in-house training as a mode of food safety training.

Majority of the food production personnel 66% were conversant with food hygiene regulations but a smaller fraction were able to apply it effectively on daily basis. Out of 18 restaurants sampled, 70% of the service personnel were able to effectively use the
equipment in preparation of salads. However, 30% were unable to use the equipment as required.

Many of the food production establishments had the presence of vermin infestation. Over 55.6% of the restaurants were infested with rats. Many of the outlets 50% had poor ventilation though walls were regularly painted. Also 66.7% provided their staff with availability of sinks and good drainage systems, out of which 83.8% were cleaned regularly.

On the knowledge of HACCP, an average of 79% of the operational staff (restaurant managers, food production staff and food service staff) were ignorant off HACCP system of food safety and quality. Only a small percentage of 11.1% was informed and was able to apply it effectively in their workplaces. However, many people recommended the HACCP system as the best management system in the control of food-borne or related diseases. Out of the eighteen restaurants sampled, public health teams could inspect only 25.8% while 22.2% showed inconsistency in the inspection.

A number of factors influenced the application of the HACCP principles: poor training, lack of equipment, lack of co-operation, poor supervision and harassment from public health officers remained major problems facing chain and unclassified restaurant staff in Nairobi.
5.2 Conclusions

Based on the study objectives, the following conclusions were arrived at:

Staff working in the restaurants had low level of professional and food safety training in chain and unclassified restaurants; many of those trained through refresher courses and were professionally trained to certificate level.

Water for use in restaurants was portable with low levels of *coli*form counts and with *E. coli* absence thus not a health hazard.

There was no statistical difference between chain and unclassified restaurants in terms of the level of bacteriological contamination in salads (*Kachumbari* and coleslaw).

A higher percentage of food handlers had no knowledge of food safety standards. Though this was the case, they were informed and knowledgeable about the hygienic practices necessary to ensure safety of food.

There was lack of surveillance and consistency in supervision from government and public health officers and this was one of the major factors that hindered the application of HACCP.

Poor training, lack of equipment, lack of co-operation, poor supervision and harassment from public health officers were major problems facing chain and unclassified restaurants in Nairobi.
5.3 Recommendations

5.3.1 Recommendations from the study

Based on the study the following recommendations and suggestions were made:

- In order to curb the spread of food and water-borne diseases, there is need for higher level of professional training of food handlers, especially those directly involved in food preparation. This can be possible if they are supported by the existing expertise and public health officers, who should provide technical assistance to fulfill these requirements.
- There is an urgent need to re-train government public health officers on modern food safety standards, food inspection, certification techniques and surveillance of food and water borne diseases.
- Food safety is a shared responsibility and therefore governments should equip their laboratories with modern analytical technologies and support hotels and restaurants by taking food samples for testing and analysis to determine their potential health risks.
- Apart from training staff, it is pertinent that any staff handling food should be trained on modern and international safety standards.

5.3.2 Recommendations for further research

- Further survey should be conducted to concretely establish the bacteriological levels in other foods and water including star rated hotels and other smaller outlets like kiosks.
- Research should also be curried out to establish government preparedness in combating food-borne illnesses by considering food quality and information centres available that provide information and advice on matters relating to control and quality.
• Research should be carried out to establish potential risks from production to consumption so that the risk factors and strategies to reduce them can thoroughly be described.
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INTERVIEW SCHEDULE FOR THE RESTAURANT MANAGER

TO WHOM IT MAY CONCERN

I am a student at Kenyatta University from the school of pure and applied sciences. I am carrying out a research on food Safety in Restaurants within Nairobi City Centre. You have been chosen as one of the participants of this study. This study is designed to promote business by clearing the doubt on food safety status in Nairobi. Please assist me by answering the questions as accurately as possible. There will be confidentiality of the information given. It will be used for academic purposes only.

Thanks for your co-operation.

TYPE OF RESTAURANT ________________

SECRET CODE ______________________

PART 1 Demographic data
1. Type of restaurant
   Chain □ Unclassified □
2. Gender
   Male □ Female □
3. Age
   0-18 yrs □
   19-25 yrs □
   26-35 yrs □
   26-35 yrs □
4. Marital status
   Married □ Not married □
5. When was this restaurant establishment?
   _____________________________ (Year)
6. What is your highest level of professional training
   Certificate □
7. How long have you worked as a Restaurant Manager in this outlet?
   - 0-4 years  
   - 5-9 years  
   - 10-14 years  
   - 15 years and above  
8. What is your approximate price range for the following dishes?

<table>
<thead>
<tr>
<th>Dishes</th>
<th>10-30</th>
<th>31-60</th>
<th>61-90</th>
<th>91-120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salads (kshs.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coleslaw</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomato salad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lettuce salad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrot salad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kachumbari</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>50-100</td>
<td>101-150</td>
<td>151-200</td>
<td>200 and above</td>
</tr>
<tr>
<td>Chicken</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chipped potatoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part ii Food hygiene and sanitation

9. Where do you get your food supplies
   1. Purchasing from the market (wakulima)
   2. Supplies
   3. Those selling in the streets
   4. Others specify ________________________________

10. Do you do any assortment of ingredients during receiving?
    Yes  
    No  

11. At what temperature do you store the following food items?

<table>
<thead>
<tr>
<th></th>
<th>-20°C to -1°C</th>
<th>1°C to 10°C</th>
<th>11°C to 45°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Two</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Three</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>As is necessary</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

12. At what temperature do you serve your vegetables

   1. 0°C to 10°C
   2. 11°C to 45°C
   3. Above 45°C
   4. Not sure

13. How often do you clean your restaurants?
   
   Once a day [ ]
   Twice a day [ ]
   As soon as it gets dirty [ ]
   Others specify (per day) ____________________________

14. When there is a problem of water supply what do you do to ensure production of salad is on process?

   ____________________________________________________

15. How many pairs of kitchen uniform do you issue your staff every year?

   ____________________________________________________

16. How frequent do you attend medical examinations per year?
   
   One [ ]
   Two [ ]
   Three [ ]
   As is management will feel fit [ ]
   An other specify ________________________________
17. What type of training do you offer your staff related to food safety and quality?
   1. In-house training
   2. Workshops
   3. Vocational training
   4. Full-time

18. How do you dispose your refuse from the kitchen?
   1. Refuse disposal agents
   2. Cart
   3. Kitchen staff
   4. By selling to vendors

Part iii Microbiological contamination

19. Do you encounter customer complaints
   Yes ☐ No ☐

20. If yes in 21 (above), list some of the complaints
   1. 
   2. 
   3. 
   4. 

21. Are there any complaints related to food contamination?
   Yes ☐ No ☐

22. If yes in 23 (above), mention a few
   1. 
   2. 
   3. 
   4. 

23. When was your last time you heard of food poisoning in the restaurant?

Part iii HACCP

24. Mention some of the management tools that you use in ensuring that food is safe and wholesome for consumption.
   1. 
   2. 
   3. 
   4. 
25. Do you know what HACCP is all about?
   Yes □  No □

26. Have you applied the HACCP system in your restaurant?
   Yes □  No □

27. If yes in 26 [above], mention some of the constraints that hinder that application of these principles
   1. __________________________________________
   2. __________________________________________
   3. __________________________________________

28. How do you apply the HACCP principles? Explain
   __________________________________________
   __________________________________________
   __________________________________________

Part IV Public Health Officer Supervision

29. Is there any consistent support from the public health officers?
   Yes □  No □

30. Are you satisfied with their support
   Yes □  No □

31. If not in 32 [above], mention some of the reasons
   1. __________________________________________
   2. __________________________________________
   3. __________________________________________
   4. __________________________________________

32. When was your last time you heard of food poisoning in the restaurant?
   ___________________________ (year)

Part iii HACCP

33. Mention some of the management tools that you use in ensuring that food is safe and wholesome for consumption
   1. __________________________________________
   2. __________________________________________
   3. __________________________________________
34. Do you know what HACCP system in your restaurant?

Yes □  No □

35. If yes in 28 [above] , mention some of the constraints that hinder that application of these principles

1. 
2. 
3. 
4. 

36. How do you apply the HACCP principles? Explain

Part iv public health supervision

37. Is there any consistent support from the public health officer?

Yes □  No □

38. Are you satisfied with their support?

Yes □  No □

39. If not in 32 [above] , mention some of the reasons

1. 
2. 
3. 
4. 

40. How often is the inspection [per month]?

___________ (per month)

41. Mention some of problems you encounter from public health officers

1. 
2. 
3. 
4. 
42. Outline some of the recommendations the government can do to ensure food safety and quality.

1. 

2. 

3. 

4. 

THANK YOU FOR YOUR CO-OPERATION
QUESTIONNAIRE FOR FOOD SERVICE PERSONNEL

TO WHOM IT MAY CONCERN

I am a student at Kenyatta University from the school of pure and applied sciences. I am carrying out a research on Food Safety in Restaurants within Nairobi City Centre.

You have been chosen as one of the participants of this study. This study is designed to promote business by clearing the doubt of food status in Nairobi.

Please assist me by answering the questions as accurately as possible. There will be confidentiality of the information given. It will be used for academic purposes only.

Thanks for your co-operation.

TYPE OF RESTAURANT __________________________
SECRET CODE __________________________

Part 1

1. Type of restaurant
   Chain [ ] Independent [ ]

2. Gender
   Male [ ] Female [ ]

3. Marital status
   Married [ ] Not married [ ]

4. Age category
   1. Below 18 years [ ]
   2. Between 19-25 yrs [ ]
   3. Between 26-35 yrs [ ]
   4. Above 35 yrs [ ]

5. How long have you worked in this establishment?
   0-4 years [ ]
   5-9 years [ ]
   10-14 years [ ]
   15 yrs and above [ ]

6. Have you been trained as a food and beverage service personnel?
   Yes [ ] No [ ]
7. If yes in 6 [above] what level of professional training have you attained?
   a) Refresher course  □
   b) Certificate  □
   c) Diploma  □
   d) Higher National diploma □
   e) Other [specify] ______________________

Part 11

8. Are you conversant with food hygiene regulations?
   Yes □   No □

9. If yes in 8 [above] briefly explain how you apply it

_________________________________________________________________
_________________________________________________________________

10. What temperatures do you serve the following foods?

   Vegetables salads ________°C
   Fruits salads ________°C
   Chicken ________°C
   Meats ________°C

11. Which water do you use for making ice cubes?
   (a) Mineral water  □
   (b) Tap water  □
   © Any water  □
   (d) Boiled water  □

12. Do you re-use salad dressing?
   Yes □   No □
13. How many types of salads can you serve using one service spoon?
   One  
   Two  
   Three  
   As many as possible  

Part III

14. Are you conversant with food poisoning micro-organisms?
   Yes  
   No  

15. If yes in 14 [above] name some of the micro-organisms that cause food poisoning
   1. 
   2. 
   3. 
   4. 

16. What time do you wash your hands when handling food?
   Before visiting toilet  
   After visiting toilet  
   Before and after visiting toilet  
   None of the above  

17. How often do you go for medical check-up [per year]?
   Once  
   Twice  
   Thrice  
   As is necessary  
   None of the above  

Part IV

18. Are you conversant with HACCP system of food safety?
   Yes  
   No  
19. If yes in 18 [above] explain how you apply it ____________________________

20. In order of prevalence mark factors that hinder you from attaining high standards of hygiene in food service department.
   a. Poor training
   b. Lack of equipment
   c. Lack of co-operation from fellow staff
   d. Poor supervision
   e. Lack of understanding of the principles of food hygiene and safety
   f. Any other [specify]

THANK YOU FOR YOUR CO-OPERATION
QUESTIONNAIRE FOR THE FOOD PRODUCTION PERSONNEL

TO WHOM IT MAY CONCERN:

I am a student at Kenyatta University from the school of pure and applied sciences. I am carrying out a research on Food Status in Chain and unclassified Restaurants Within Nairobi City Centre’. You have been chosen as one of the participants of this study. This study is designed to promote business by clearing the doubt of food safety status in Nairobi.

Please assist me by answering the questions as accurately as possible. There will be confidentially of the information given. It will be used for academic purposes only

Thanks for your co-operation

TYPE OF RESTAURANT ____________________________

SECRET CODE _________________________________

Part I demographic characteristic

1. Type of restaurant
   Chain ☐ Unclassified ☐

2. Gender
   Male ☐ Female ☐

3. Age
   1. Between 0-18 yrs
   2. Between 19-25 yrs
   3. Between 26-35 yrs
   4. Above 35 yrs

4. Marital status
   Married ☐ Not married ☐

5. Have you trained as food production personnel?
   Yes ☐ No ☐

6. What is your highest level of training
   1. Refresher course ☐
   2. Certificate ☐
   3. Diploma ☐
   4. Higher National diploma ☐
7. How long have you worked in this establishment?
   1. 0-4 years  □
   2. 5-9 years  □
   3. 10-14 years □
   4. 15 and above yrs □

Part II

8. Are you conversant with food hygiene regulations?
   Yes □ No □

9. If yes in 8 (above), state briefly how you apply them

________________________________________________________________________

________________________________________________________________________

10. Where do you normally keep your vegetables after preparing in readiness for service?
    Mark where applicable.
    1. In the fridge □
    2. In convenient airy condition □
    3. Where there is available space □

Part III

11. Are you conversant with food contaminating bacteria?
    Yes □ No □

12. If yes in 11 (above), mention some of the micro-organisms
    1. ________________________________
    2. ________________________________
    3. ________________________________
    4. ________________________________

13. Do you wash your foods before preparing them?
    Yes □ No □

14. If yes in 13 (Above), name some of the foods that you pay more attention in washing
    1. ________________________________
    2. ________________________________
    3. ________________________________
    4. ________________________________
15. What are some of the steps you take in order to ensure that food is safe from contamination?
   1. 
   2. 
   3. 

16. After preparation of salads at what temperature do you keep them in food service counters? Mark where appropriate
   1. Below 0°C
   2. 1°C-10°C
   3. 11°C-35°C
   4. 36°C-45°C
   5. Above 45°C

17. What do you do with leftover salads?
   1. Keep in fridge and re-use later
   2. Throw away
   3. Reconstitute
   4. Any other specify

18. Do you attend medical check-ups?
   Yes ☐ No ☐

19. If yes in 18 (above), how often (per year)?
   1. Once ☐
   2. Twice ☐
   3. Three ☐
   4. None of the above ☐

Part IV
20. Do you know what HACCP is all about?
    Yes ☐ No ☐
21. If yes in 20 (above), outline how it is applied?

In your opinion which system will give desired results as far as hygiene is concerned?

1. HACCP
2. Public Health supervision
3. Food safety regulations

THANK YOU FOR YOUR CO-OPERATION
INTERVIEW SCHEDULE FOR A PUBLIC HEALTH OFFICER

TO WHOM IT MAY CONCERN

I am a student at Kenyatta University from the school of pure and applied sciences. I am carrying out a research on Food Status in Chain and unclassified Restaurants Within Nairobi City Centre. You have been chosen as one of the participants of this study. This study is designed to promote business by clearing the doubt of food safety status in Nairobi.

Please assist me by answering the questions as accurately as possible. There will be confidentiality of the information given. It will be used for academic purposes only.

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<table>
<thead>
<tr>
<th>TYPE OF RESTAURANT</th>
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<thead>
<tr>
<th>SECRET CODE</th>
</tr>
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<tbody>
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<table>
<thead>
<tr>
<th>Part 1 Demographic data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender</td>
</tr>
<tr>
<td>Male □ Female □</td>
</tr>
<tr>
<td>2. Age</td>
</tr>
<tr>
<td>1. Below 18 years □</td>
</tr>
<tr>
<td>2. Between 19-25 yrs □</td>
</tr>
<tr>
<td>3. Between 26-35 yrs □</td>
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<tr>
<td>4. Above 35 Years □</td>
</tr>
<tr>
<td>3. How long have you worked as a public health officer</td>
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<tr>
<td>1. Below 5 yrs □</td>
</tr>
<tr>
<td>2. Between 6-9 yrs □</td>
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<tr>
<td>3. Between 10-14 yrs □</td>
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<tr>
<td>4. Above 15 yrs □</td>
</tr>
<tr>
<td>4. Have you been trained as a public health officer?</td>
</tr>
<tr>
<td>Yes □ No □</td>
</tr>
<tr>
<td>5. If yes in 4 (above), what level of professional training have you attained?</td>
</tr>
<tr>
<td>1. In service □</td>
</tr>
<tr>
<td>2. Certificate □</td>
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<tr>
<td>3. Diploma □</td>
</tr>
</tbody>
</table>
4. Degree

5. Any other (specify)

6. What area of Jurisdiction do you carry your public health inspection?

7. How many restaurants do you inspect per day. Specify number?
   1. 1-5 yrs
   2. 6-10 yrs
   3. 11-15yrs
   4. 15 and above

8. What are your roles as a public health officer?
   1. 
   2. 
   3. 
   4. 

9. Which food safety guidelines (regulations) do you use for your inspection schedules?
   1. 
   2. 
   3. 
   4. 

10. How many cases of food poisoning have occurred the last six months in the restaurants that you have inspected (specify)

11. Mention some of the specific food poisoning cases
   1. 
   2. 
   3. 
   4. 

12. What are some of the factors that hinder you from discharging your duties?
   1. 
   2. 
   3. 
   4. 
13. Name some of the outlets, which according to your opinion need to be closed
   1. 
   2. 
   3. 

14. In case you find that the restaurants do not meet the requirements of food hygiene
    regulations what step do you take?

15. State some of the recommendations, which you think if implemented, will achieve
    high standards of hygiene
   1. 
   2. 
   3. 
   4. 
   5. 

16. Do you know what HACCP is all about?
    Yes [ ] No [ ]

17. Have you ever applied the HACCP system?
    Yes [ ] No [ ]

18. If yes in 17 (above) explain how it is applied?

19. How many times do you carry your inspection per month?

THANKS FOR YOUR CO-OPERATION
OBSERVATION CHECKLIST

TYPE OF RESTAURANT

SECRET CODE

Part 1 Demographic characteristics

1. Type of restaurant

   Chain [ ] unclassified [ ]

2. Which year was the restaurant established

3. Who owns the restaurant

Part 11 Hygiene and safety

4. When receiving ingredients does the receiving clerk do assortment

   Yes [ ] No [ ]

5. How long does it take to store ingredients after receiving?

   Below 15 minutes [ ]

   16-30 minutes [ ]

   31 minutes – 1 hour [ ]

   Over 1 hour [ ]
6. What is the holding temperature for the following ingredients in store?

<table>
<thead>
<tr>
<th>Food item</th>
<th>-20°C-1°C</th>
<th>1°C-10°C</th>
<th>11°C-45°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fruits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry goods</td>
<td></td>
<td></td>
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</tbody>
</table>

7. Are there any signs of availability of insects or rodents in food preparation areas?
   Yes    No

8. If yes in 7 (above) name some of the insects and rodents

9. Are walls cleaned on daily basis?
   Yes    No

10. Are food preparation areas served with adequate ventilation?
    Yes    No

11. Are walls regularly painted?
    Yes    No

12. If yes in 11 (above) how often? (Per year)
    Once
    Twice
    Several
Depending on dirt

13. Are food preparation and service areas supplied with enough sinks?
   Yes  No

14. Do the food preparation and service areas served with cold and hot water systems?
   Yes  No

15. Are staff gloomed with clean kitchen uniform?
   Yes  No

16. Do they wash their hands before and after visiting the toilet?
   Yes  No

17. Do the staff wash their hands before or after handling food?
   Yes  No

18. How do they dispose their refuse?
   Waste bins
   Special containers
   Waste bins next to the kitchen
   Others (specify) ____________________________

Part 111 Micro-organisms

19. Do the staff keep food in the required temperature before serving it?
   Yes  No

20. Are drainage systems cleaned daily?
Yes No

21. Are there adequate waste disposal packets provided?

Yes No

Thank you for your co-operation.
MOST PROBABLE NUMBER OF *COLIFORMS* / GM OR ML

<table>
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<tr>
<th>+VE Tubes out of 3 tubes</th>
<th>Most probable number (MPN)</th>
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**TVC – HIGHER THAN CONTROL UNIT CONFIRM**

**MEDICAL MICROBIOLOGY**

Probability Tables (according to McCrandy)

<table>
<thead>
<tr>
<th>QUANTITY OF WATER</th>
<th>50 ml</th>
<th>10 ml</th>
<th>1 ml</th>
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<tbody>
<tr>
<td>No. of sample of each</td>
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<tr>
<td>Quantity tested</td>
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</tbody>
</table>

**Number giving positive reaction (acid and gas)**

**Probable number of coliform bacilli in 100 ml of water**