

**FOOD HANDLING PRACTICES AND THE PREVALENCE
OF FOOD BORNE PATHOGENS AMONG FOOD
HANDLERS IN EMBU MUNICIPALITY, KENYA**

BY

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REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC
HEALTH AND EPIDEMIOLOGY OF KENYATTA UNIVERSITY.**

AUGUST, 2003

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*Food handling
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DECLARATION

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

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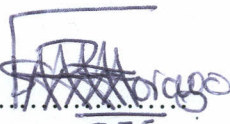
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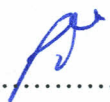
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DEDICATION

This work is dedicated to my wife Margaret, children (Kenneth, Lysbeth, Ann and Peter) and to all Public Health Practitioners world-wide.

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My special thanks go to my supervisors' Professor Alloys S.S Orago and Professor Romanus O. Okelo of the Department of Zoology Kenyatta University for their special role of tirelessly guiding me through the journey of academia in a superb manner and with great patience.

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TABLE OF CONTENTS

DECLARATION.....	II
DEDICATION.....	III
ACKNOWLEDGEMENTS.....	IV
TABLE OF CONTENTS.....	V
LIST OF TABLES	X
LIST OF FIGURES	XII
ACRONYMS USED IN THIS THESIS.....	XIII
DEFINITION OF TERMS USED IN THE STUDY.....	XIII
ABSTRACT	XIVV
CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW	1
1.1 GENERAL INTRODUCTION	1
1.2 LITERATURE REVIEW.....	2
1.2.1 Food borne diseases	2
1.2.2 Food handling practices	3
1.2.3 Food handling regulatory measures	4
1.3 RATIONALE FOR THE STUDY	5
1.3.1 Statement of the problem	5
1.3.2 Research questions	6
1.3.3 Justification/Significance of the study	6
1.3.3.1 Theoretical significance	6

1.3.3.2 Practical significance	7
1.4 HYPOTHESES.....	7
1.5 OBJECTIVES OF THE STUDY	7
1.5.1 General Objective.....	7
1.5.2 Specific Objectives.....	7
CHAPTER TWO: MATERIALS AND METHODS.....	9
2.1 THE STUDY AREA	9
2.2 STUDY POPULATION	13
2.2.1 Inclusion criteria.....	13
2.2.2 Exclusion criteria	13
2.2.3 Ethical considerations	13
2.3 THE STUDY DESIGN	13
2.4 SAMPLING AND SAMPLE SIZE DETERMINATION.....	14
2.4.1 Sampling	14
2.4.2 Sample size.	14
2.5 DATA COLLECTION PROCEDURES AND INSTRUMENTS.....	16
2.6 DATA MANAGEMENT AND ANALYSIS.....	17
CHAPTER THREE: RESULTS.....	18
3.1 SELECTED SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION ...	18
3.1.1 Age.....	18
3.1.2 Sex.....	18
3.1.3 Level of Education.	18
3.1.4 Distribution of foodhandlers-by category of eating-house.	18
3.2.0 Prevalence of food borne pathogens among the food handlers.....	19

3.2.1 Ova and cyst.....	18
3.2.2 Stool Culture	23
3.2.3 Physical Examination.....	25
3.3 KNOWLEDGE OF FOOD BORNE ILLNESS AMONG THE FOOD HANDLERS.....	27
3.4 FOOD HANDLING PRACTICES AND COMPLIANCE WITH HEALTH REQUIREMENTS.....	29
3.4.1 Distribution of food handlers assessed on food handling practices according to category of eating-houses.	29
3.4.3. Distribution of food handlers with medical certificates.	31
3.4.4. Observation on food handling practices.....	33
3.4.4.1 Use of protective garments.....	33
3.4.4.2. Condition of protective garments.....	33
3.4.4.3 Use of head covers by cooks.....	33
3.4.4.4. Washing of hands before touching food.	34
3.4.4.5. Hand washing after touching raw foods.....	34
3.4.4.6. Touching of foods directly with bare hands.....	34
3.4.4.7. Cashiers handling food after handling money	34
3.4.4.8. Licking of fingers by food handlers while handling food.....	35
3.4.4.9. Blowing into wrapping papers to open them for packing.	35
3.4.4.10 Smoking within food premises.....	35
3.4.4.11 Scratching and touching foods without washing hands.	35
3.4.4.12 Spitting within the food premises while serving or preparing food.....	35
3.4. 5 Conditions and provisions that may influence food handlers' practices.....	37
3.4.5.1 Wiping and drying utensils with towels.....	37
3.4.5.2 Condition of the towels used for wiping and drying utensils.....	37

3.4.5.3 The practice of re-using chopping boards used on raw foods to handle cooked foods.	38
3.4.5.4 The practice of re-using raw foods knife on cooked foods.	39
3.4.5.5 Provision of wash hand facilities in the eating-houses	39
3.4.5.6 Provision of cold storage facilities.....	39
3.4.5.7 Provision of refuse containers.....	39
3.4.5.8 Provisions of refuse covers to refuse containers.	40
3.4.5.9 Source of the water used in the kitchen.	40
3.4.5.10 Distance to water source from the kitchen.....	40
3.5 RELATIONSHIPS OF VARIOUS CHARACTERISTICS IN THE STUDY POPULATION	43
3.5.1 Prevalence of food borne illness	43
3.5.1.2 Sex.....	44
3.5.1.3 Physical conditions.....	44
3.5.2 Knowledge of food borne illnesses	45
3.5.3 Food handling practices and compliance with health requirements.	47
CHAPTER FOUR: DISCUSSION.....	52
4.1 PREVALENCE OF FOOD BORNE PATHOGENS	52
4.2 KNOWLEDGE OF FOOD BORNE ILLNESSES	53
4.3 FOOD HANDLING PRACTICES AND COMPLIANCE WITH HEALTH REQUIREMENTS.....	55
CHAPTER 5: A SUMMARY OF CONCLUSIONS.....	57
CHAPTER SIX: RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE RESEARCH WORK.....	58
6.1 RECOMMENDATIONS.....	58
6.2 SUGGESTIONS FOR FUTURE RESEARCH WORK.....	58

REFERENCES:.....56

APPENDICES60

APPENDIX 1: RESEARCH INSTRUMENTS60

APPENDIX 2: KNOWLEDGE INDEX FOR FOOD HANDLERS71

APPENDIX 3:ETHICAL CLEARANCE DOCUMENTS.....72

**A) INTRODUCTION LETTER FROM PERMANENT SECRETARY,
MINISTRY OF HEALTH.....72**

**B) RESEARCH CLEARANCE FROM MINISTRY OF EDUCATION
SCIENCE AND TECHNOLOGY73**

**C)INTRODUCTION LETTER FROM MEDICAL OFFICER OF HEALTH,
EMBU.....74**

**APPENDIX 6: ABSTRACTS FOR PAPERS ACCEPTED FOR PUBLICATION
OR SEMINARS/WORKSHOPS75**

LIST OF TABLES

Table 1	Results of stool specimen examination for ova and cysts	37
Table 2	Results of stool specimen examination for culture	37
Table 3	Distribution of various clinical conditions and health requirements on food handling to category of eating-house.....	39
Table 4	Distribution of food handlers assessed on food handling practises according to categories of eating-houses.....	43
Table 5	Distribution of food handlers assessed on food handling practises by sex, according to category of eating -house.....	45
Table 6	Distribution of food handlers with medical certificates.....	45
Table 7	Distribution of food handling practises among the food handlers according to category of eating-house.....	49
Table 8a	Distribution of conditions and provisions that influence food handling practises according to category of eating-houses	53
Table 8b	Distribution of conditions and provisions that influence food handling practises according to category of eating-houses	54

LIST OF FIGURES

Figure 1	Location of Embu District	22
Figure 2	Location of Embu Municipality	23
Figure 3	Map of Embu Municipality	24
Figure 4	Age distribution of food handlers.....	32
Figure 5	Distribution of food-handlers by sex.....	33
Figure 6	Food-handlers education level.....	34
Figure 7	Distribution of foodhandlers who attended medical examination by category of eating houses.....	35
Figure 8	Knowledge of food borne illnesses amongst food handlers ...	41

ACRONYMS USED IN THIS THESIS

CAP:	Chapter
Dip:	Diploma
EHS:	Environmental health science
FAO:	Food and Agricultural Organisation
FSI:	Food science and inspection
GoK:	Government of Kenya
HACCP:	Hazard Analysis Critical Control Point
HIS:	Health Information systems
ISO:	International Standards Organisation
MOH:	Ministry of Health
PHE:	Public health engineering
ROK:	Republic of Kenya
WHO:	World Health Organization

DEFINITION OF TERMS USED IN THE STUDY

- a) Prevalence- Prevalence of a disease is the number of cases in defined population at a specified point in time. Prevalence is often expressed as cases per 1000 or per 100 population
- b) Food borne illness- food borne illness is define as a disease either infectious or toxic in nature, caused by agents that enter the body through ingestion of food.
- c) Food borne disease out break –this is defined as :-
- I. Two or more persons experiencing a similar illness usually gastrointestinal after eating a common food and
 - II. Epidemiological analysis implicates food as the source of illness.
- d) Food handler- The term in this study applies to a person who gets into contact with food for commercial purposes in the process of preparation and serving.
- e) Food handling –The term in this study applies to all those activities in the preparation and serving of food for commercial purposes.
- f) Food borne pathogens _ This refers to organisms that are responsible for transmission of food borne diseases.
- g) Eating houses _ In this study, this applies to licensed premises where food is prepared and served for and for commercial purposes

ABSTRACT

Food borne diseases constitute a growing public health problem world-wide and a significant cause of reduced economic activity. It is estimated that up to 70% (WHO,2000) of diarrhoeal diseases may be caused by contaminated foods. Most food borne diseases are attributed to food contamination through unhygienic food handling practices, infected food handlers and lack of appropriate knowledge on food borne diseases by food handlers. Very little research work and surveillance of food borne diseases has been done in Africa and Kenya in particular. The incidences of food borne diseases are not easy to estimate in Kenya as most of them are lumped together when recording, as diarrhoeal diseases

This study sought to assess the food handling practices and the prevalence of foodborne illness amongst the foodhandlers in Embu Municipality. Both random and systemic sampling procedures were used to identify food handlers to be included in the study as they attended routine medical examination. Stool specimens were taken for microscopic analysis for ova and cysts; using Ritches modified formol ether stool concentration method and culture for bacterial investigations. Knowledge on food borne diseases, socio-demographic factors and food handling practices were evaluated using pre-tested structured questionnaires.

The results showed that food borne illnesses and food handling practices were still a public health problem in Embu Municipality, seventy (28.9%) of the food handlers were infected with *Salmonella typhi* and ten (4.1) with *Entamoeba histolytica*. Significant differences ($\chi^2 = 6.86$; $P < 0.05$; $df=1$) were noted in the prevalence of *Salmonella typhi* among food handlers who were 30 years old and below and those above 30 years.

Over 50% of the food handlers had high knowledge and understanding of the food borne illnesses, their symptoms, causes and preventive measures. Significant differences ($\chi^2 = 9.26 < 0.05$; $df=1$) were noted between those with secondary education and above and those with primary education and below on the knowledge of specific food borne illnesses. Compliance with food handling practices and health measures as laid out in the Public Health Act Cap 242 and the Food, Drugs and Chemical Substances Act Cap 254 laws of Kenya was not satisfactory. About 42% of the food handlers had no valid medical certificates, 21% without protective garments and even among those who had them, (31.5%) were dirty. Among the cooks, 76.6% did not have head covers. Touching of foods with bare hands was observed in 55.1% of the food handlers, while 42% did not wash hands after touching raw foods. Most cashiers, (64%) were found handling food after handling money without washing hands. Significant differences ($\chi^2 = 37.06$; $p < 0.001$; $df=1$) were noted between those who washed hands before touching foods in high and low class eating houses. Though most of the premises were provided with refuse containers, the majority (71.9%) of the containers were without refuse covers.

Food borne illnesses and food handling practices are still a major threat to public health in Embu Municipality. Measures should be undertaken by the Government to ensure effective and efficient enforcement of the Public Health Act Cap. 242 and The Food Drugs and Chemical substances Act Cap.254 and training of food handlers. Results of this study will be useful to public health managers in their effort towards improvement of public health.

CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

1.1 General Introduction

Food borne diseases are widespread Public Health problem and a significant cause of reduced economic activity. Each year throughout the world, millions of people particularly infants and children, suffer and die from food borne diseases (WHO, 1992a). Food borne illness are defined by WHO as diseases usually either infectious or toxic in nature, caused by agents that enter the body through ingestion of food (WHO, 2002). Many cases of food borne illnesses, could be prevented and many lives saved if food handlers were better educated and trained in safe food handling practices and consumers better advised on the choice of their food (WHO, 1995) and choice of eating places.

Microbial and parasitic food borne illnesses account for most episodes of acute food borne diseases (WHO, 2000). The Kenya Health Policy framework of 1994 reported diarrhoea among the top ten causes of morbidity and mortality (ROK, 1994). It is estimated that 70% of cases of diarrhoeal diseases may be caused by contaminated food (WHO, 2000).

A cholera outbreak occurred in Embu in 1992 (ROK, 1992) and between February and April, 2001 there was a typhoid outbreak in the same district, where 294 disease cases were reported with resultant 23 deaths (ROK, 2001). In the typhoid outbreak in Embu, approximately 50% of the cases interviewed attributed their infection to consumption of food from commercial food establishments and schools (ROK, 2001).

The above scenario suggested that there existed a problem of food borne diseases in Embu District that required investigation. An investigation into food borne illnesses can take different approaches in which many parameters could be assessed. In this in

study, food-handling practices among food handlers was determined together with the prevalence of food borne illness among the food handlers.

1.2 LITERATURE REVIEW

1.2.1 Food borne diseases

Food borne diseases represent one of the most widespread and overwhelming Public Health problems of the modern world (WHO, 2000). According to the latest edition of the *World Health Statistics Quarterly*, food-borne diseases may be 300 – 350 times more frequent than reported cases tend to indicate (Abramov, 1997). A wide range of food borne diseases affects developing countries. Cholera, campylobacteriosis, *Escherichia coli* (*E. coli*) gastro-enteritis, salmonellosis, shigellosis, typhoid and paratyphoid fevers, brucellosis, amoebiasis and poliomyelitis are only a few examples (WHO, 1992b).

Each year, some 1,500 million episodes of diarrhoea occur in children under the age of five, and over 3 million children die as a direct result (WHO, 1994). It was previously thought that contaminated water supplies were the main source of pathogens causing diarrhoea, but it is now recognised that food plays an equally important role. It is estimated that up to 70% of cases of diarrhoeal diseases may be caused by contaminated food (WHO, 2000). Infections due to pathogenic strains of *E. coli* are probably the commonest cause of diarrhoea in developing countries accounting for up to 25% diarrhoea diseases in infants and children and have been specifically associated with complementary foods (WHO, 1998). Cholera is a serious problem in developing countries because of its health and socio-economic consequences. In 1991, it occurred in Latin America where some 19,295 died (WHO, 1994) and in 1997, 65 countries,

mainly in Africa, Asia and Latin America were affected with over 147,000 cases and 6,274 deaths (Quevedo, 1993). Water was believed to be the sole vehicle for transmission of cholera and other diarrhoeal diseases however, increasing numbers of epidemiological studies have shown that food is an equally important route of transmission (Esrey and Feacchem, 1989).

There has been little surveillance of foodborne illnesses and research done in Africa. As a result data are extremely scarce. Occasionally an acute illness directly associated with some food is documented, as for instance in Tanzania where the first outbreak of major botulism claiming at least 18 occurred in 1991 (Abramov, 1997).

In Kenya the prevalence of food-borne diseases are not easy to estimate as most of them are lumped together as diarrhoeal diseases. Data from the health information system of the Ministry of Health reveals that between 1997 and 1999, there were 6,833 cases and 566 deaths from food-borne diseases (ROK, 2000)

1.2.2 Food handling practices

The most important factors in the prevalence of food borne illnesses include the lack of appropriate knowledge on the part of food handlers or consumers and negligence (despite some knowledge) in safe food handling. Surveys of food borne disease outbreaks world-wide have shown that most such cases occur as a result of an error in handling food during preparation, in homes, food service points, catering establishments, hospital canteens, schools, the military or at banquets and parties (WHO, 2000). A major risk of food contamination may arise from food handlers, depending on their degree of conscientiousness in handling food, the amount of training

on food handling that they have received and the degree of supervision applied in each particular establishment (Hopkin, 1999).

A five-year study of food borne diseases in Saudi Arabia indicated an incidence of 22 cases per 100,000 persons and in about 56.7% of the incidences, food was incorrectly handled in the home. Workers camps and food service establishments were also major sites of food borne disease outbreaks (Alkanahl *et al.*, 1993).

World-wide, surveys of food borne disease outbreaks indicate that most of them resulted from poor food handling leading to contamination with and/or survival and growth of micro-organisms. For example, use of contaminated equipment, contamination by infected person, use of contaminated raw ingredients, cross-contamination and addition of toxic chemicals or use of foods containing natural toxicants were recognised as the major sources of food borne disease outbreaks in Israel (WHO, 1995).

1.2.3 Food handling regulatory measures

The Government has the responsibility of ensuring that up-to-date food legislation, relevant to the prevailing national problem is in place and is properly enforced. In this respect, there exists The Food Drugs and Chemical Substances Act Cap. 254 Laws of Kenya (Food Hygiene) in which regulations spell out the hygienic requirements to be observed in food establishments and The Public Health Act Cap. 242 which deals with sanitary measures to be observed in food premises.

In 1978, the Government of Kenya through the Ministry of Health developed the Food Inspection Code, for Public Health Officers (ROK, 1978). This was for purposes of operationalisation of the Cap. 254 of the Laws of Kenya.

Internationally, a number of tools have been developed, the Codex Alimentarius Commission, a joint commission by FAO/WHO which looks into food safety standards (FAO, 1995).

The International Standards Organization (ISO) 9000 of 1998 which deals mainly with quality assurance of manufactured foods (Hoyle, 1998). There are other voluntary programmes that promote good agricultural and manufacturing practices and the application of modern methods of foods safety assurance such as the Hazard Analysis Critical Control Point system (HACCP) (Bryan, 1992).

1.3 Rationale for the Study

1.3.1 Statement of the problem

Food borne diseases are a serious threat to Public Health in Kenya as evidenced by the frequent outbreaks of cholera, typhoid and other diarrhoeal diseases in the country. In the year 2001 alone, cholera outbreaks were reported in nine (9) districts in Kenya with a total of 1001 cases and 55 deaths. Three hundred and ninety six (396) of the cases and 27 deaths were from Wajir District and 291 of the cases and 2 deaths from Machakos District. (ROK, 2001) Majority of diarrhoea diseases (70%) could be due to food-borne illness (WHO, 2000). These continue to be among the top ten causes of morbidity in Embu and other parts of the country (ROK, 1994). Between February and April 2001, a typhoid outbreak occurred in Embu District with majority of the cases coming from Embu Municipality where 294 cases were reported with 23 deaths. Fifty

percent (50%) of the cases interviewed in this outbreak attributed their infection to consumption of food from commercial food establishments and schools (ROK, 2001)

The Kenya Health policy framework (ROK, 1994) recognised diarrhoeal diseases as among the top ten causes of morbidity and mortality. The situation of diarrhoeal diseases in Kenya including Embu district may be the same as reported elsewhere in the world where it is estimated that up to 70% of cases may be caused by contaminated food (WHO, 2000). The government of Kenya has put in place a number of regulatory measures for the purposes of controlling food safety in the country. Among them is the Public Health Act Cap. 242, which deals mainly with the sanitary measures to be considered in food establishments The Food Drugs and Chemical Substances Act Cap. 254, which address the health measures to be observed in food premises and the Food Inspection, Code (1978) which serves as guide for Public Health Officers in their routine inspection of food premises. But despite these efforts, food-borne disease outbreaks and illness continue to be reported in various parts of the country.

This being the situation, there was need to assess the food handling practises and the prevalence of food borne illnesses among the food handlers in eating houses in Embu Municipality

1.3.2 Research questions

This research sought to answer the following questions:

- (a) What factors influence food-handling practices among the foodhandlers?
- (b) Do these practices contribute to the transmission of food borne illnesses?
- (c) What proportion of food handlers are infected with specific food borne illnesses?

1.3.3 Justification/Significance of the study

1.3.3.1 Theoretical significance

There are no studies that have been carried out in Embu Municipality regarding food handling practises and prevalence of food borne diseases. This study therefore, will serve as a base line for such similar studies in the future.

1.3.3.2 Practical significance

The findings of this study will be of use to public health managers and administrators as they endeavour to reduce the disease burden from food borne illnesses. It will also provide a lot information and data that will go along way in the improvement and strengthening of the Public Health Act CAP. 242 and the Food Drugs and Chemical Substances Act CAP.254

1.4 Hypotheses

There are no unhygienic food handling practices among the handlers in Embu Town.

There is no significant prevalence of food borne illnesses among food handlers in Embu Municipality.

1.5 Objectives of the Study

1.5.1 General Objective

To assess the food handling practices and the Prevalence of food borne illness the food handlers in Embu Municipality

1.5.2 Specific Objectives

- a) To determine the prevalence of food borne pathogens among the food handlers in the study area.
- b) To assess the level of knowledge of food borne illness amongst the food handlers in the study area.

- c) To identify the current food handling practices and compliance with health requirements amongst the food handlers in the study area.

CHAPTER TWO: MATERIALS AND METHODS

2.1 The study area

The study will be carried out in Embu Municipality (figures: 1,2,and3). Embu Municipality is within the Central Division of Embu District. It is one of the 5 divisions of Embu District, which is in Eastern Province.

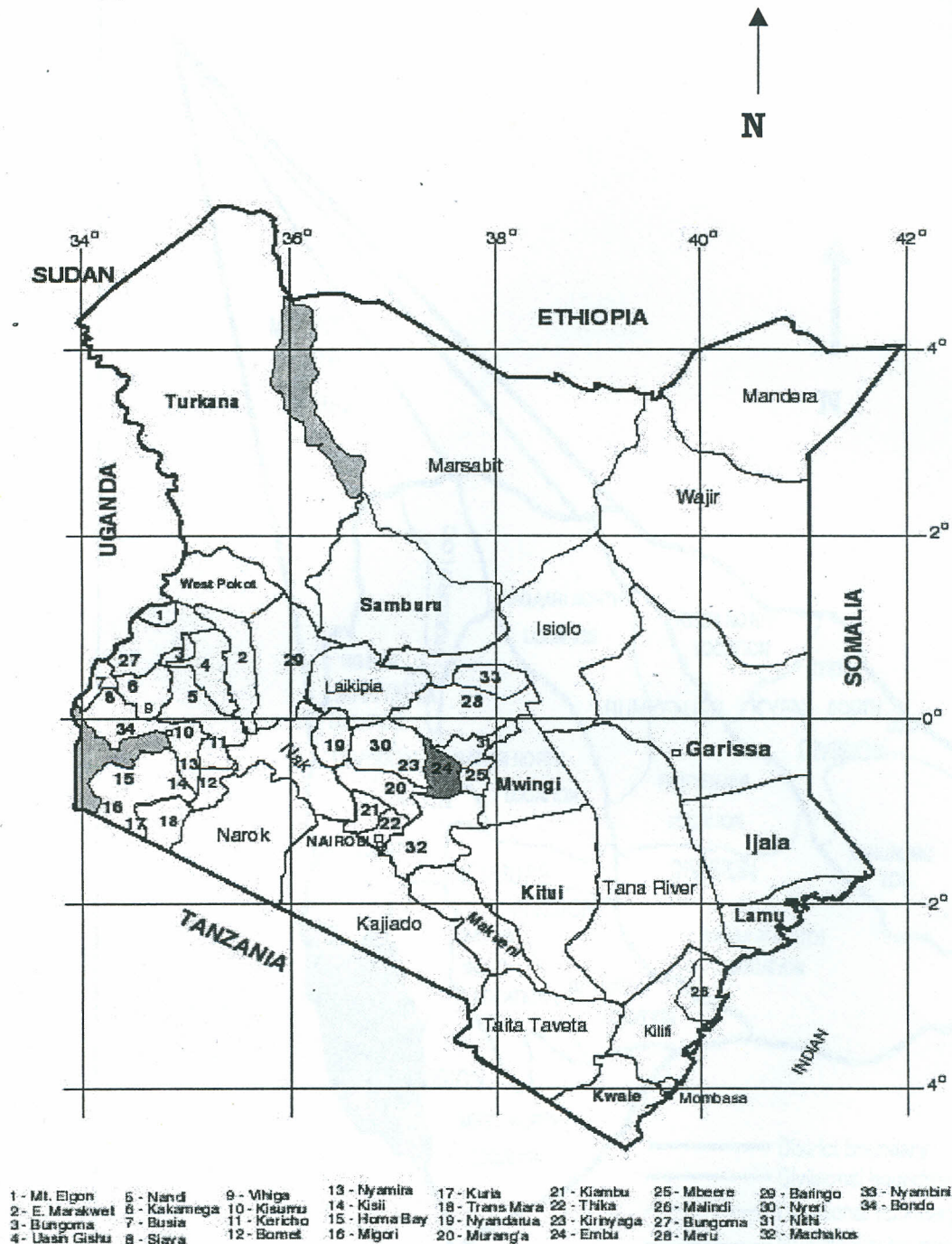
It lies approximately between longitude $37^{\circ} 27'$ East and latitude $0^{\circ}27'$ South at an altitude of 1400m. It occupies an area of 80 square Kilometres and is divided into two administrative locations and seven sub-locations. The locations include Embu Municipality and Mbeti North.

The Municipality has a population of 52,446 people, comprising of 26,237 males and 26,446 females (ROK, 1999).

Embu Municipality is the business center for Embu District and the headquarters for Eastern Province. Wholesale and retail shops form the bulk of the businesses operated within Embu Municipality. There are a number of catering businesses in the Municipality with over 100 eating-houses. The Municipality also has *Jua kali* shades, small-scale industries, coffee factories and a tannery.

Embu Municipality has a total of nine health facilities, one Provincial General Hospital, one mission hospital, four dispensaries, two private dispensaries and one nursing home(ROK,1997).

Figure 1: Location of Embu District



Scale 1:4 500 000
0 50 100 150 200 250 Kms

Figure 2: Location of Embu municipality

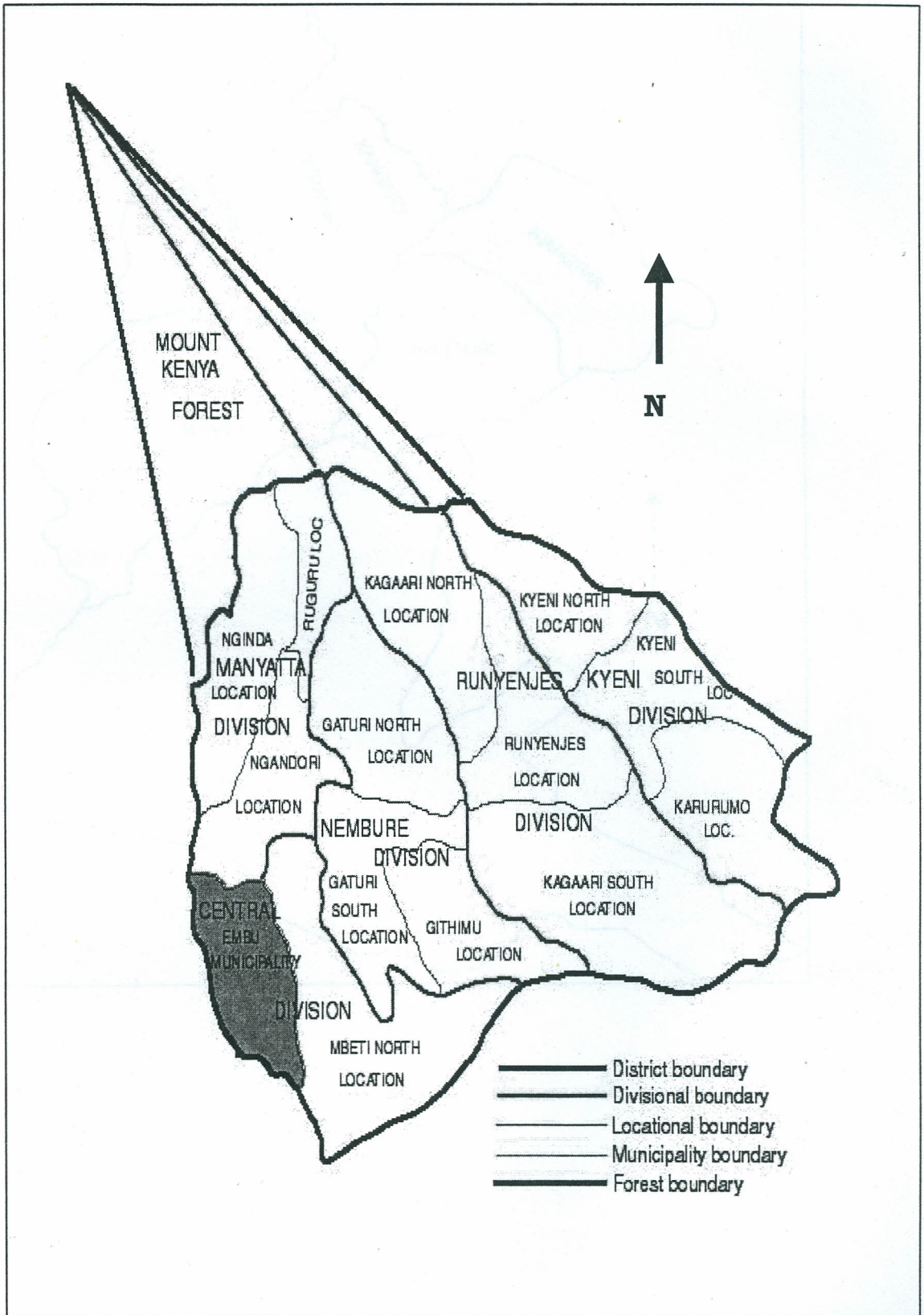
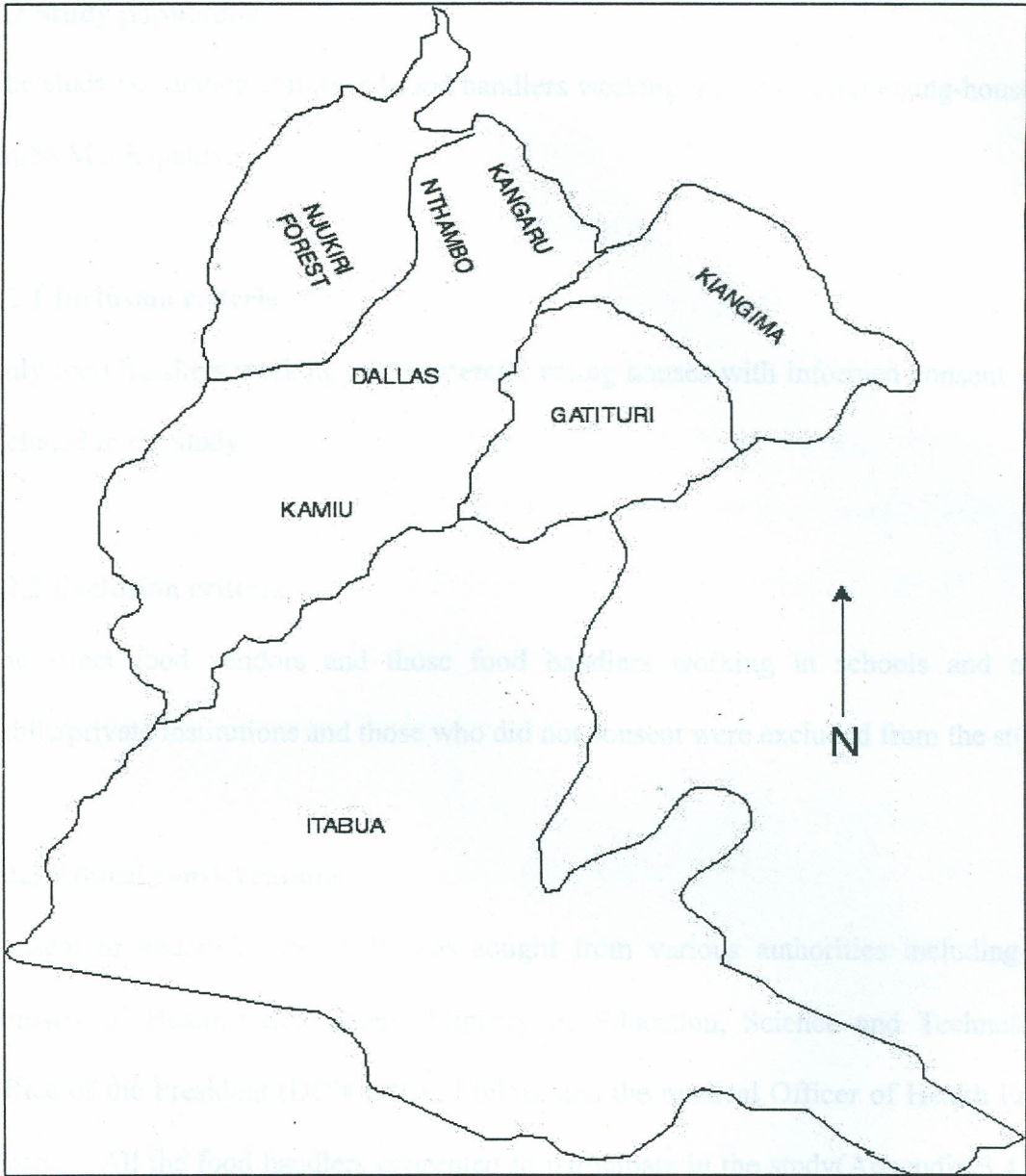


Figure 3: Map of Embu Municipality



2.2 Study population

The study population comprised food handlers working in commercial eating-houses in Embu Municipality.

2.2.1 Inclusion criteria

Only food handlers working in commercial eating houses with informed consent were included in the study.

2.2.2 Exclusion criteria

The street food vendors and those food handlers working in schools and other public/private institutions and those who did not consent were excluded from the study.

2.2.3 Ethical considerations

Consent to undertake the study was sought from various authorities including the Ministry of Health-Headquarters, Ministry of Education, Science and Technology, Office of the President (DC's office, Embu), and the medical Officer of Health Embu District. All the food handlers consented to participate in the study (Appendix 3,4 and 5).

2.3 The study design

This was a descriptive cross-sectional study.

2.4 Sampling and sample size determination

2.4.1 Sampling

Embu Municipality which is within the central division of Embu District was purposively selected due to financial limitations.

Both random and systematic sampling procedures were used. Days for examining the food handlers to be included in the study were chosen at random using random tables and the food handlers to be included were identified systematically, every third person, each day from the queue of food handlers attending routine medical check up at the District health office until a total of 242 was covered. The food handlers were given poly pots and instructed on how to collect the stool specimen and deliver to the laboratory within one hour of collection. The food handlers examined above were also interviewed on knowledge of food borne illnesses.

The food handlers were followed within a week's time after the laboratory results were out, to the different categories of eating houses they came from and subjected to the questionnaire on food handling practises, together with all other food handlers found working within the eating houses without further sampling.

2.4.2 Sample size.

Data available at the District Health office Embu indicates that food handlers from commercial eating-houses are 612 persons.

A representative minimum sample size of the population was therefore determined using the formula previously used by Fisher *et al.*, (1998) formula thus:

$$N = \frac{Z^2 Pq D}{d^2}$$

Where:

- N = Minimum required sample size
- P = Proportion of target population to be sampled in this case 0.5
- Z = Confidence level in this case 1.96
- q = 1 - P
- d = Degree of accuracy desired in this case 0.05.
- D = Design effect in this case 1

As the design effect in my study was one, the minimum required sample size was 400. Since the total estimated population for food handlers in Embu town was 612 persons, minimum sample size was calculated using the formula as used by Fisher *et al.*, 1998 for population < 10,000.

$$NF = \frac{N}{1+(n/N)}$$

Where:

- Nf = Minimum required sample size
- n = Minimum sample obtained in the above formula = 400
- N = Estimated population of food handlers = 612

This gave the minimum required sample size as 242 food handlers. The sampling frame included the food handlers working in the various eating houses within Embu Municipality, which were categorized as: -

Tourist hotels: These included high-class hotels where local and international financial transactions and bookings are undertaken.

Budget hotels: These were middle class hotels and restaurants

Fast-food-hotels: This encompassed chips shops, snack bars and roast meat and (*Nyama Choma*) premises,

Kiosks : Temporary and semi-permanent structures where food was prepared.

2.5 Data collection procedures and instruments

The food handlers were subjected to medical examination as prescribed in Appendix 1. The food handlers were issued with Poly pots and instructed on how to collect and deliver the stool specimens. The stool specimens were received at the laboratory whereby they were labelled appropriately. The stool specimens were then processed for ova and cyst analysis through Riches Modified Formol Ether Stool Concentration Method and culture for identification of pathogenic bacteria. Both tests were carried out on specimens through procedures and techniques as described by Cheesbrough (1998 and 2000). When the food handlers were registered for medical examination, they were subjected to pre-tested structured Questionnaire (Appendix 1 B) to test their knowledge on food borne illnesses. Thereafter within a period of at least a week when the laboratory results were out the food handlers were followed to the respective categories of eating houses and subjected to food handling practices assessment using pre-tested in questionnaire as outlined in Appendix 1 C.

The above mentioned questionnaires were designed in light of the objectives. The questionnaires were pre-tested outside Embu Municipality in Runyenjes town in order to establish their validity and reliability. The questionnaires were modified accordingly after pre-testing in order to avoid bias when collecting data on food handling practices, the food premises were visited without prior information.

2.6 Data management and analysis

All data were treated with confidentiality where necessary. Information from the questionnaire was entered into statistical packages of social sciences (SPSS/PC + Inc., 444N. Michigan Avenue Chicago, IL60611 (312) 329-3600 computer package which was used in the analysis). The results were presented in descriptive and inferential methods. The descriptive methods were in form of tables and figures. The inferential method was mainly chi-square to test associations of selected socio-demographic factors, incidence of food borne diseases, knowledge of food handlers and food handling practices. In the processing of data on knowledge of food borne illnesses, this study developed a scoring index (Appendix 2) where a score of one was given for each correct response. For each outcome variable, the scores for the various questions were summed up and categorized as follow: <50% expected maximum score as low knowledge (score 0-1), and $\geq 50\%$ as high knowledge (score 2-3).

CHAPTER THREE: RESULTS

3.1 Selected socio-demographic characteristics of the study population

The selected socio-demographic characteristics of the 242 subjects of the study are as shown in Figures 4,5, 6 and 7.

3.1.1 Age

The age of the food handlers interviewed and examined on food borne diseases ranged between 18 and 56 years with a mean age of 27.5 years, The majority of the food handlers (66.5%) were 18 to 28 years. Those food handlers who were above 28 years were eighty-one (33.5%) (Figure 4).

3.1.2 Sex

One hundred and twenty five (51.7%) of the food handlers interviewed and examined on food borne diseases were females and one hundred and seventeen (48.3%) were males (Figure 5).

3.1.3 Level of Education.

The majority of the food handlers (57.4%) had secondary school education, eighty-five (35.1%) had primary education, fifteen (6.2%) had college/university and only a few (1.2%) did not have formal education (Figure 6).

3.1.4 Distribution of foodhandlers-by category of eating-house.

One hundred and three (42.6%) of the food handlers interviewed and examined on food borne illnesses had come from budget hotel while the distribution of the rest were as

follows: one hundred and five (43.4%) from fast food hotel, eighteen (7.4%) from kiosk and sixteen (6.6%) from tourist hotel (Figure 7).

3.2.0 Prevalence of food borne pathogens among the food handlers

To determine the Prevalence of food borne pathogens among the food handlers, stool specimen were taken from the food handlers for ova and cyst through Riches Modified Formal Ether Concentration Method and Stool culture for identification of pathogenic bacteria. The results were as shown in Table 1 and 2.

3.2.1 Ova and cyst

Ova were not isolated in any of the two hundred and forty two (242) specimens. Out of two hundred and forty two (242) specimens examined for ova and cyst, only ten (4.1%) were found to contain cysts of *Entamoeba histolytica*, three (1.2%), The rest two hundred and thirty two specimens (95.9%) were negative. The results were re-grouped further according to the number of food handlers as per each category of eating-house. The results show that there was at least a food handler from each category with *Entamoeba histolytica*. The proportions were as follows; two (0.8%) from tourist, three (1.2%) from fast food, four (1.7%) from budget hotels and one (0.4%) from kiosks. (Table 1)

Figure 4: Age distribution of food handlers

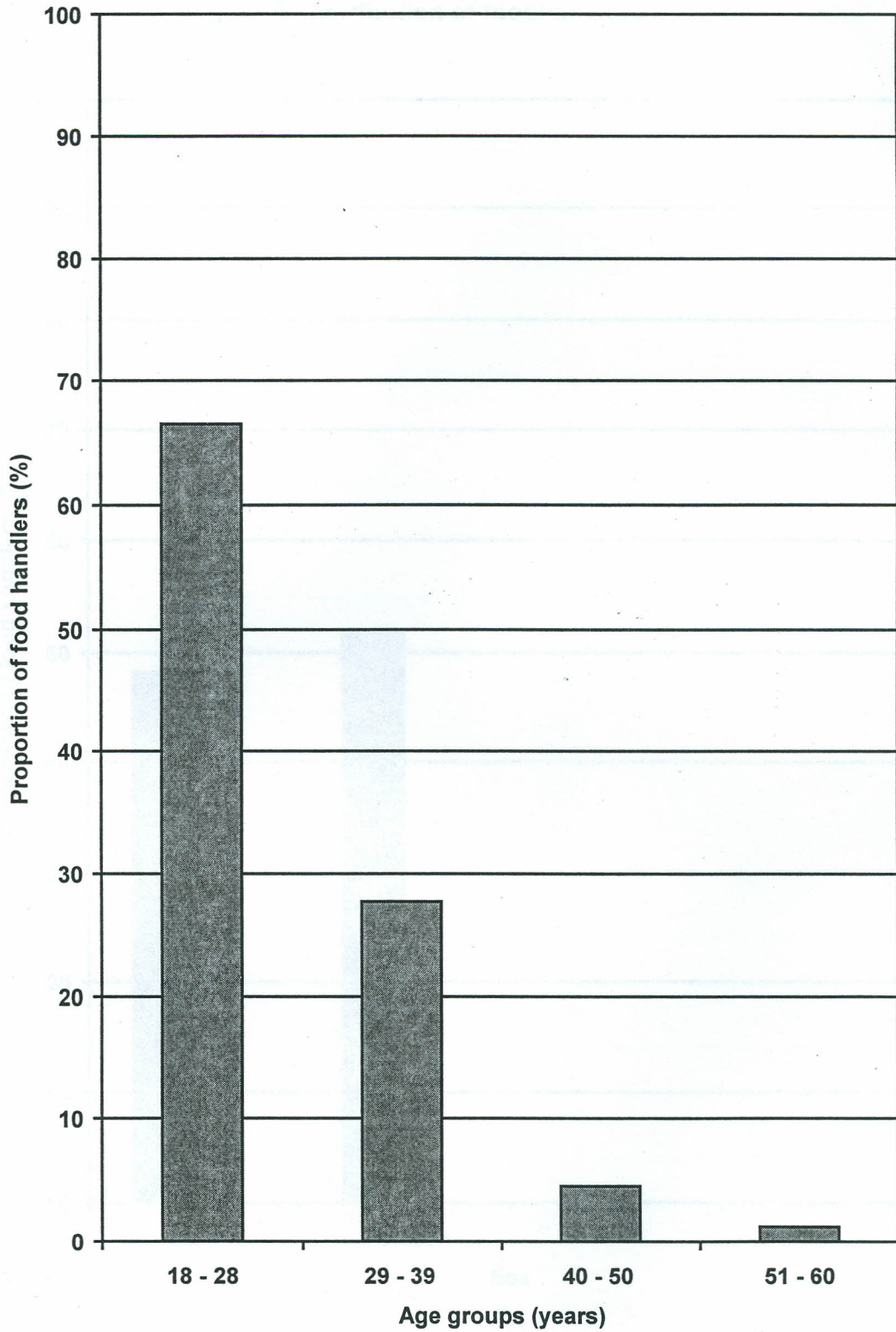


Figure 5: Distribution of foodhandlers by sex

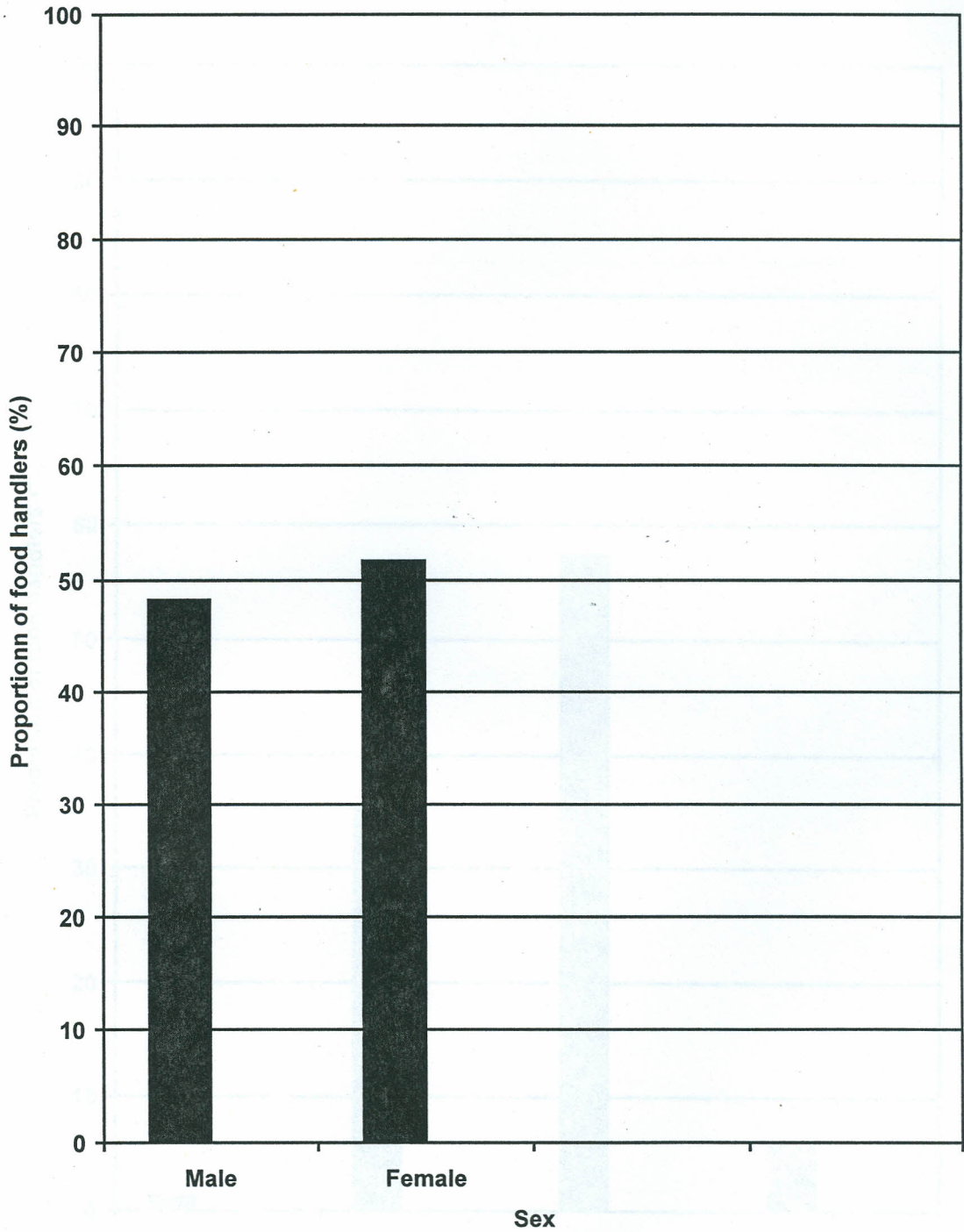


Figure 6: Food handlers education Level

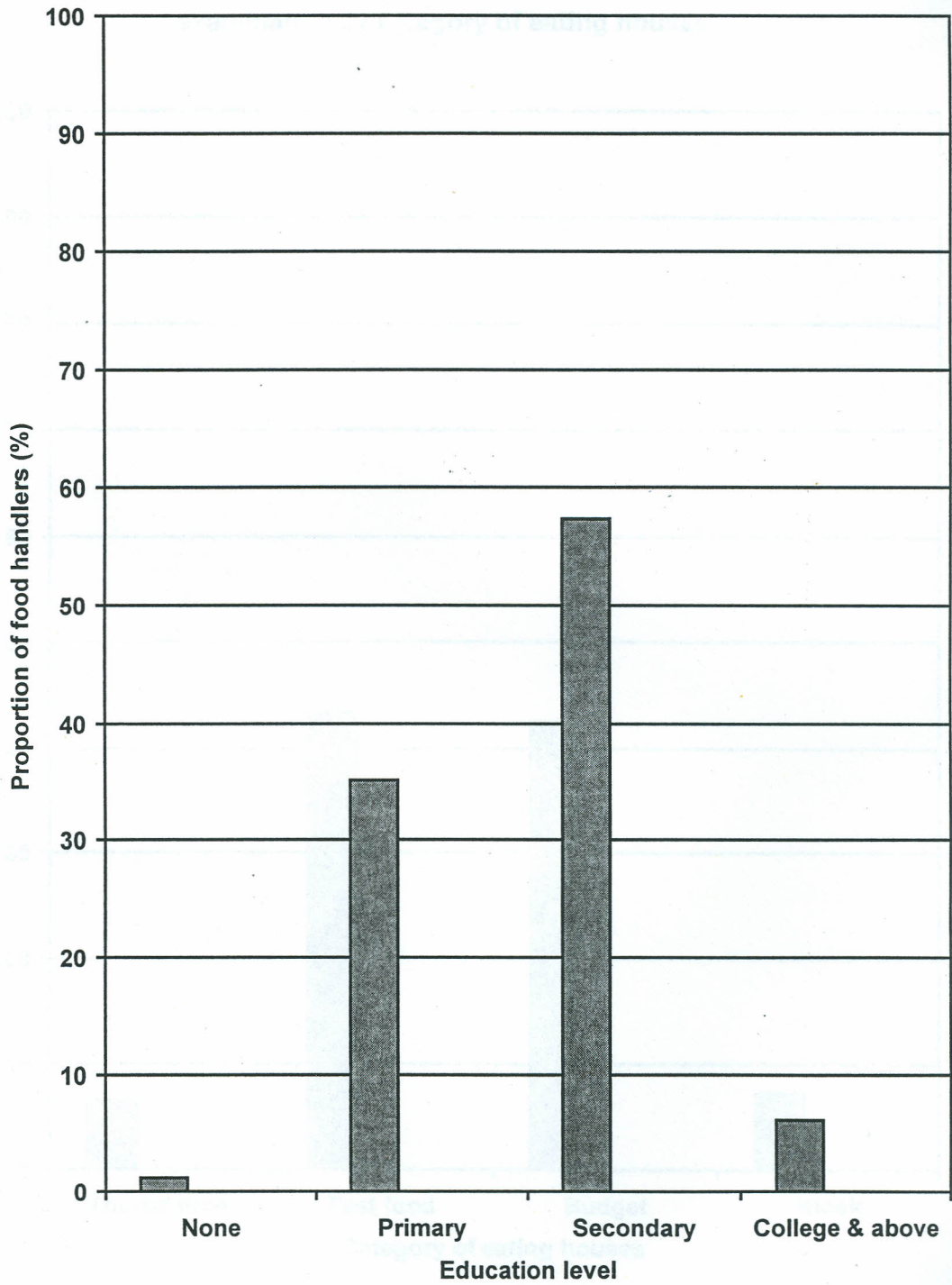
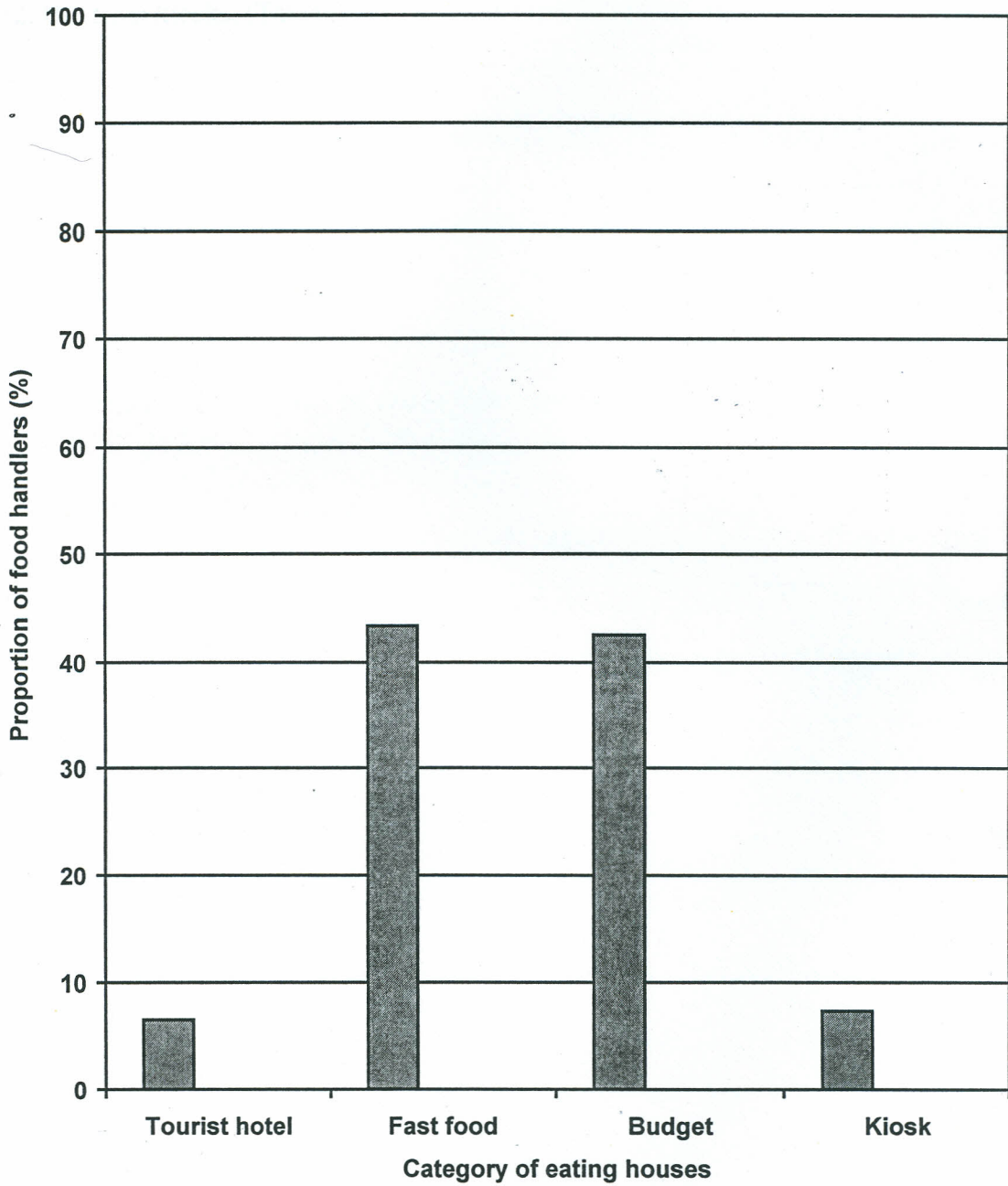


Figure 7: Distribution of food handlers who attended medical examination by category of eating houses



3.2.2 Stool Culture

Two hundred and forty two (242) specimens were examined for pathogenic bacteria out of these, seventy (28.9%) were found to contain *Salmonella typhi*. One hundred and seventy two (71.1%) did not. Of those infected with *Salmonella typhi*, fortyfive (18.6%) were from fast food, eighteen (7.4%) were from budget hotels and seven (2.9%) from kiosks. (Table2)

Table 2: Results of stool examination for pathogenic bacteria

Type of test	Pathogenic organism	Number	Percentage
Stool Culture	Positive for <i>Salmonella typhi</i>	70	28.9
	Negative for <i>Salmonella typhi</i>	172	71.1

Table 1: Results of stool examination specimen for Ova and Cysts

Type of test	Pathogenic organism	Number	Proportion
OVA AND CYST	Positive for <i>E.histolytica</i>	10	4.1
	Negative for <i>E.histolytica</i>	232	95.9
	Positive for Ova	0	0
	Negative for Ova	242	100

Table 2: Results of stool examination specimen for Culture

Type of test	Pathogenic organism	Number	Proportion
Culture	Positive for <i>Salmonella typhi</i>	70	28.9
	Negative for <i>Salmonella typhi</i>	172	71.1

3.2.3 Physical Examination

Physical examination was carried out on food handlers to ascertain whether they had any clinical conditions that could endanger food-handling practices. In the physical examination, Long fingernails were those that protruded beyond the fingertips and short fingernails were those that did not protrude beyond the fingertips. Long hair was regarded as hair that had grown beyond 15mm, while short hair was that hair which had grown up to a height of equal to or less than 15mm (15mm is equivalent to gauge two (2) of the electrical shaving machines)

The results of physical examination are as shown in Table3, distributed according to category of eating-houses. The results of two hundred and forty two (242) food handlers that were examined none had nasal eye or ear discharges. Signs of lice were a rare condition they were found only in five (2.1%) of the food handlers. These were four (3.8%) out of those in fast food eating-houses and one (1.0%) in budget eating-houses. Dandruff was found in seven (2.9%) of the food handlers. These were three (2.9%) out of those in fast food, three (2.9%) in budget hotel and (6.3%) in tourist hotel. Cuts and wounds were found in eight (3.3%) of the food handlers. These were five (4.8%)out of those in budget hotels. There was no food handler from tourist hotels and kiosks with cuts and wounds.

The most common condition was long hair, which was found in one hundred and fifty (62%) of the food handlers. These were seventy two (68.6%) out of those in fast food fifty seven (53.3%) in budget hotels, thirteen (72.2%) in kiosks, eight (50%) in tourist hotels. Long finger nails was the second most common condition which was found in, ninety five (39.3) of the food handlers. These were forty three (41.7%)out of those in budget hotels, thirty nine (37.1) in fast food hotels, six (33.3%) in kiosks and seven (43.8%) in tourist hotels.

Table 3: Distribution of various clinical conditions and health requirements on food handlers according to category of eating-house

Condition	Category of eating house								Total	
	Tourist hotel		Fast food		Budget		Kiosk			
	No	%	No	%	No	%	No	%	No	%
Long finger nails										
Yes	7	43.8	39	37.1	43	41.7	6	33.3	95	39.3
No	9	56.2	66	62.9	60	58.3	12	66.7	147	60.7
Short Hair										
Yes	8	50.0	33	31.4	46	44.7	5	27.8	92	38.0
No	8	50.0	72	68.6	57	53.3	13	72.2	150	62.0
Cuts and wounds										
Yes	0	0	5	4.8	3	2.9	0	0	8	3.3
No	16	100	100	95.2	100	97.1	18	100	235	97.1
Dandruff										
Yes	1	0.4	3	1.2	3	1.2	0	0	7	2.9
No	15	93.7	102	97.1	100	97.1	18	100	234	96.7
Sign of lice										
Yes	0	0	4	3.8	1	1.0	0	0	5	2.1
No	16	100	101	96.2	102	99	18	100	237	97.9
Nasal discharge										
Yes	0	0	0	0	0	0	0	0	0	0
No	16	100	105	100	103	100	18	100	242	100
Eye discharge										
Yes	0	0	0	0	0	0	0	0	0	0
No	16	100	105	100	103	100	18	100	242	100
Ear discharge										
Yes	0	0	0	0	0	0	0	0	0	0
No	16	100	105	100	103	100	18	100	242	100

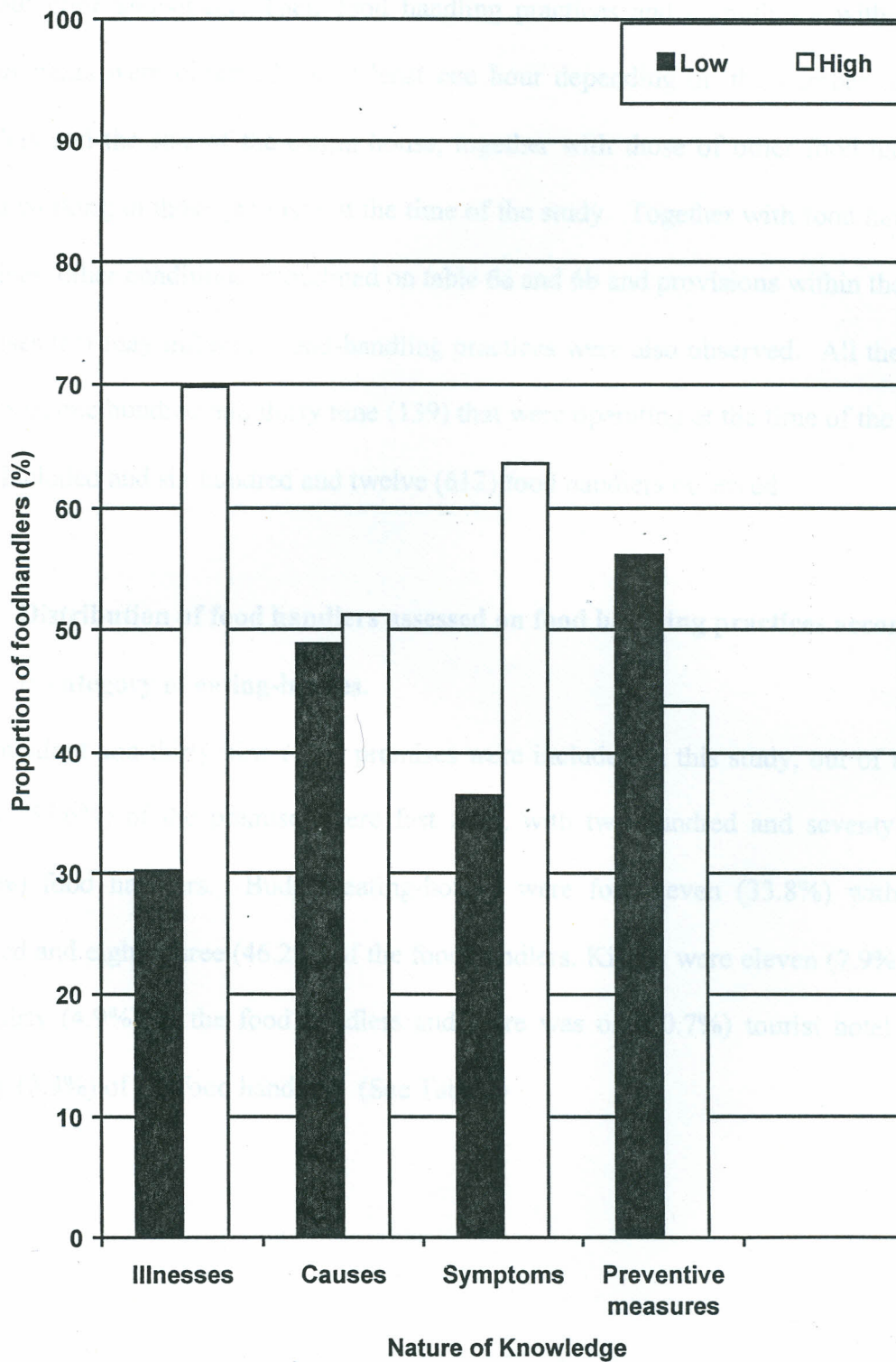
No = Number

3.3 Knowledge of food borne illness among the food handlers

Knowledge of food borne illnesses was collapsed into two categories as shown on knowledge index (Appendix 2) that was developed purposely for this study. The two categories were as follows: those who knew 0- 1 (low knowledge) and those who knew 2-3 or more (high knowledge).

Two hundred and forty two (242) food handlers were interviewed through a structured questionnaire to test their knowledge on food borne illnesses, causes, symptoms and preventive measures (Figure 8). The overall knowledge mean score of food borne illness amongst the food handlers was 53.1%. Majority of the food handlers, one hundred and sixty nine (69.8%) knew two or more specific food borne illnesses, while seventy-three (30.2%) knew one or none. One hundred and fifty four (63.6%) knew at least 2 or 3 symptoms of the food borne illnesses, while eighty-eight (36.4%) knew 1 or none. One hundred and twenty four (51.2%) knew 2 or 3 causes of food borne illnesses, but one hundred eighteen knew 1 or none. The least known were the preventive measures, as only one hundred and six (43.8%) knew 2 or 3 preventive measures, while the rest, one hundred and thirty six (56.2) knew 1 or none (Figure 8).

Figure 8: Knowledge of foodborne illnesses amongst food handlers



3.4 Food handling practices and compliance with health requirements

After the food handlers were subjected to medical examination, and interviewed on the knowledge of food borne illness, they were followed to their respective eating houses without prior knowledge. Their food handling practices and compliance with health requirements were observed for at least one hour depending on the number of food handlers and the size of the eating house, together with those of other food handlers found working in those premises at the time of the study. Together with food handling practices, other conditions as outlined on table 6a and 6b and provisions within the food premises that may influence food-handling practices were also observed. All the food premises, one hundred and thirty nine (139) that were operating at the time of the study were included and six hundred and twelve (612) food handlers observed.

3.4.1 Distribution of food handlers assessed on food handling practices according to category of eating-houses.

One hundred and thirty nine (139) premises were included in this study, out of these, eighty (57.6%) of the premises were fast food, with two hundred and seventy nine (45.6%) food handlers. Budget eating-houses were forty-seven (33.8%) with two hundred and eighty three (46.2%) of the food handlers. Kiosks were eleven (7.9%) and had thirty (4.9%) of the food handlers and there was one (0.7%) tourist hotel with twenty (3.3%) of the food handlers. (See Table4)

Table 4: Distributions of food handlers assessed on food handling practices according to categories of eating-houses.

Category of eating house	Number of premises and food handlers			
	Premises		Food handlers	
	No	%	No	%
Tourist hotel	1	0.7	20	3.3
Fast food	80	57.6	279	45.6
Budget	47	33.8	283	46.2
Kiosk	11	7.9	30	4.9
Total	139	100	612	100

No = Number

3.4.2 Distribution of food handler assessed on food handling practices by sex.

Observation on food handling practices was done on six hundred and twelve (612) food handlers, four hundred and nine (66.8%) were males. With one hundred and ninety three (68.7%) of those working in fast food being males, one hundred and eighty seven (66.5%) in budget, eighteen (60%) in kiosks and eleven (60%) in tourist hotels. Two hundred and three (33.2%) were females, with ninety-four (33.5%) of those working in budget hotel, eighty-eight (31.3%) in fast food, twelve (40%) in kiosk and nine (45%) from tourist hotel.

(Table 5)

3.4.3. Distribution of food handlers with medical certificates.

Six hundred and twelve (612) food handlers were checked to ascertain whether they possessed valid medical certificates. Three hundred and fifty six (58.2%) of the food handlers had valid medical certificate, majority of these (62.3%) out of those working in fast food eating houses, one hundred and fifty eight (56.2%) from budget, twelve (40%) from kiosks and eleven (55.0%) from tourist hotel (Table 6).

Table 5: Distribution of foodhandlers assessed on food handling practices by sex according to category of eating-house

Category of eating house	Sex of food handlers					
	Male		Female		Total	
	No.	%	No.	%	No.	%
Tourist	11	55.0	9	45.0	20	100
Fast food	193	68.7	88	31.3	281	100
Budget	187	66.5	94	33.5	281	100
Kiosk	18	60.0	12	40.0	30	100
Total	409	66.8	203	33.2	612	100

No = Number

Table 6 Distribution of food handlers with medical certificates

Category of eating house	Medical certificates					
	With certificates		Without certificates		Total	
	No	%	No	%	No	%
Tourist	11	55.0	9	45.0	20	100
Fast food	175	62.3	106	37.7	281	100
Budget	158	56.2	123	43.8	281	100
Kiosk	12	40.0	18	60.0	30	100
Total	356	58.2	256	41.8	612	100

No = Number

3.4.4. Observation on food handling practices

The results on observation made on food handling practices were as shown on Table 7.

3.4.4.1 Use of protective garments

Out of six hundred and twelve (612) food handlers that were observed, it was found that four hundred and eighty three (78.9%) of the food handlers were using protective garments. These were two hundred and twenty one (78.6%) out of those working in fast food, two hundred and eighteen (77.6%) budget, twenty four (80%) from kiosks and all the food handlers in tourist hotel, twenty (100%).

3.4.4.2. Condition of protective garments

From the four hundred and eight three (483) food handlers found wearing protective garments, three hundred and thirty one (68.5%) were clean protective garments. These were one hundred and fifty five (70.1%) of those working in fast food eating houses, one hundred and fifty five (66.5%) budget hotels, all twenty (100%) from tourist hotel and eleven (45.8%) in kiosks.

3.4.4.3 Use of head covers by cooks

There were one hundred and ninety one (191) cooks working in various categories of eating-houses. Thirty-nine (20.4%) of them were found wearing head covers. These were nineteen (9.9%) out of those working in fast food eating houses, twelve (15%) from budget, all five (100%) from tourist and three (27.3%) in kiosks.

3.4.4.4. Washing of hands before touching food.

The practice was observed in four hundred and ninety nine (81.3%) of the six hundred and twelve (612) food handlers. These were two hundred and fifty three (90%) of those working fast food, two hundred and four (72.6%) budget, all twenty (100%) in tourist hotel and twenty-two (73.3%) in kiosks.

3.4.4.5. Hand washing after touching raw foods

This was observed in three hundred and fifty two (57.5%) of the food handlers, out of the six hundred and twelve (612). These were one hundred and eighty three (65.1%) out of those working in fast food, one hundred and twenty five (44.5%) in budget, twenty-four (80%) in kiosks and all twenty (100%) in tourist hotels.

3.4.4.6. Touching of foods directly with bare hands.

This was observed in three hundred and thirty seven (55.1%) of the food handlers from a total of six hundred and twelve. These were one hundred and forty nine (53.0%) out of those working in fast food, one hundred and forty four (51.2%) in budget, twenty-four (80%) in kiosks, all twenty (100%) from tourist hotel.

3.4.4.7. Cashiers handling food after handling money

There were one hundred and thirty nine (139) cashiers in all the food premises studied. Eighty-nine (64%) of the cashiers were found handling food immediately after handling money without washing hands. These were fifty (62.5%) out of those working in fast food, thirty (66.0%) in budget, eight (72.2%) in kiosk and none (0%) from tourist.

3.4.4.8. Licking of fingers by food handlers while handling food

This was a rare practice as out of six hundred and twelve (612) food handlers, it was observed in one hundred and twenty (19.8%) of the food handlers. These were sixty five (23.3%) out of those in budget, fifty two (18.5%) in fast food, four (13.3%) from kiosk and none (0%) from tourist hotel.

3.4.4.9. Blowing into wrapping papers to open them for packing.

Out of the six hundred, and twelve (612) food handlers observed, one hundred and nineteen (19.4%) were found practicing this. These were fifty six (20%) out of those working in fast food, fifty three (18.9%) in budget, ten (33.3%) in kiosk and none (0%) from tourist hotel.

3.4.4.10 Smoking within food premises

It was a rare practice as it was observed in only twelve (2.0%) of the food handlers out of six hundred and twelve. These were five (1.8%) out of those working in budget, four (2.5%) in fast food and none from kiosks and tourist hotels.

3.4.4.11 Scratching and touching foods without washing hands.

Six hundred and twelve (612) food handlers were observed. One hundred and four (17%) were found with this practice, fifty-seven (9.3%) were from fast food, forty-three (7.0%) from budget, four (0.7%) from kiosk and none from tourist hotels.

3.4.4.12 Spitting within the food premises while serving or preparing food.

This was a very rare practice. Out of six hundred and twelve food handlers observed, it was only found in two (0.3%) of the food handlers and both were from fast food eating-house.

Table 7: Distribution of food handling practices among the food handlers according to category of eating-house

Practices		Category of eating house									
		Tourist		Fast food		Budget		Kiosk		Total	
		No	%	No	%	No	%	No	%	No	%
Using protective garments	Yes	20	100	221	78.6	218	77.6	24	80.0	483	78.9
	No	0	0	60	21.4	63	22.4	6	20.0	129	21.1
Clean protective garments	Yes	20	100	155	70.1	145	66.5	11	45.8	331	68.5
	No	0	0	66	29.9	73	33.5	13	54.2	152	31.5
Use of head cover by cooks	Yes	5	100	19	20.0	12	15.0	3	27.3	39	20.4
	No	0	0	76	80.0	68	85.0	8	72.7	152	79.6
Washing of hands before touching food	Yes	20	100	253	90.0	204	76.6	22	73.3	499	81.5
	No	0	0	28	10.0	77	27.4	8	26.7	113	18.5
Washing of hands after touching raw food	Yes	20	100	183	65.1	125	44.5	24	80.0	352	57.5
	No	0	0	98	34.9	156	55.5	6	20.0	260	42.5
Touching of foods with bare hands	Yes	20	100	149	53.0	144	51.2	24	80.0	337	55.1
	No	0	0	132	47.0	137	48.8	6	20.0	275	44.9
Cashiers handling food after handling money	Yes	0	0	50	62.5	31	66.0	8	72.7	89	64
	No	1	100	30	37.5	16	34.0	3	27.3	50	36
Licking of fingers	Yes	0	0	52	18.5	65	23.1	4	13.3	121	19.8
	No	20	100	229	81.5	216	76.9	26	86.7	491	80.2
Blowing into wrapping papers	Yes	0	0	56	20.0	53	18.9	10	33.3	119	19.4
	No	20	100	225	80.0	228	81.1	20	66.7	493	80.6
Smoking in food premises	Yes	0	0	7	2.5	5	1.8	0	0	12	2.0
	No	20	100	274	97.5	276	98.2	30	100	600	98.0
Scratching and touching foods without washing hands	Yes	0	0	57	20.3	43	15.3	4	13.3	104	17.0
	No	20	100	224	79.7	238	84.7	26	86.7	508	83.0
Spitting while serving or preparing food	Yes	0	0	2	0.3	0	0	0	0	2	0.3
	No	20	100	279	99.3	281	100	30	100	610	99.7

3.4.5 Conditions and provisions that may influence food handlers' practices

These results on conditions and provisions that may influence the food handlers practices on food handling are as shown on Table 8a and 8b

3.4.5.1 Wiping and drying utensils with towels

The practice of wiping utensils with towels before serving food on them was observed in eighty-seven (62.6%) of the food premises out of one hundred and thirty nine. These were forty-five (56.3%) out those working in fast food, thirty-seven (78.7%) in budget hotels, four (36.4%) in kiosk and none in tourist hotel.

3.4.5.2 Condition of the towels used for wiping and drying utensils

In the eighty-seven (87) food premises where towels were used for wiping and drying utensils, fifty-two (37.4%) were found to be dirty. Among the dirty towels, were thirty five (43.7%) out of those used in fast food, ten (21.3%) in budget; seven (63.6%) in kiosks and none in tourist hotel.

3.4.5.3 The practice of re-using chopping boards used on raw foods to handle cooked foods.

This practice was observed in twenty-three (16.5%) of the eating-houses out of one hundred and thirty nine (139). These were seventeen (21.3%) out of those in fast food, six (12.8%) in budget and none from kiosks and tourist hotel.

3.4.5.4 The practice of re-using raw foods knife on cooked foods.

This was not a common practice as it was observed in twenty (14.4%) of the eating-houses, out of the one hundred and thirty nine. These were fourteen (17.5%) out of the in fast food and six (12.8%) in budget hotels.

3.4.5.5 Provision of wash hand facilities in the eating-houses

All the one hundred and thirty nine (139) eating houses were using various types of hand washing facilities. Wash hand basins were the most common and were used in one hundred and seventeen (84.2%) of the eating houses. These were sixty six (82.5%) out of those in fast food, forty six (97.9%) in budget, four (36.4%) in kiosks and one (100%) from tourist hotel. Other eating-houses used jua kali boilers bucket with jug, basin and jug and stand pipe.

3.4.5.6 Provision of cold storage facilities

Seventy-two (51.8%) of the food premises out of one hundred and thirty nine (139) did not have cold storage facilities. These were provided in only sixty-seven (48.2%) of the food premises. Two types were provided, refrigerators in twenty-nine (28.1%) of the food premises. These were twenty-one (26.3%) out of those in fast food, fifteen (31.9%) in budget and two (18.2%) in kiosks. Twenty-eight (20.1%) of the food premises were provided with freezers. These were sixteen (20.0%) in fast food, twelve (25.5%) in budget, none in tourist hotel and kiosks.

3.4.5.7 Provision of refuse containers

In the one hundred and thirty nine (139) food premises, refuse containers were provided in one hundred and twenty two (87.8%). These were sixty-five (81.3%) out of those in fast food, forty-seven (100%) in budget, nine (81.8) in kiosks and one (100%) in tourist hotel.

3.4.5.8 Provisions of refuse covers to refuse containers.

Of the one hundred and twenty two (122) refuse containers, provided only twenty two (5.8%) had covers. These were thirteen (16.3%) out of those in fast food, eight (17.0%) from budget, one (100%) from tourist and none from kiosk.

3.4.5.9 Source of the water used in the kitchen.

In one hundred and thirty nine (139) food premises, one hundred and twenty seven (91.4%) had water taps in the kitchen. These were seventy two (90.0%) out of those in fast food, forty-five (95.7%) in budget, nine (81.8%) in kiosk and one (100%) from tourist. Other sources of water for food premises were storage tank (7.0) drums (1.4%).

3.4.5.10 Distance to water source from the kitchen.

One hundred and twenty seven (91.4%) of the food premises had water taps in the kitchen. Only twelve (8.6%) had water source between 1 to 2 metres and above.

Table 8a: Distribution of conditions and provisions that influence food-handling practices according to category of eating-house.

Condition	Category of eating house										
	Tourist		Fast food		Budget		Kiosk		Total		
	No	%	No	%	No	%	No	%	No	%	
Wiping utensils with towels	Yes	1	100	45	56.3	37	78.7	4	36.4	87	62.6
	No	0	0	35	43.7	10	21.3	7	63.6	52	37.4
Use of clean towel	Yes	1	100	45	56.3	37	78.7	4	36.4	87	62.6
	No	0	0	35	43.7	10	21.3	7	63.6	52	37.4
Unhygienic use of Chopping boards	Yes	0	100	17	21.3	6	12.8	0	0	52	16.5
	No	1	0	63	78.7	41	87.2	11	100	116	83.5
Raw knife usage on cooked foods	Yes	0	100	14	17.5	6	12.8	0	0	20	14.4
	No	0	0	66	82.5	41	87.2	11	100	119	85.6
Type of wash hand facilities provided -	Wash hand basin	1	100	66	82.5	46	97.9	4	336.4	117	84.2
	Bucket with jug	0	0	3	3.8	0	0	3	27.3	6	4.3
	Basin and jug	0	0	2	2.5	0	0	2	18.2	4	2.9
	Jua kali boilers with tap	0	0	6	7.5	1	2.1	2	18.2	9	6.5
	Stand pipe	0	0	3	3.8	0	0	0	0	3	2.2
Use of cold storage facilities	Refrigerators	1	100	21	26.3	15	31.9	2	18.2	39	28.1
	Freezers	0	0	16	10.8	12	8.6	0	0	28	20.1
	None	0	0	43	53.8	20	42.6	9	81.8	72	51.8
Refuse containers	Provided	1	100	65	81.3	47	100	9	81.8	122	87.8
	Not provided	0	0	15	18.7	0	0	2	14	17	12.2
Cover to refuse containers	(N/A)	0	0	15	18.8	0	0	2	1.4	17	12.2
	Provided	1	100	13	16.3	8	17.0	0	0	22	5.8
	Not provided	0	0	52	65.0	39	83.0	11	81.8	100	71.9

Table 8b: Distribution of conditions and provisions that influence food handling practices according to category of eating house

Condition		Category of eating									
		Tourist		Fast food		Budget		Kiosk		Total	
		No	%	No	%	No	%	No	%	No	%
Source of water used from the kitchen	Tap in kitchen	1	100	72	90	45	95.7	9	81.8	127	91.4
	Storage tank	0	0	7	8.8	2	4.3	1	9.1	10	7.2
	Drums	0	0	1	1.2	0	0	1	9.1	2	1.4
Distance to water source from kitchen	Tap in kitchen	1	100	72	90	45	95.7	9	81.8	127	91.4
	1 to 2 meters	0	0	2	2.5	2	4.3	2	18.2	6	4.4
	2.1 to 3 meters	0	0	2	2.5	0	0	0	0	3	2.2
	3.1 to 4 meters	0	0	0	0	0	0	0	0	1	0.7
	4.1 to 5 meters	0	0	2	2.5	0	0	0	0	2	1.4
	More than 5 meters	0	0	2	2.5	0	0	0	0	4	2.9

3.5 Relationships of various characteristics in the study population

3.5.1 Prevalence of food borne pathogens

3.5.1.1 Age

The food handlers were categorised into two groups. The youth, were those with 30 years and below and the elderly, as those above 30 years. Among those with 30 years and below, forty-five (18.6%) were found infected with *Salmonella typhi* and one hundred and thirty-eight (57.0%) were not infected. For those above 30 years, twenty-five (10.3%) were infected, while thirty-four (14.0%) were not. There was significant difference in the infection with *Salmonella typhi* between the two age groups. There were more of those with 30 years and below that were infected than those above 30 years ($\chi^2 = 6.86$; $p < 0.05$; $df=1$).

Long finger nails were found in sixty eight (28.1%) of those 30 years and below while one hundred and fifteen (47.5%) maintained short nails. In food handlers above 30 years, twenty-seven (11.2%) had long fingernails and thirty-two (13.2%) did not. The results however did not show any significant difference between those with long finger nails and those who did not in the two age groups ($\chi^2 = 1.39$; $p > 0.05$; $df=1$).

Long hair was found in one hundred and seventeen (48.3%) of those 30 years and below, while sixty-six (27.3%) had short hair. In workers above 30 years, thirty-three (13.6%) had long hair but twenty-six (10.7%) did not. The result did not show any significant difference between those with long hairs and those who did not in the two age groups. ($\chi^2 = 1.21$; $p > 0.05$; $df=1$)

3.5.1.2 Sex

The food handlers were grouped as males and females. Thirty (12.4%) of the males were infected with *Salmonella typhi* and eighty-seven (36.0%) were not infected. For females, forty (16.5%) were infected as compared to eighty-five (35.1%) that were not infected. However there was no significant statistical difference between males and females infected with *Salmonella typhi* ($\chi^2 = 1.19$; $p > 0.05$; $df=1$).

In the maintenance of fingernails, seventy-three (30.2%) of the males had short fingernails and forty four (18.2%) did not. More females, seventy-four (30.6%) had short nails than men and fifty one (21.1%) did not. There was no significant difference between males and females with shorter or longer finger nails ($\chi^2 = 0.26$; $P > 0.05$; $df=1$).

Regarding the maintenance of hair, there were more females one hundred and three (42.6%) with long hair as compared to twenty-two (9.1%) who did not. As for males, forty-seven (19.4%) had long hair as compared to seventy (28.9%) who did not. The difference between males and females in keeping of long hair was significant. More females tended to keep long hairs than males ($\chi^2 = 45.74$; $P < 0.001$; $df=1$).

3.5.1.3 Physical conditions

The eating-houses had been categorized as tourist; fast food, budget and kiosk. Forty-three (20.4%) in tourist eating houses were found with long finger nails and fifty-eight (27.5%) did not. Thirty-two (15.2%) had longer fingernails in fast food and fifty-five (26.1%) did not. Five (2.4%) in kiosks had longer fingernails but eight (3.8%) did not. In tourist hotel, five (2.4%) had long fingernails and five (2.4%) did not. This reveals that there was no significant statistical difference between the four categories of hotel in taking care of fingernails ($\chi^2 = 1.07$; $P > 0.05$; $df=1$).

3.5.2 Knowledge of food borne illnesses

Food handlers were grouped into two categories, those with primary education and below, who were eighty-eight (36.4%) and those with secondary education and above, were one hundred and fifty four (63.6%). From those with primary education and below who knew one or none of the food borne diseases, were thirty seven (15.3%) and those who knew two or more were fifty one (21.1%). Those with secondary education and above who knew one or none of the food borne diseases were thirty six (14.9%) and those who knew two or more were one hundred and eighteen (48.8%). The difference between those with secondary education and above and those with primary education and below in knowledge of food borne illnesses was as significant as there were more food handlers with secondary education and above who knew two or more of the food borne diseases ($\chi^2 = 9.26$ $p < 0.05$; $df=1$).

On causes of food borne illnesses, one hundred and forty three (17.8%) of the foodhandlers with primary education and below, knew one or none of the causes of food borne illnesses and forty-five (18.6%) knew two or more. For those with secondary education and above, seventy five (31.0%) of the food handlers knew one or none of the food borne illnesses, while seventy nine, (32.6%) knew two or more of the food borne illnesses. However there was no significant difference between those with primary education and below and those with secondary education and above in knowledge of food borne illnesses ($\chi^2 = 0.001$; $p > 0.05$; $df=1$).

On the symptoms of food borne illnesses, thirty-nine (16.1%) of the food handlers with primary education and below knew one or none of the symptoms of food borne

illnesses and forty-nine (20.2%) knew two or more symptoms. For those with secondary education and above, forty nine (20.2%) knew one or none of the food borne illnesses, while one hundred and five (43.4%) knew two or more. The difference between those with primary education and below and those with secondary education and above in knowledge of the symptoms of food borne illnesses was significant as there were more of those with secondary education and above who knew more than two symptoms of food borne illnesses. ($\chi^2 = 3.78$; $p < 0.05$; $df = 1$)

Regarding preventive measures of food borne illnesses, forty-eight (19.8%) of the food handlers with primary education and below knew one or none of the preventive measures of the food borne illnesses and forty (16.5%) knew two or more of the preventive measures. For those with secondary education and above, eighty-eight (36.4%) knew one or none of the food borne illnesses, while sixty-six (27.3%) knew two or more. However the difference in knowledge between those in primary education and below and those with secondary education and above was not significant ($\chi^2 = 0.15$; $p > 0.05$; $df = 1$).

Regarding the aspect of age, on knowledge of specific food borne illnesses, forty eight (19.8%) of the food handlers 30 years and below knew one or none of the food borne illnesses and one hundred and thirty five (55.8%) knew more than two. While those above thirty years, twenty-five (10.3%) knew one or none of the food borne illness and thirty-four (14.0%) knew more than two. There were more food handlers of age 30 years and below who knew more than two food borne illnesses, the difference between the two age groups in knowledge of food borne illnesses was significant ($\chi^2 = 5.52$; $p < 0.05$; $df = 1$).

On the aspect of sex regarding food borne illnesses, sixty-nine (28.5%) of males knew one or none of the preventive measures of food borne illnesses, and forty eight (19.8) knew two or more. For the females, sixty-seven (27.7%) knew one or none and fifty eight (24.0%) knew two or more. Though there were more females than males who knew two or more preventive measures, the difference between the two sexes in knowledge of preventive measures was not significant ($\chi^2 = 0.7$; $p > 0.05$ $df=1$)

3.5.3 Food handling practices and compliance with health requirements.

The category of eating houses were re-grouped into two categories high class which were eight one (58.3%) and low class which were fifty eight (41.7%). The association of the different parameters in food handling practices were evaluated.

In protective garments two hundred and forty one (39.4%) of the food handlers in high class eating-houses were found wearing protective garments and fifty-eight (9.5%) were not. Of those in low class eating houses, two hundred and forty two (39.5%) were wearing protective garments, but seventy-one (11.6%) were not. The difference between those putting on protective garments in the two categories was very small and it was not statistically significant ($\chi^2 = 0.99$; $P > 0.05$; $df=1$).

Among a total of four hundred and eight three (483) food handlers that were putting on protective garments, one hundred and seventy five (36.2%) were found to be clean in the high class eating houses while sixty six (13.7%) were dirty.

In the low class-eating house, one hundred and fifty six food handlers (32.3%) were found putting on clean protective garments and eighty-six (17.8%) were putting on dirty protective garments. The difference between those putting on clean garments in the two categories of eating-houses was minimal and was not statistically significant ($\chi^2 = 3.72$; $P > 0.05$; $df=1$).

There were one hundred and ninety-one (191) cooks. Twenty-four (12.6%) in high-class hotel were putting on head covers, and seventy-six (39.8%) were not. In low class eating houses, fifteen (7.9%) were putting on head covers and seventy-six (39.8%) were not. This reveals that though there was a difference between the two categories of eating houses in putting on head covers by the cooks, the difference was not statistically significant ($\chi^2 = 1.66$; $P > 0.05$; $df=1$).

Concerning washing of hands before touching foods, two hundred and seventy three (44.6%) of the food handlers in high class eating houses were washing hands before touching foods and twenty six (4.2%) were not. In the low class eating houses, two hundred and twenty six (36.9%) were washing hands before touching foods and eighty-seven were not. The results show that there were some differences between those who washed hands in high class and low class eating houses and the difference was highly significant with more of those in high class eating houses washing hands before touching food than those low class eating houses ($\chi^2 = 37.06$; $p < 0.001$; $df=1$).

Washing of hands after touching raw foods was observed in two hundred and three (33.2%) of the food handlers in high class eating houses and ninety-six (15.7%) were not. In low class eating houses, one hundred and forty nine (24.3%) were observed washing hands after touching raw foods and one hundred and sixty four (26.8%) were not. The results shows that more food handlers in high class hotels washed hands after touching raw foods than those in low class hotels and this difference was statistically significant ($\chi^2 = 25.76$; $P < 0.001$; $df=1$),

Touching of foods with bare hands was observed in one hundred and sixty nine (27.6%) of the food handlers in high-class eating-houses and one hundred and thirty

(21.2%) were not. In low class eating houses, one hundred and sixty eight (27.5%) were touching foods with bare hands and one hundred and forty five (23.7%) were not. The results reveal that there were some differences between both categories of hotel in touching foods with bare hands, however, the difference was not statistically significant ($\chi^2 = 0.50$; $P > 0.05$; $df=1$).

The observation of cashiers handling food was made in one hundred and thirty nine (139) premises and cashiers. Fifty (36.0%) of the cashiers in high class eating houses handled food after handling money without washing hands and thirty (21.6%) were not. In low class eating houses, thirty-nine (28.1%) of the cashiers handled food after handling money without washing hands, and twenty (14.4%) did not. This shows that there were more cashiers in high-class hotels handling money without washing hands, than in low class hotels. However, the difference between the two categories was not statistically significant ($\chi^2 = 0.19$; $P > 0.05$; $df=1$).

Licking of fingers while serving or preparing food was observed in fifty-two (8.5%) of the food handlers in high class eating houses and two hundred and forty seven (40.4%) were not.

In low class eating-houses this was observed in sixty-nine (11.3%) of the food handlers and two hundred and forty four (39.9%) were not. This shows that there were very few food handlers licking fingers after serving or preparing food and the small difference observed between both categories of eating houses was not significant ($\chi^2 = 2.09$; $P > 0.05$; $df=1$).

Blowing into wrapping papers to open them was observed in fifty-six (9.2%) of the food handlers in high class eating houses and two hundred and forty three (39.7%) were not. In low class eating houses, it was observed in sixty-three (19.3%) of the food handlers and two hundred and fifty (40.8%) were not. There were slightly more food handlers in low class eating houses observed blowing into wrapping papers to open them, however, the difference between both categories of hotels was not significant ($\chi^2 = 0.19$; $P > 0.05$; $df=1$).

Forty six (33.1%) of the eating houses in the category of high class were found using towels for wiping utensils before serving food on them and thirty five (25.2%) were not. In the low class-eating houses, forty-one (29.5%) of the food premises were using towels, while seventeen (12.2%) were not. There were slightly more food handlers in high-class hotels using towels for wiping utensils than in low class hotels. However, the difference between the two categories of eating-houses was not significant ($\chi^2 = 2.79$; $P > 0.05$; $df=1$).

Refuse containers were provided in sixty-six (47.5%) of the high-class eating-houses, fifteen (10.8%) did not have them. In the low class eating houses, fifty-six (40.3%) of the food premises had refuse containers while two (1.4%) did not have them. The results reveal that there were more premises in high class hotels provided with refuse containers than in low class hotels and the difference between both categories was highly significant ($\chi^2 = 7.15$; $P < 0.01$; $df=1$).

In seventy-three (52.5%) of the high class eating houses, water was within 0 to 1 meter away from the kitchen. But eight (5.8%) had water source between 1.1 metres and above, while in the low class eating houses, fifty four (38.8%) had water sources 0 to 1 metre from kitchen and four (2.9%), 1.1 metres and above. This shows that more food

premises in the high class eating-houses had water supplied within 0 to 1 meter away from kitchen, than those in low class hotel. However, the difference between both categories of hotel was not statistically significant ($\chi^2 = 0.38$; $P > 0.05$; $df=1$).

CHAPTER FOUR: DISCUSSION

4.1 Prevalence of food borne pathogens

Although the scope of food borne illnesses is wide and the mode of transmission varied, this study concentrated on food borne pathogens that are transmitted mainly through cross-contamination by food handlers through poor food handling practices.

In all the two hundred and forty two (242) food handlers examined, only *Entamoeba histolytica* and *Salmonella typhi* were isolated (Table 1 and 2). The presence of these pathogens among the food handlers is a contravention of the Public Health Act Cap. 242 (ROK, 1972) and The Food Drugs and Chemical Substances Act Cap 254 (ROK, 1992) which prohibits any person suffering from any disease in a communicable form from working in food premises.

The findings are in agreement with the WHO report on health consequences of biological contamination in food, which identified typhoid and Amebiasis among the food borne illnesses that affect developing countries (WHO, 1992b). Amebiasis which is caused by *Entamoeba histolytica* and typhoid which is caused by *Salmonella typhi* are diarrhoeal diseases as such, the findings reinforces the Kenya Health Policy Framework of 1994 which ranked diarrhoeal diseases among the top ten causes of morbidity and mortality in the country (ROK, 1994).

These results suggest that routine medical examination and treatment for all food borne pathogens among food handlers should be intensified. The prevalence of food borne pathogens among the food handlers can lead to serious outbreaks if left unchecked. Food borne illnesses represent one of the most widespread and overwhelming Public Health problems of the modern world (WHO, 2000). This is supported by the fact that most of the cases in the typhoid outbreak in Embu in 2001, attributed their infection to the consumption of food from commercial establishments (ROK, 2001).

The food handlers in the Study were within the age bracket of 18-56 years and the prevalence of the food borne illness was 114 per 1000. A similar study among food handlers (16-74) years in Sweden (Norling, 1994) showed a prevalence of 79 persons per 1000. This was slightly lower than that of Embu Municipality. The possible reasons could be that Sweden is a developed country with high standards of hygiene practices.

There were surprisingly no helminths isolated from any of the food handlers in the study. This could be due to the high latrine coverage in Embu District, which was estimated at 92% in a rapid assessment of water supply and sanitation survey carried out in 1996 in the district (ROK, 1996). The other possible explanation is the frequent de-worming using antihelminths and the mandatory medical examination of the food handlers conducted after every six months as required by the Food Drugs and Chemical Substance Act Cap. 254. (ROK, 1992). However in a World Bank study (Warren, 1989) on helminths infection, on health sector priorities in the developing countries *Ascaris* was found to affect over 1000 million in the developing countries. This difference could be due to the fact that the World Bank study targeted all persons while this study concentrated on commercial food handlers.

4.2 Knowledge of food borne illnesses.

The most important factors in the prevalence of food borne illnesses include the lack of knowledge on the part of food handlers and negligence in safe food handling (WHO, 2000). In this study, knowledge of food borne illnesses amongst the food handlers was high with a mean score of above 50%. It was noted that the food handlers had high knowledge of the specific food borne illnesses, and their causes (Figure 8). This could be attributed to the massive health education campaigns that were conducted during the typhoid out break in Embu of 2001 (ROK, 2001).

Though the mean score on knowledge level of causes and symptoms of food borne illnesses was high, knowledge on the preventive measures was low. This agrees with the findings of a research conducted in Germany (Oltersdoff, 1993) on knowledge of food hygiene and food safety, where a great proportion of the Germany population had low knowledge of preventive measures of food borne illnesses.

In this study, level of education influenced knowledge of specific food borne illnesses and their symptoms. There were more food handlers with secondary education and above who knew two or more specific food borne diseases and their symptoms. However there was no significant difference in knowledge of causes of food borne illnesses between those with primary education and below and those with secondary education and above. Showing that, possibly level of education does not influence knowledge on causes of food borne illnesses. This agrees with a survey (Ahmed, 1994) on knowledge of causes of diarrhoea among Food handlers carried out in the rural communities of two villages in Sudan, where there was no difference in education levels on knowledge of the causes of diarrhoea.

There were more females than males in this study who knew two or more preventive measures of food borne illnesses. However the difference between the two sexes in knowledge was not significant. A study in Nigeria, on Environmental health and evaluation of foodhandlers (Abidoeye and Otokiti, 1990) revealed that there were less females who had knowledge on preventive measures of food borne illnesses. This study also revealed that the young food handlers were more knowledgeable on specific food borne illnesses than older population this could be attributed to the fact that majority (63.6%) of the food handlers had at least secondary education and above and hence able to recall illness easily (Figure3).

4.3 Food handling practices and compliance with health requirements

Food borne disease outbreaks world-wide occur as a result of error in food handling food during preparation (WHO, 2000). The results of this study revealed that there was non-compliance in keeping and observation of appropriate health measures and food handling practices (Tables 7 and 8). In this study, it was found that out of the six hundred and twelve (612) foodhandlers observed, 41.8% did not have valid medical certificates, 21.1% were working without protective garments and of those with garments, 31.5% were found to be dirty, 79.6% of the cooks were found without head covers, 18.5% of the foodhandlers did not wash hands after visiting the toilet and 42.5% after touching raw foods. Touching cooked foods with bare hands was observed in 55.1% and 64% of the cashiers were handling money after handling food without washing hands. Other poor food handling practices and conditions included use of dirty towels for wiping utensils by 37.4% of the foodhandlers, re-use of chopping boards used on raw foods to cut cooked foods without washing as observed in 16.5% of the food premises, and lack of refuse covers to refuse containers observed in 71.9% of the food premises. Poor food handling practices leads to contamination with and survival and growth of pathogenic microorganisms and hence food borne illnesses (WHO, 1995). The above results contravene the provisions of The Public Health Act Cap. 242 and The Food Drugs and Chemical Substances Act Cap 254 laws of Kenya which demands total compliance in good food handling practices. The results of this study suggest weakness in the enforcement of the Public Health Act Cap. 242 and the Food Drugs and Chemical Substances Act Cap. 254, Laws of Kenya, or ignorance of the foodhandlers.

In a five-year study (Alkanahl and Gasim, 1993) of food borne diseases in Saudi Arabia, it was revealed in 56.6% of the incidents food was incorrectly handled at home, workers camps and food establishments. These findings agree with the Ministry of Health report on the typhoid outbreak of 2001 in Embu where 50% of those infected attributed their infection to consumption of food from commercial food establishments and schools where food handling was poor (ROK, 2001). In a survey in USA (Alter Kruse, 1996), only 67% of the food handlers washed hands or changed cutting boards after cutting up raw meat or poultry.

CHAPTER 5: A SUMMARY OF CONCLUSIONS

Food handling practices and food borne illnesses are still a major threat to public health in Embu Municipality as:-

- a) Food borne pathogens were found amongst some of the food handlers, 28.9 % had *S.typhi* and 4.1% *E.histolytica*.
- b) Low knowledge on preventive measures of food borne illness, 56.2% knew one or none of the preventive measures.
- c) Unhygienic food handling practices were noted amongst foodhandlers, 64% of cashiers were found handling money and thereafter handling food without washing hands.
- d) There is inadequate compliance with the requirements of the Public health Act and the Food Drugs and Chemical Substances Act amongst the foodhandlers, 41.8% of the food handlers were found working in eating houses without medical certificates.

CHAPTER SIX: RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE RESEARCH WORK.

6.1 Recommendations

In order to improve on food handling practices to ensure reduction of morbidity and mortality from food borne illnesses in Embu municipality and else where:-

- a) There should be strict adherence to medical examination requirements as set out in the law.
- b) Short courses should be organised to educate the food handlers on preventive measures of food borne illness and hygienic food handling practices.
- c) The public health managers and administrators to devise means and ways of ensuring compliance in observance of the Public Health measures and requirements as set out in the Public Health Act Cap 242 and Food Drugs and Chemical Substances Act Cap 254.

6.2 Suggestions for future research work

Research work is recommended on:-

- a) Other food pathogens that were not covered in this study.
- b) Food handling amongst street food vendors, food processing and manufacturing industries, schools and institution of higher learning ,and medical institutions
- c) Attitude of foodhandlers on observation of health measures and requirements.
- d) Similar research work in another municipality.

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APPENDICES

APPENDIX 1: RESEARCH INSTRUMENTS

A: Questionnaire for medical examination of food handlers

Name Serial No.....

Date of Examination

Age.....

Sex.....

Plot No.

Category of Eating-House. (Tick as appropriate)

a) Tourist Hotel b) Fast Food

c) Budget Hotel d) Kiosk

Tests on Specimens (Tick as appropriate)

Test Outcome

(i) Stool culture: Bacteria isolated Yes No

If yes, specify _____

(ii) Ova & Cyst (Tick as appropriate) Seen Not seen

(iii) If Ova and Cyst are seen in (ii) above, specify type:

.....

Physical Examination (Tick as appropriate)

a) Nasal Discharge: Yes No

b) Eye Discharge Yes No

c) Ear Discharge Yes No

d) Cuts & Wounds on Skin Yes No

e) Finger Nails Short Yes No

f) Hair Short Yes No

g) Dandruff Yes No

h) Sign of Lice in Hair Yes No

Others specify

Name of the Investigator.....

Date.....

Initials.....

Note:

In the physical examination; Longer fingernails were those that protruded beyond the fingertips and shorter fingernails were those that did not protrude beyond the fingertips. Long hair was regarded as hair that had grown beyond 15mm, while short hair was that hair which had grown up to a height of equal to or less than 15mm (15mm is equivalent to gauge two (2) of the electrical shaving machines)

B: Questionnaire on knowledge of food borne illnesses.

Guidance on possible correct responses on knowledge of food borne illnesses for questions 8-11

Common food borne illnesses in Embu.

- ◆ Typhoid
- ◆ Cholera
- ◆ Amebiasis
- ◆ Ascariasis
- ◆ Brucellosis

Causes of food borne illnesses

- ◆ Food or water contaminated with faeces
- ◆ Soiled hands
- ◆ Contaminated utensils
- ◆ Flies landing on foods
- ◆ Improperly cooked foods
- ◆ Ingestion of milk or dairy products from infected animals

Common symptoms of food borne illnesses.

- ◆ Continued fever, constipation and diarrhoea.
- ◆ Profuse water stools and vomiting
- ◆ Dysentery with mucus and blood.

- ◆ Passing of live worms in stool
- ◆ Profuse sweating and headache.

Preventive measures

- ◆ Sanitary disposal of human faeces.
- ◆ Boiling of drinking water
- ◆ Washing of hands after defecation and before touching foods.
- ◆ Use of clean utensils
- ◆ Control of fly breeding
- ◆ Boiling of milk.

1. Name Serial No

2. Date

3. Age

4. Sex

5. Plot No.

6. Level of Education (Tick as appropriate)

a) Primary School

c) College/University

b) Secondary

d) None

7. Category of Eating House (Tick as appropriate)

a) Tourist

c) Budget Hotel

b) Fast food

d) Kiosk

8. Name any three food borne illness that are likely to be transmitted through

poor food handling practices

a) c)

b) d)

9. What is the cause of each of the food borne illnesses that you have mentioned in (8)

above?

a) c)

b) d)

(10) Mention at least one symptom that a patient suffering from each of the diseases you mentioned in (8) above might present with.

a) c)

b) d)

(11) State at least one preventive measure that may be adopted for the control of each of the food borne illnesses you have mentioned in (8) above.

- a)
- b)
- c)
- d)

..... d) Khusk

..... are there in these premises?

..... total

..... How many of these food handlers possess valid medical certificates?

(Verify by checking certificates)

..... protective garments when preparing and serving food?

To

If yes, how many?

..... If yes in No. 4 what is the general condition? (Tick as appropriate)

- a)
- b)

..... are there in these premises?

..... Do rooks cover their heads? (Tick as appropriate) Yes No

If yes in no 7, how many?

..... Do flies have any work to do? (Tick as appropriate)

8a) Before touching foods Yes No

If yes, how many?

8b). After handling raw meat, or vegetables: Yes No

If yes, how many?

9. Do the food handlers touch foods with bare hands when serving: (Tick as appropriate) Yes No

If yes, how many?

10. Do the cashiers in the eating-houses touch foods after handling money without washing hands? (Tick as appropriate) Yes No

If yes, how many?

11. Do the food handler's lick their fingers to pick up wrapping papers: (Tick as appropriate)

Yes No

If yes, how many?

12. The food handlers blow into wrapping papers to open them? (Tick as appropriate)

Yes No

If yes, how many?

13. Do the food handlers smoke in any of the food preparation or serving area: (Tick as appropriate)

Yes

No

If yes, how many?

14. Do the food handlers scratch and touch foods without washing hands. (Tick as appropriate)

Yes

No

If yes, how many?

15. Do the food handlers spit around while serving or preparing food? (Tick as appropriate)

Yes

No.

If yes, how many?

16. Do the food handlers use towels for wiping and drying plates, knives and spoons before serving? (Tick as appropriate) Yes No

If yes in No. 16, What is the condition? (Tick as appropriate)

Dirty

Clean

17. Do the food handlers utilise the chopping boards used for raw foods to chop cooked foods without thorough washing? (Tick as appropriate) Yes No

18. Do the food handlers use the same knives used to cut raw foods on cooked foods without washing? (Tick as appropriate) Yes No

19. Are wash hands basins provided in the kitchen and dinning halls?

(Tick as appropriate)

Yes

No

20. If No. in Number 22, specify what is used.....

21 What equipment is there for cold storage of food (Raw and Cooked) (Tick as appropriate)

Refrigerator Freezer

Others Specify.....

22. Does the premises have facilities for storage of refuse before collection? (Tick as appropriate)

Yes

No

23. If yes in No. 25, are these facilities provided with covers? (Tick as appropriate)

Yes

No

24. Source of water utilized in kitchen and hall. (Tick as appropriate)

Tap

Drum

Storage tank

Any other (specify).....

24. What is the distance from the source of water to the kitchen if not taken from kitchen tap in meter?

Name of the investigator.....

Date

Initials.....

Note:

Dirty protective garment refers to a garment that is greasy, spotted with food marks and any other spots or marks spread in most parts of the garment, that may be repugnant to the eyes and might be a source of food contamination.

Clean protective garment refers to a protective garment without any food mark or spot or only with a few food marks and spots that are not spread in most parts of the garment.

Appendix 2: Knowledge index for food handlers

To determine the knowledge of the food handlers on food borne illnesses, the following index was used. (Developed for the purposes of this study)

1. Food handlers knowledge on specific food borne illnesses
2. Food handlers knowledge on causes of food borne illnesses
3. Food handlers knowledge on symptoms of food borne illnesses
4. Food handlers knowledge on preventive measures:
 - ◆ Knowledge on specific food borne illnesses =3 points
 - ◆ Knowledge on causes of food borne illnesses =3 points
 - ◆ Knowledge on symptoms of food borne illnesses =3 points
 - ◆ Knowledge on preventive measures =3 points

Scoring

- ◆ Low knowledge =0-1 point <50%
- ◆ High knowledge =2-3 points ≥50%

Appendix 3: ETHICAL CLEARANCE DOCUMENTS**a) Introduction letter from Permanent secretary, Ministry of Health****MINISTRY OF HEALTH**

Telephone: Nairobi 717077
When replying please quote

*Afu House
Cathedral Road
P.O. Box 30016
Nairobi*

Ref. 79157379

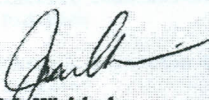
14th February 2002

The Permanent Secretary
Ministry of Education
P.O. Box 30016
NAIROBI.

Re: RESEARCH AUTHORISATION FOR JOHN GACHUKI KARIUKI.

The above named is a Public Health Officer sponsored by the Ministry Of Health for a masters degree course at Kenyatta University .He is due for his field work to collect data for his research on "An appraisal Of Food handling Practices And Incidence of Food borne Illnesses in Eating Houses among food Handlers In Embu Town", Eastern province.

The Purpose of this letter is to request your office to grant him permission to carry the out the research.


J. M. Waithaka
For Permanent Secretary

b) Research clearance from Ministry of Education Science and Technology

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

Telegrams: "EDUCATION", Nairobi

Telephone: Nairobi 334411

When replying please quote

Ref. No. MOEST 13/001/32C. 32/2
and date



JOGOO HOUSE "B"
HARAMBEE AVENUE
P.O. Box 30040
NAIROBI

19TH FEBRUARY, 2002

JOHN GACHUKI
MINISTRY OF HEALTH
P.O BOX 30016
NAIROBI

Dear Sir,

RE: RESEARCH AUTHORIZATION


Please refer to your application for authority to conduct research on "Appraisal of Food Handling practices and Incidence of food Borne Illness in Eating Houses among Food Handlers in Embu Town.

I am pleased to inform you that you have been authorized to conduct research in Embu District for a period ending 30th September, 2002.

You are advised to report to the District Commissioner, the District Education Officer and the Town Clerk, Embu Municipal Council before commencing your research project.

You are further expected to avail two copies of your research findings to this Office upon completion of your research project.

Yours faithfully,


A. G. KAARIA
FOR: PERMANENT SECRETARY/EDUCATION

CC.

The District Commissioner
Embu District

The District Education Officer
Embu District

The Town Clerk
Embu Municipal Council
P.O Box
EMBU

c) Introduction letter from Medical officer of health, Embu

MINISTRY OF HEALTH

Telephone: 0161-20080
 Fax: 0161- 30424
 E-mail: mohembu@salph.co.ke



OFFICE OF THE
 MEDICAL OFFICER OF HEALTH
 P.O. BOX 1905
EMBU

When replying please quote our reference
 Ref. No: M4/VOL.II/119

Date: 25th March 2002


TO

**The Clerk Embu Municipal Council
 The Medical superintendent Embu
 Provincial General Hospital
 District Public Health Officer – Embu District
 All businessmen Embu Municipality**

RE: KARIUKI J G – RESEARCH WORK

Above named is a post graduate student doing a research on an appraisal of food handling practices and the incidence of foodborne illnesses in eating houses among food handlers in Embu municipality.

Please assist him in any way possible to facilitate his work.


Dr. Nicholas Muraguri
 Medical officer of Health
Embu District

**APPENDIX 6: ABSTRACTS FOR PAPERS ACCEPTED FOR PUBLICATION
OR SEMINARS/WORKSHOPS**

**AN APPRAISAL OF FOOD HANDLING PRACTICES AND THE
PREVALENCE OF FOOD BORNE ILLNESSES IN EATING HOUSES IN
EMBU MUNICIPALITY, KENYA**

Kariuki J. G.¹, Orago A. S.S.¹ and Okelo R.O.¹

1 Kenyatta University

**Paper to be presented at the 8th annual conference on scientific advances for
sustainable development in Africa in Kenyatta University, Nairobi 6th – 8th August
2002.**

ABSTRACT

Food borne diseases constitute a growing public health problem world-wide and a significant cause of reduced economic activity. It is estimated that up to 70% (WHO,2000) of diarrhoeal diseases may be caused by contaminated foods. Most food borne diseases are attributed to food contamination through unhygienic food handling practices, infected food handlers and lack of appropriate knowledge on food borne diseases by food handlers. Very little research work and surveillance of food borne diseases has been done in Africa and Kenya in particular. The incidences of food borne diseases are not easy to estimate in Kenya as most of them are lumped together when recording, as diarrhoeal diseases.

This study sought to assess the food handling practices and the prevalence of food borne illness amongst the foodhandlers in Embu Municipality. Both random and systemic sampling procedures were used to identify food handlers to be included in the study as they attended routine medical examination. Stool specimens were taken for

microscopic analysis for ova and cysts; using Ritches modified formol ether stool concentration method and culture for bacterial investigations. Knowledge on food borne diseases, socio-demographic factors and food handling practices were evaluated using pre-tested structured questionnaires.

The results showed that food borne illnesses and food handling practices were still a public health problem in Embu Municipality, seventy (28.9%) of the food handlers were infected with *Salmonella typhi* and ten (4.1) with *Entamoeba histolytica*. Significant differences ($\chi^2 = 6.86$; $P < 0.05$; $df=1$) were noted in the prevalence of *Salmonella typhi* among food handlers who were 30 years old and below and those above 30 years.

Over 50% of the food handlers had high knowledge and understanding of the food borne illnesses, their symptoms, causes and preventive measures. Significant differences ($\chi^2 = 9.26 < 0.05$; $df=1$) were noted between those with secondary education and above and those with primary education and below on the knowledge of specific food borne illnesses. Compliance with food handling practices and health measures as laid out in the Public Health Act Cap 242 and the Food, Drugs and Chemical Substances Act Cap 254 laws of Kenya was not satisfactory. About 42% of the food handlers had no valid medical certificates, 21% without protective garments and even among those who had them, (31.5%) were dirty. Among the cooks, 76.6% did not have head covers. Touching of foods with bare hands was observed in 55.1% of the food handlers, while 42% did not wash hands after touching raw foods. Most cashiers, (64%) were found handling food after handling money without washing hands. Significant differences ($\chi^2 = 37.06$; $p < 0.001$; $df=1$) were noted between those who washed hands before touching foods in high and low class eating houses. Though

most of the premises were provided with refuse containers, the majority (71.9%) of the containers were without refuse covers.

Food borne illnesses and food handling practices are still a major threat to public health in Embu Municipality. Measures should be undertaken by the Government to ensure effective and efficient enforcement of the Public Health Act Cap. 242 and The Food Drugs and Chemical substances Act Cap.254 and training of food handlers. Results of this study will be useful to public health managers in their effort towards improvement of public health.

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