

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES FOOD SCIENCE AND NUTRITION PROGRAM

HOSPITAL FOOD SAFETY

An Assessment of the Hygienic and Food Handling Practices in
Selected Hospitals in Addis Ababa- Ethiopia

By:

Faben Getachew

JUNE, 2010

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A thesis submitted to:

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ACRONYMS

ACC: Aerobic Colony Count

CCP: Critical Control Points

CDC: Centers for Disease Control and Prevention

EHNRI- Ethiopian Health and Nutrition Institute

EHEC: Entero Hemorrhagic *Escherichia coli*

FAO: Food and Agriculture Organization

FDA: Food and Drug Administration

GHP: Good Hygienic Practices

GKP: Good Kitchen Practices

GMP: Good Manufacturing Practices

HA: Hazard Analysis

HACCP: Hazard Analysis and Critical Control Points

MoARD: Ministry of Agriculture and Rural Development

MoH: Ministry of Health

MoTI: Ministry of Trade and Industry

NASA: National Aeronautical and Space Administration

PHLS- Public Health Laboratory Service

QSAE : Quality and Standards Authority of Ethiopia

RTE: Ready-to-eat Food

SOP: Standard Operating Procedures

SSOP: Standard Sanitation Operation Procedures

UNIDO: United Nations Industrial Development

WHO: World Health Organization

ABSTRACT

The purpose of this study was to assess the status of food hygiene and food safety issues and practices in some selected hospitals in Addis Ababa- Ethiopia and provide a baseline data for implementing HACCP in hospital food services. In addition, knowledge and practice of food handlers with regard to food hygiene in hospitals was assessed, gaps in hospital food safety and hygiene was identified and microbial analysis of food was conducted.

The assessment and observation checklist for comparing standards of GHP and GKP has uncovered some gaps regarding the status of the premises, status and storage of equipments, some aspects of personal hygiene and sanitation and pest control. The common unsatisfactory scores include having unclean floors, walls and ceilings, insect infestation and poor ventilation, poor storage of utensils, not using appropriate tools by food handlers, improper covering of refuse receptacle and absence of a hand wash basins near the toilets.

*The questionnaire based assessment has provided insight into inadequacies in the general food service staff knowledge with regard to food hygiene principles as 86.8% were not aware of the correct refrigerator temperature, 78.9% of them thought that chilling and freezing eliminates harmful germs in food. In addition to that, 71.1% of them were unaware of the best way to wash fresh fruits and vegetables to keep them free from food poisoning microorganisms. On the other hand, better results were obtained for self-reported food hygiene practices and control measures. High scores were obtained for knowledge about food related microorganisms such as *Vibrio cholera* (89.5%), *Salmonella* (97.4%) and *Hepatitis A* (60.5%). Knowledge of *C.botulinum* and *S.aureus* was absent.*

*A total of 45 samples (15 meat, 15 vegetable and 15 legume based sauces) were analyzed for Aerobic colony count, total coliforms, *E. coli* type I and CNS. Data from the microbiological analysis show that most of the samples were within the good/acceptable range but the incidence of fecal coliforms and *E.coli* indicate a poor food handling practice and/or cross-contamination during distribution or in the kitchen.*

A HACCP system has not been implemented in any of the studied hospitals and in view of the findings of this study it can be underlined the importance of a full implementation of the system.

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

The World Health Organization (WHO) defines food safety as the conditions and measures that are necessary during production, processing, storage, distribution and preparation of food to ensure that it is safe, sound, wholesome and fit for human consumption (WHO, 1984). Food safety remains a critical issue nowadays among professionals in the food service sector as well as consumers (Scheule *et al.*, 2001; Badrie *et al.*, 2006). This is basically due to outbreaks of food-borne diseases resulting in substantial costs to individuals and the economy (Kaferstein *et al.*, 1997; Egan *et al.*, 2007) and indeed the widespread and increasing incidence of food-borne diseases has severe social and economic impacts on the human population (Molins *et al.*, 2001).

Food related infections constitute an important health problem in both developed and developing countries (Jacob, 1989; Dugassa, 2007). Figures show that an estimate of 76 million food related illnesses are seen annually in the USA (Mead *et al.*, 1999; Anding *et al.*, 2007), a total of 23,010 cases of dysentery have been reported in Turkey in 1997 (State Statistics Institute, 1999; Acikel *et al.*, 2007) and Emilia-Romagna, a single region in Italy, had 1564 episodes of food-borne diseases between 1988 and 2000 (Emilia Romagna Region, Health Assessorship, 2002; Legnani *et al.*, 2004). Though illnesses and outbreak estimates are available for developed countries (Mead *et al.*, 1999; Lynch *et al.*, 2006; Malhotra *et al.*, 2008), lack of effective surveillance systems hampers availability of similar estimates for developing countries (Malhotra *et al.*, 2008).

According to the FAO/WHO report during the regional conference on food safety for Africa in 2005 it has been said that the food safety system in developing countries and Africa in particular is weak and unable to protect human health. In Ethiopia, 2004 reports by the Ministry of Health (MoH) show that among the ten leading causes of outpatient visits to health institutions are all forms of diarrheal diseases and intestinal parasites which may be related to food directly or indirectly. However, health institutions that compile monthly morbidity statistics do not identify if the cause for such illnesses is due to food or other (FAO/WHO, 2005). In addition, no

systematic surveillance system is in place due to weak structural organization, underdeveloped human resource and insufficient resource allocated to food-borne surveillance.

Occurrence of such diseases is rarely reported and exchange of information between regulatory bodies is virtually absent. As a result, the prevalence and magnitude of the problem inflicted by food-borne illnesses is not known (FAO/WHO, 2005).

Food-borne diseases become of paramount importance in hospitals. Hospitals have been identified as high food safety risk institutions because they serve potentially hazardous foods to vulnerable people (South Australia Department of Health, 2008). These people are more susceptible to food-borne illnesses than the general population (South Australia Department of Health, 2008) and consequently food contamination by pathogens could be particularly harmful (Carvalho *et al.*, 2000; Bertin *et al.*, 2009). Infact, small numbers of enteric pathogens that may be innocuous to most healthy people can cause disease and even death in highly susceptible patients, especially in immuno-compromised subjects (Poupet-Réglier *et al.*, 2005).

Although providing safe food to patients who are at risk of acquiring infection is a major duty in hospitals epidemiological and surveillance data suggest that faulty practices in food service establishments and home play a crucial role in the causal chain of food-borne diseases (Dryden *et al.*, 1994; Khuri-Bulos *et al.*, 1994; Spearing *et al.*, 2000; Gullar *et al.*, 2004; Tokuç *et al.*, 2008).

Great efforts are being made worldwide to improve food safety at all levels of the food chain and many countries, like European countries, legislation has mandated that all food operators adhere to the HACCP system (Angelillo *et al.*, 2001). HACCP is a structured and rational approach to the analysis and prevention of potential hazards point at every stage of food operation. It requires operators to enumerate and identify all steps in their activities that are critical to achieving food safety and to identify and evaluate safety measures (Angelillo *et al.*, 2001).

The concept of HACCP in Ethiopia has been introduced in 2001 by the United Nations Industrial Development Organization (UNIDO) initiative and many food manufacturing industries have been adhering to it since then, but still it is not a mandatory legal requirement that all food operators put in place, implement and maintain a permanent procedure based on the HACCP principles (Lecture notes).

Outbreaks of food borne illnesses are frequently an upshot of failures in food safety control systems in catering and only limited data exist concerning food safety issues in Ethiopia and there have been no or few studies on hospital food services or the use of HACCP in hospitals.

1.2 STATEMENT OF THE PROBLEM

A FAO/WHO joint Expert Committee on Food Safety concluded as early as 1983 that illness due to contaminated food is perhaps the most widespread health problem in the contemporary world (WHO, 1984; Molins *et al.*, 2001). Data published since then by various countries confirm this statement and indicate that the problem has been on increase since then (Sockett *et al.*, 1993; Molins *et al.*, 2001).

The issue of food safety in healthcare facilities poses a great challenge as potential risks of hospital food from preparation to the patient's tray are countless. In fact food may be prepared or brought in by catering service providers in hefty quantities and served to a large number of patients by many hands (Poupet-Réglier *et al.*, 2005).

Food hygiene in the hospital can acquire peculiar features: indeed, many patients could be more vulnerable than healthy subjects to microbiological and nutritional risks; large numbers of persons can be exposed to infections and possible complications; gastroenteritis can impair digestion and absorption of nutrients (Buccheri *et al.*, 2007). As hospitalized patients are at increased risk of becoming ill when exposed to potential food-borne pathogens, and as hospital food services need to provide a wide variety of dietary items, it is critical that appropriate food-handling practices are maintained (Poupet-Réglier *et al.*, 2005).

More aggravated situations and challenges prevail in Ethiopia where food safety issues are not well understood and have received little attention. Though there are no or few indicative studies in Hospital Food Catering Services regarding the status of food safety hazards, no doubt food borne illnesses resulted from improper food handling and lack of HACCP based food catering practices could increase the risk of increased illness in hospitalized patients. This study will be

conducted to answer questions on the current food safety and hygiene status of the hospitals, knowledge of the food service staff with regard to food safety, hygiene and HACCP and finally to know the microbial quality of food served to patients.

1.3 SIGNIFICANCE

Food safety is more importantly a public health issue as it plays a noteworthy role in health development and consequently national economic development. Thus great endeavors should be made to improve it at all levels of the food chain.

As part of the food chain, hospitals are required to give a detailed attention to food hygiene in order to minimize food hazards, given the presence of vulnerable groups of the society.

Benefits include:

- It will increase knowledge and awareness of the public on potential food hazards and related food safety problems
- It will help hospitals to develop, implement and maintain an effective food safety management system
- It will have an important implication for future development of hygiene legislations
- It will provide information on the current status of hospital food safety
- It can help policy and decision makers to create and implement training programs for food service staff
- It can help in safeguarding the health of the nation and the reduction of healthcare costs
- It can help in the development of a risk-based food strategy by governments
- It can be used as a yardstick for future researchers interested in further studies

1.4 OBJECTIVES

GENERAL OBJECTIVES

The general objective of this study is to assess the status of food hygiene and food safety issues and practices in some selected hospitals in Addis Ababa- Ethiopia and provide a baseline data for implementing HACCP in hospital food services.

SPECIFIC OBJECTIVES

The study has the following specific objectives:

- To evaluate knowledge and practice of food handlers with regard to food hygiene in hospitals
- To identify gaps in hospital food safety and hygiene (Good Kitchen Practices, Good Hygienic Practices) practices to underpin the development of specifically targeted and effective training programs
- To assess the microbiological quality of food prepared and served to patients

CHAPTER TWO: LITERATURE REVIEW

2.1 Food safety and hazards

WHO defines food safety as the conditions and measures that are necessary during production, processing, storage, distribution and preparation of food to ensure that it is safe, sound, wholesome and fit for human consumption (WHO, 1984). Food safety remains a critical issue nowadays among professionals in the food service sector as well as consumers (Scheule *et al.*, 2001; Badrie *et al.*, 2006). This is basically due to outbreaks of food-borne diseases resulting in substantial costs to individuals and the economy (Kaferstein *et al.*, 1997; Egan *et al.*, 2007)

Food safety is directly related to the harmful substances present in it. Any substance that is reasonably likely to cause harm, injury or illness, when present above an established acceptable level, is a food safety hazard. Food hazards in foods may arise from different sources. They can be natural components of the food itself, they can arise from contamination of the food during any stage of the production, processing, storage and distribution or can be a result of decomposition and deterioration of the food items. In most countries regulatory bodies have established acceptable limits for all types of hazards (Ali, 2000). Food hazards are grouped into three main categories: chemical, physical and microbiological hazards.

2.1.1 Chemical hazards

Chemical hazards refer to the contamination of food by chemicals. Contamination may occur through environmental pollution of water, air and soil. Examples can be cases of contamination with toxic metals and dioxins. In addition, chemical contamination can also occur through the intentional use of various chemicals like pesticides, veterinary drugs, other agrochemicals and adulterants (FDA, 2005).

The accidental or intentional addition of excessive amounts of toxic chemicals to food can cause illness or even death. No poisonous or toxic materials should be used that are not immediately necessary or appropriate for the maintenance of the establishment, the cleaning or sanitizing of equipment or utensils, or the control of insects or rodents. Chemicals must be used in accordance

with manufacturers' recommended instructions and no poisonous or toxic materials should be used in a way that contaminates food or that constitutes a hazard to employees or others (FDA, 2005).

2.1.2 Physical hazards

Physical hazards include objects which are not a part of food, never was meant to be food, but somehow got into the food. Examples are pieces of glass or metal, toothpicks, cigarette butts, pebbles, hair, staples, jewelry. Eating these can cause injury. A physical hazard can enter a food product at any stage of production. Hard or sharp objects are potential physical hazards and can cause, cuts to the mouth or throat, damage to the intestine, damage to teeth or gums (Olsen, 1998).

2.1.3 Biological hazards

Biological hazards include pathogenic macroparasites or microorganisms. Next to bacteria, microbial hazards in food include various eukaryotic microorganisms like fungi, protozoa (e.g. *Toxoplasma*, *Sarcocystis* species, *Cyclospora*, *Giardia* and *Cryptosporidium*), viruses and prions (Untermann, 1998).

Protozoa, viruses and prions cannot multiply in food. They are either present in raw food of animal origin like meat or brought into the food by way of contamination. Among virus species for which foods can serve as vectors there are basically the following: poliovirus; hepatovirus (hepatitis A) and various gastroenteritis viruses like rotavirus, astrovirus as well as caliciviruses which include Norwalk and Norwalk-like viruses (Untermann, 1998). Man is the reservoir for these agents and transmission is essentially via the faeco-oral route. The foods can either be contaminated directly by man or indirectly by way of contaminated water. The infection of humans with pathogenic protozoa is also via faeco-oral routes e.g. *Entamoeba histolytica*, *Giardia lamblia* and *Cryptosporidium parvum* infections (Untermann, 1998).

In contrast, with the exception of individual species fungi and bacteria can multiply in food, if conditions which are necessary for their growth are met. Fungi which have to be mentioned in connection with foodborne diseases are mycotoxin-producing moulds. Mycotoxins produced by

fungi in raw materials or in foods are toxigenic for humans and have to be considered as hazards. They can also be ingested by animals via feed and are then excreted, for example, into milk e.g. Aflatoxin B is ingested by cattle and is passed into milk (Untermann, 1998).

Bacteria include species which cause illness by their toxins. These toxins can be heat-labile (e.g. Botulinus toxin) or heat-stable (e.g. *Staphylococcus* enterotoxins). Infectious pathogens, however, play a more important epidemiological role. The special significance of bacteria as microbial hazards in food is due to their complex kinetics of inactivation, survival and growth. Some of these bacteria include *Mycobacterium bovis*, *Brucella melitensis*, *Salmonella spp.*, *Vibrio cholera*, *Shigella spp.*, *Campylobacter jejenum*, *Escherichia coli* (EHEC) and *Clostridium perfringens* (Untermann, 1998). The types of microorganisms that cause the majority of sporadic cases and outbreaks of food poisoning are listed in Table 1.

Table 1. Major food poisoning microorganisms Source: (Gould *et al.*, 1995)

Minimum growth temperature	Heat resistance	
	Low ^a : Vegetative cells	High ^b : Spores
Low	<i>Listeria monocytogenes</i> <i>Yersinia enterocolitica</i> <i>Vibrio parahaemolyticus</i> <i>Aeromonas hydrophila</i> <i>Salmonella</i> species	<i>Clostridium botulinum</i> E and non-proteolytic B <i>Bacillus cereus</i> <i>Bacillus subtilis</i> <i>Bacillus licheniformis</i>
Medium	<i>Escherichia coli</i> enteropathogenic strains <i>Staphylococcus aureus</i>	<i>Clostridium perfringens</i> <i>Clostridium botulinum</i> A and proteolytic B
High	<i>Campylobacter jejuni</i> and <i>C. coli</i>	

^a In excess of 6 log inactivation of vegetative microorganisms by pasteurization, e.g. at a temperature of about 70°C for 2 min (Gould *et al.*, 1995).

^b In excess of 6 log inactivation of spores at temperatures ranging from about 90°C for the most heat-sensitive types to about 120°C for 10 min for the most heat-tolerant types (Gould *et al.*, 1995).

Microbial hazards cause the most food borne illness outbreaks and are of the greatest concern to food service managers and health inspectors.

2.2 Foodborne infections

Food infections follow the ingestion of bacteria, their toxins or viruses, which may be present in already contaminated food, or derived during processing from other foods by cross contamination (from surfaces, equipment or catering staff hands), or, less likely, from carriers (Barrie *et al.*, 1996). On top of that, poisonous chemicals and/or other harmful substances may also be causes for foodborne diseases if they are present in food. People can become ill if a pesticide is inadvertently added to a food, or if naturally poisonous substances are used to prepare a meal.

More than 250 different foodborne diseases have been identified and most of these diseases are bacterial, viral and parasital infections. Other diseases include poisonings that are caused by harmful toxins or chemicals that have contaminated the food. In many countries, people become ill after mistaking poisonous mushrooms for safe species, or after eating poisonous reef fishes (CDC, 2005). These different diseases have many different symptoms, so there is no one "syndrome" that is foodborne illness. However, the microbe or toxin enters the body through the gastrointestinal tract, and often causes the first symptoms such as nausea, vomiting, abdominal cramps and diarrhea (CDC, 2005).

The most commonly recognized foodborne infections are those caused by the bacteria *Campylobacter*, *Salmonella*, and *E.coli* O157:H7, and by a group of viruses called calicivirus, also known as the Norwalk and Norwalk-like viruses. Some common diseases such as Hepatitis A, *Shigella*, *Giardia lamblia* and *Cryptosporidia* are occasionally foodborne, even though they are usually transmitted by other routes. In addition to disease caused by direct infection, some foodborne diseases are caused by the presence of a toxin in the food that was produced by a microbe in the food. For example, the bacterium *Staphylococcus aureus* can grow in some foods and produce a toxin that may lead to intense vomiting; botulism occurs when *Clostridium botulinum* grows and produces a powerful paralytic toxin in foods. These toxins can produce illness even if the microbes that produced them are no longer there (CDC, 2005).

The spectrum of foodborne diseases is constantly changing. A century ago, cholera and typhoid fever were very common foodborne diseases. Today other foodborne infections have taken their

place, including some that have only recently been discovered. For example, in 1996, the parasite *Cyclospora* suddenly appeared as a cause of diarrheal illness related to Guatemalan raspberries (CDC, 2005). The vast majorities of reported cases of foodborne illnesses are not part of recognized outbreaks, but occur as individual or "sporadic" cases maybe because many of these cases are actually part of unrecognized widespread or diffuse outbreaks (CDC, 2005).

Food related infections constitute an important health problem in both developed and developing countries (Dugassa, 2007; Jacob, 1989). Figures show that an estimate of 76 million food related illnesses are seen annually in the United States of America (Mead *et al.*, 1999; Anding *et al.*, 2007), a total of 23,010 cases of dysentery have been reported in Turkey in 1997 (Acikel *et al.*, 2007; State Statistics Institute, 1999), Emilia-Romagna, a single region in Italy, had 1564 episodes of food-borne diseases between 1988 and 2000 (Emilia Romagna Region Health Assessorship, 2002; Legnani *et al.*, 2004). Though illnesses and outbreak estimates are available for developed countries (Mead *et al.*, 1999; Lynch *et al.*, 2006; Malhotra *et al.*, 2008), lack of effective surveillance systems hampers availability of similar estimates for developing countries (Malhotra *et al.*, 2008).

In most developing countries procuring an adequate supply of safe and nutritious food is a major problem; concerns for sanitation may not be great, physical facilities may be poor, and lower aesthetic standards may prevail, as a result food and drinking water are frequently contaminated with pathogens and therefore the burden of foodborne illnesses in developing countries is considered to be significant and in worst conditions than developed countries as a result of inadequate food safety program (Dugassa, 2007).

Most of the foodborne diseases are preventable but there is no simple one-step prevention measure. Prevention measures need to prevent or limit contamination all the way from farm to table. A variety of good agricultural, manufacturing and kitchen practices can reduce the spread of microorganisms and prevent the contamination of foods. Careful review of the whole food production process can identify the principal hazards, and the control points where contamination can be prevented, limited, or eliminated. A formal method can be used to evaluate and control the risk in foods and it is called the Hazard Analysis Critical Control Point, or HACCP system (CDC, 2005).

2.3 The Food Control System

2.3.1 Prerequisite programs

According to the Canadian Food Inspection Agency (1998), prerequisite programs are universal steps or procedures that control the operational conditions within a food establishment allowing for environmental conditions that are favorable for the production of safe food. The Codex International Code of Practice and General Principles of Food Hygiene is believed to be the basis for these programs. The wide range of activities and events included in prerequisite programs may have an impact on an HACCP system for a specific food product even though they are not parts of the HACCP system per se.

Briefly stated, prerequisite programs include concerns and aspects of the entire food environment before the HACCP system is initiated. They include the suitability of facilities, control of suppliers, safety and maintenance of production equipment, cleaning and sanitation of equipment and facilities, personal hygiene of employees, controls of chemicals, pest control and the like. These programs include good manufacturing practices and should be brought up to acceptable standards before the HACCP system is initiated (Jay, 2000).

Food establishments working with ready-to-eat (RTE) food products understand the importance of developing and implementing procedures to reduce the potential for contamination with microorganisms. Therefore, it is extremely important that anyone involved with ready-to-eat food products develop and implement effective Good Manufacturing Practices (GMPs) and Standard Operating Procedures (SOPs) as the foundations of a successful HACCP program (North American Meat Processors, 1995).

As the matter of fact, prior to application of HACCP to any sector of the food chain, that sector should have in place prerequisite programs such as good hygienic practices according to the Codex General Principles of Food Hygiene, the appropriate Codex Codes of Practice, and appropriate food safety requirements. These prerequisite programs to HACCP, including training, should be well established, fully operational and verified in order to facilitate the successful application and implementation of the HACCP system. All prerequisite programs

must be initially verified and validated and appropriate preventive measures and a monitoring system should be in place. Whereas a deviation from the limits set for the monitoring of prerequisites occurs, a proper corrective action should be applied and addressed under the HACCP plan (Codex Alimentarius Commission, 1997).

GMP is a crucial element in food quality. It encloses all practices regarding the conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

In other words it contains detailed requirements in order to avoid the incidence of problems in:

- Personnel - disease control, hygiene, clothing, training, etc.
- Plant and grounds - construction and design, product flow, drainage, etc.
- Sanitary operations - general maintenance, cleaning and sanitizing, pest control, etc.
- Sanitary facilities and controls - water supply, plumbing, sewage disposal, rubbish and offal disposal, etc.
- Freezers and coolers - monitored and maintained to ensure temperature control, recording devices, alarms, etc.
- Equipment maintenance and calibration - adequate frequency for thermometers, recording devices, compressed air equipment, etc.
- Recall program - It is recommended that all RTE facilities develop a recall program and that mock recalls should be conducted periodically to ensure that the program works as planned (Sandrou *et al.*, 2000).

Standard Operating Procedures (SOPs) can be defined as established or prescribed methods to be followed routinely for the performance of designated operations or undesignated situations (Mulat, 2003). They are very concise and specific step-by-step instructions and establishments are encouraged to have SOPs for every task or activity in the facility. SOPs are also very useful in training employees and in establishing a consistent method for conducting daily operations. Therefore, individual establishments should develop SOPs for their operations. GMPs can help guide the development of SOPs and SSOPs describe how GHP is to be achieved (North American Meat Processors, 1995).

As part of Good Manufacturing Practice (GMP) there is Good Hygienic Practice (GHP) which is mainly concerned with all precautions required to ensure appropriate hygiene. This includes microbiological safety as well as hygienic suitability such as general hygiene and product spoilage (Heggum, 2001). Combining strong GMPs, SOPs, SSOPs and HACCP will increase the total process control system and help in the production of a product that is as safe as possible (Mulat, 2003).

2.3.2 The Hazard Analysis and Critical Control Point (HACCP) System

HACCP is an internationally recognized food safety assurance system that concentrates prevention strategies on known hazards; it focuses on process control, and the steps within that, rather than structure and layout of premises (Egan *et al.*, 2007). HACCP is defined as "an effective system based on Good Manufacturing Practices (GMP) and Standard Sanitation Operation Procedures (SSOP), for providing safe and healthy foods" (Pierson *et al.*, 1992). HACCP is an effective system because the food safety system is designed to provide the information flow for preventive and corrective actions and can easily be established on the production lines of all kinds of foods (Unnevehr *et al.*, 1998; Ergönül *et al.*, 2003). In addition, it establishes procedures whereby these hazards can be reduced or eliminated and requires documentation and verification of these control procedures (Codex Alimentarius, 1997).

HACCP has become a regulatory tool of choice by food manufacturing industries and the larger companies in the hospitality and catering sector for many countries, advanced through its adoption by the Codex Alimentarius Commission in the early 1990s. It has been defined as a method for ensuring food safety since the late 1960s and became recognized and widely endorsed in the 1980s and in the 1990s through its adoption by the US Department of Commerce for seafood, United States Department of Agriculture for meat and poultry, and United States Food and Drug Administration for other foods, including juices (Adams, 2002).

The forerunner of the development of the HACCP system as an approach to prevent food safety hazards is the Pillsbury Company, in conjunction with NASA (National Aeronautical and Space Administration) and the US Army Natick Laboratories (Corlett, 1998). The need for this preventive approach resulted from the recognition that the approach in use at that time for food

safety was based primarily on inspection and testing of foods was neither practical nor effective for ensuring that foods for that space program were free of unacceptable health hazards (Corlett, 1998; Tibebe, 2008).

The system is not restricted to food manufactures but it can also be applied to field production starting from planting operation until food preparation in restaurants, catering services and even homes.

The HACCP system should be suitably placed in the total management system of a food manufacturing company (Komemushi, 2003) and emphasis on the hazard analysis step is important, because weak analysis of the HA (hazard analysis) step makes the HACCP system ineffective, such as the system used by the companies that caused the large scale food poisoning outbreak (Komemushi, 2003).

In the catering sector, different kinds of raw materials are used. So, microbiological risks must be taken into account. The main sources of the microbiological hazards threatening the health of the consumers are *Clostridium botulinum* and its neurotoxin possibly found in rice, starch, dairy and meat products; *Salmonella* originated from undercooked poultry and red meat; *Clostridium perfringens*, *Staphylococcus aureus* and *E. coli* O157:H7 (Scott *et al.*, 1995). Food intoxications and infections caused by pathogen microorganisms also cause economic losses (Ergönül *et al.*, 2003).

In addition the application of HACCP is compatible with the implementation of quality management systems, such as the ISO 9000 series, and is the system of choice in the management of food safety within such systems.

2.4 Meal supply in healthcare settings

Hospital support services have to provide food for patients and staff daily throughout the year. Hospital food should be palatable, attractive, nutritious and free from contamination. Patients are not there by choice: some are too ill to eat and some have anorexia; the immunosuppressed, elderly, and children are particularly vulnerable to the effects of food poisoning. Religious, vegetarian and other special diets have to be considered and provided. Patients receiving

treatment at meal times require a flexible service to avoid storage of meals on wards, staff with variable meal times and visitors who cannot leave the hospital (e.g., relatives of patients on intensive care or children's wards) need consideration and so forth (Barrie, 1996).

Food-borne diseases become of paramount importance in hospitals and healthcare settings. At best, foodborne disease outbreaks in healthcare settings result in inconvenient mild gastrointestinal symptoms; at worst, they are life threatening. In these settings a nutritious diet is essential for patient treatment and recovery and therefore food must be safe, of good quality, wholesome, and served at times that are convenient and appropriate (Lund *et al.*, 2009). In many hospitals meals are prepared and cooked in the hospital kitchen and distributed directly to the wards but sometimes they are prepared and stored.

Hospitals have been identified as high food safety risk institutions because they serve potentially hazardous foods to vulnerable people (South Australia Department of Health, 2008). These people are more susceptible to food-borne illnesses than the general population (South Australia Department of Health, 2008) and consequently food contamination by pathogens could be particularly harmful (Carvalho *et al.*, 2000; Bertin *et al.*, 2009). Infact, small numbers of enteric pathogens that may be innocuous to most healthy people can cause disease and even death in highly susceptible patients, especially in immuno-compromised subjects (Poupet-Réglier *et al.*, 2005). As clinical manifestations are common in hospitalized patients, the true incidence of outbreaks of food-borne disease in hospitals and extended-care facilities is not known and it is unlikely that all events are reported (Poupet-Réglier, *et al.*, 2005).

Generally, the organisms that cause foodborne diseases in hospitals are the same as those causing foodborne diseases in the community. However, outbreaks in hospitals can have more serious consequences for patients. While food-poisoning is commonly self-limiting in previously healthy individuals, debilitated patients may suffer much more serious sequela. Children and the elderly tend to be the worst affected and deaths in hospital outbreaks of foodborne disease are recorded regularly (Lund *et al.*, 2009). For example, between 1999 and 2004, four outbreaks of *Listeria monocytogenes* infection associated with sandwiches purchased from, or provided in, hospitals occurred in the UK (Shetty, 2009); a nosocomial, foodborne outbreak of *Salmonella Enterica serovar enteritidis* occurred in a University Hospital of Heraklion in Greece in 2005 (Gikas,

2007); A hospital outbreak of *Clostridium perfringens* food poisoning in the UK has occurred in 1995 (Regan *et al.*, 1995).

The solution to all problems of avoiding food contamination rests in proper hygiene, proper cooking, proper handling and proper storage of food items. This can only be achieved and maintained if there is proper training, retraining and constant supervision. Good catering practices and procedures depend on provision of appropriate training in food and personal hygiene for food handlers; understanding and complying with current legal requirements by catering and hospital management and planned preventive maintenance of plant. Food hygiene is more than cleanliness. It means the use of policies, practices and procedures to protect food from contamination and prevent multiplication of bacteria to numbers capable of causing food poisoning or food spoilage and ensure the destruction of disease-producing microorganisms by thorough cooking. In hospitals, catering staff are the main food handlers, although nursing and domestic staff may distribute or serve meals (Barrie, 1996).

Microbiological risk can be decreased significantly by preparing food properly in the kitchen. When this rule is not adhered to, kitchens can also become an important contamination point for food. The kitchen staff, therefore, plays an important role in food safety. CDC reports that approximately 20% of food-related infection is due to food handlers (Acikel *et al.*, 2007).

2.5 Causes of nosocomial foodborne disease outbreaks

Foodborne illnesses are usually an upshot of inappropriate food handling practices and a good number of food poisoning outbreaks resulted from food that has been mishandled or mistreated during preparation or storage, inadequate pretreatment, contaminated working environment, high initial bacterial load and so forth (Dugassa, 2007).

The sources of food contamination are diverse but the following factors are believed to be the major contributors to outbreaks of foodborne disease in hospitals (Dugassa, 2007):

1. **Improper holding time/temperature:** i.e. food is held at temperatures that would permit bacterial growth.

2. **Contaminated equipment/ failure in protection from contamination:** Food may be contaminated by polluted water, flies, animals and pets, unclean utensils and pots, dust and dirt (Dugassa, 2007). Cross-contamination is also a very important notion in food safety. Failure in protecting food from contamination could be for instance preparing raw and cooked foods on the same surface, using the same equipment and/or if it is stored in close proximity to organisms that may spread disease causing microorganisms, and not giving further heat treatment before consumption (Dugassa, 2007).

3. **Poor personal hygiene of food handlers:** Food handlers with poor personal hygiene can inoculate the food item with infected excreta, pus, respiratory droppings or other infectious discharges. Sometimes food handlers may be a major source of contamination and ultimate sources of health risks either as carriers of pathogens or through poor hygienic practices (Kaferstein, 2003).

Workers can carry microbial pathogens on their skin, hair, hands, digestive systems or respiratory tracts and unless they have a thorough understanding and follow basic food hygiene principles, they may unintentionally contaminate foods, water supplies and equipment thereby creating favorable conditions for an outbreak of foodborne illnesses (Dugassa, 2007). Certain characteristics concerning these professionals, such as poor educational level, low socioeconomic level, rapid staff turnover, literacy and language problems as well as poor motivation due to low pay and job status, can also contribute to poor professional performance at work (Bertin *et al.*, 2009).

It may be difficult to pinpoint food handlers as the cause of foodborne outbreaks, since finding that food handlers are culture positive for an outbreak strain may simply mean that they are victims of events rather than the cause of them. Yet there is compelling evidence that the food handler can be the cause of outbreaks (Lund *et al.*, 2009). A study (Carvalho *et al.*, 2000) showed that food contamination occurred in Brazilian hospitals were due to food handlers. Thus, food handlers have a very important role in preventing contamination during

food preparation and distribution and this responsibility becomes even greater in hospitals (Bertin *et al.*, 2009).

4. **Chemical contamination:** The haphazard use of chemicals such as insecticides and rodenticides in kitchens also creates hazards. As a matter of fact toxic metals and compounds can find their way into food stuff from utensils, food containers or work surfaces (Dugassa, 2007) posing a great risk for the food consumer.

5. **Food from unsafe sources:** One of the many malpractices includes the provision of food from unsafe sources. For instance raw food items are frequently a source of contaminants because some might naturally harbor pathogens or come from infected animals (Dugassa, 2007).

2.6 Microbiology of Ethiopian sauces

Different kinds of foods are consumed by various ethnic groups in Ethiopia. These foods may be consumed raw or processed. Processing usually includes boiling, salting and drying, roasting, frying, baking, cooking, fermenting or various combinations of these. Microbiological studies of Ethiopian national foods started in the 1980s but studies on ready-to-eat foods are limited (Mogessie, 2002).

Meat based (the principal sources of meat being cattle, sheep and poultry), legume based (made from roasted and ground faba bean or chick pea, split pea or split/whole lentil etcí) or vegetable based sauces (made from cabbage, potato, carrot, Ethiopian kale etcí) are widely consumed together with a pancake like bread called injera. Since most households in Ethiopia do not regularly afford meat based dishes legume based sauces are daily supplements of protein to the starchy injera (Woldaregay *et al.*, 2003). In addition they are also used in the fasting periods.

These sauces are normally cooked at over 85°C for 30-60 minutes or even longer (Deriba *et al.*, 2001) and in most cases dining establishments and households with large families prepare sauces in large quantities early in the day and sauces are usually kept at ambient temperatures for several hours until served with or without re-heating (Mogessie, 2002).

Although ingredients used for gravies, stews, soups or sauces are heavily contaminated from various sources, the cooking process would eliminate most vegetative forms of bacteria, including various foodborne pathogens. Higher counts in such food items are thus results of post-cooking contamination from equipments, utensils surfaces and/or food handlers (Deriba *et al.*, 2001), dust and airborne contaminants after cooking and during serving. Such practice could lead to spoilage and safety problems with possible public health implications (Mogessie, 2002).

The growth potential of various foodborne pathogens in Ethiopian foods has been studied by different workers (Mogessie, 2002) and as a result various foods were reported to carry pathogens or allow the growth of pathogens (Deriba *et al.*, 2001). In a study of microbial spoilage of Ethiopian sauces at ambient temperatures of 22-25 °C, aerobic mesophilic bacteria, Enterobacteriaceae and yeasts were observed at levels of 10^2 cfu (ml)⁻¹ in fresh sauces obtained from different households (Mogessie, 1996b). Spoilage was noted at 48 hours in all legume based sauces, most vegetable and most meat based sauces with counts as high as 10^7 to 10^8 cfu (ml)⁻¹. The spoilage flora was dominated by *Bacillus* spp., Enterobacteriaceae, micrococci, and staphylococci. Spoilage microflora of legume based and vegetable based sauces were dominated by micrococci and staphylococci. It was assumed that some of the spoilage microorganisms might have survived cooking, while others were post-cooking contaminants (Mogessie, 1996b). This is supported by studies that showed that the hygienic practice in food handling is poor making therefore the possibilities of post-cooking contamination considerably high (Mogessie, 2002).

2.7 Food safety in Ethiopia

It has been repeatedly said that the food safety system in developing countries in general and Africa in particular is weak and unable to protect human health (Mulat, 2005; FAO/WHO,

2005). In Ethiopia, health and health related indicators of the Ministry of Health published in 2004 show that among the ten leading causes of outpatient visits to health institutions are all forms of diarrhea diseases and intestinal parasites which are directly or indirectly related to food. However health institutions that compile monthly morbidity statistics do not segregate if the cause for such illnesses is due to food or other (FAO/WHO, 2005). Furthermore, due to weak structural organization, underdeveloped human resource and insufficient resource allocated to food-borne surveillance, there is no systematic surveillance system in place. Occurrence of such diseases is rarely reported and exchange of information between regulatory bodies is virtually absent. As a result, the prevalence and magnitude of the problem inflicted by food-borne illnesses is not known (FAO/WHO, 2005).

The concept of HACCP in Ethiopia has been introduced in 2001 by the United Nations Industrial Development Organization (UNIDO) initiative and many food manufacturing industries have been adhering to it since then. The pioneer company to get HACCP certification was Dire Dawa Food Complex in 2004 followed by Harar Brewery SC. in 2004/5, Fafa Foods SC in 2006, Addis Modjo Edible Oil Complex SC. and Upper Awash Agro Industry. Since 2001 only few food operating systems have adopted and benefitted from the implementation of the system. Moreover, it is not still a mandatory legal requirement that all food operators put in place, implement and maintain a permanent procedure based on the HACCP principles.

The existing food control system in Ethiopia is inefficient in providing the necessary protection to the consumer. A number of reports published by UNIDO, FAO and WHO have highlighted some of the most significant weakness. One of the main problems in the Ethiopian food control system is the division of responsibility among various government agencies and ministries such as the Ministry of Agriculture and Rural Development (MoARD), the Ministry of Health (MoH), the Ministry of Trade and Industry (MoTI) and Quality and Standards Authority of Ethiopia (QSAE). When responsibility for food control is divided among several ministries within one country, decision on the same matter may be taken separately by various departments resulting in overlapping of duties.

By considering the importance of rule and regulations the Federal Ministry of Health of Ethiopia issued a public health law for promoting the health of the society which incorporates food quality

control and food standard requirements. Mandate was also given to regional health bureaus to formulate their own rules and regulations for application of these proclamations.

CHAPTER THREE: MATERIALS AND METHODS

3.1 STUDY LOCATION

This study has been conducted on three randomly selected hospital (HP-1, HP-2 and HP-3) kitchens in Addis Ababa- Ethiopia, under the administration of the Addis Ababa Administration Health Bureau, from October, 2009 to June 2010 to assess the status of food hygiene and food safety issues and practices. All food services in the three hospitals were carried in the hospitals' kitchen by the hospitals' food service staff. HACCP standards have not been implemented in any of the three hospitals.

3.2 SAMPLING PROCEDURES

3.2.1 Sampling procedure for participants

All of the food service staff in all three hospitals has been involved in the study: 24 from HP-1, 8 from HP-2 and 11 from HP-3, the total number of participants being 43.

3.2.2 Sampling of foods

A total of 45 samples were sampled between 12:00 p.m. and 12:40 p.m. All samples, each being 250 g, were placed in sterilized plastic bags and kept in ice box during transport to the food microbiology laboratory of the Ethiopian Health and Nutrition Research Institute (EHNRI, Addis Ababa) and examined on the same day. All samples were taken under aseptic conditions.

The main dishes served were Ethiopian traditional meals prepared with red meat, legumes and seasonal vegetables and therefore the samples consisted of 15 meat based sauces, 15 legume based sauces and 15 vegetable based foods.

A portion of 25g of the food samples were weighed into sterile stomacher bags and subsequently homogenized with 225 ml sterile peptone water. Decimal dilutions up to 10^{-4} were made and

then pour plated in duplicate using Plate Count Agar (Oxoid, Unipath Ltd., Basing Stoke, and Hampshire, England). Plates were incubated at 30 °C for 48 hrs and the total aerobic bacteria count was reported as mean cfu/g.

Total coliforms were determined by the most probable number (MPN) method. 25g of food from each sample was homogenized with 225 ml of Nutrient broth and decimal dilutions up to a factor of 10^{-4} were made. Aliquots of dilutions were inoculated into triplicate tubes containing Lauryl Tryptose broth (LTB) (Oxoid, Unipath Ltd., Basing Stoke, and Hampshire, England) and were incubated at 35 °C for 24hrs. Tubes with gas formation at the end of the incubation period were planted into the brilliant green bile (2%) broth (BGB) (Oxoid, Unipath Ltd., Basing Stoke, and Hampshire, England) and incubated. Those tubes, which formed a gas as a result of incubation process, were evaluated according to the MPN table and results of the test were reported as the most probable number (MPN) per ml of sample (Andrews, 1992).

The number of fecal coliform bacteria in a sample was determined by inoculating a known quantity of the sample on a selective agar medium containing lactose. 1ml of the diluted sample is transferred on Petri dishes and melted violet red bile agar was added and incubated. Suspect colonies were transferred into EC broth and incubated at 44 °C for 24hrs. Confirmation was obtained by gas production.

MPN method was used to determine *E. coli* and for this purpose, gas positive lauryl tryptose broth tubes were gently agitated and loopful of each suspension was transferred to tubes of EC medium (DIFCO 0314-01-0). The EC medium tubes were then incubated at 45.5 °C for 48 h. Loopful of suspension from each gassing EC medium was streaked to eosin methylene blue agar (EMB) (Oxoid CM63) and incubated at 37 °C for 24 h. Differentiation of *E. coli* was carried out by IMViC tests (Andrews, 1992) and then evaluated in accordance to MPN table.

Test for the presence of coagulase positive staphylococci (CNS) in the food samples was also based on the procedure described in the Manual of Food Quality Control of FAO (Andrews, 1992). 25ml of sample was homogenized with 225ml peptone saline solution, further diluted up to 10^{-4} and one ml each of the dilutions was pour plated in duplicate. Preparation of media was according to the directions given by the manufacturers.

3.3 DATA COLLECTION TECHNIQUES

The principal methods employed in this research are: specifically designed questionnaires, microbiological analysis of food samples and observation and assessment scoring scheme designed for comparing standards that evaluate GKP & GHP kitchen conditions.

3.3.1 QUESTIONNAIRE

This involved the application of specifically designed questionnaires based on questionnaires of previous studies by Byrd-Bredbenner, *et al.* (2007) and Angelillo *et al.* (2001). Questionnaires were intended for the medical directors or sanitary department heads and food service staff. The questionnaire addressed to the medical directors or sanitary department heads focused on the general characteristics of the hospital, service catering organization and measures used to prevent and control food-borne diseases. The questionnaire addressed to the food service staff focused on depicting their socio-demographic characteristics, knowledge and practice of food hygiene, knowledge of commonly occurring food-borne diseases, practices regarding the use of preventive measures against food cross-contamination and knowledge of HACCP (Hazard Analysis and Critical Control Points). Questionnaires addressed to the food service staff was first developed in English and then translated to Amharic and administration was carried out in Amharic. The full content of the questionnaires are included in Annex 1 and 2.

The questionnaires have been pilot tested on an expedient sample to prevent ambiguity of interpretation and ensure ease of completion to improve the validity of responses.

3.3.2 OBSERVATION AND ASSESSMENT

This involves the application of a customized scoring scheme designed for comparing standards that evaluate kitchen conditions (GKP and GHP) based on the Codex Alimentarius General Principles of Food Hygiene, as observed by the researcher at the time of visit. All the kitchens of all the hospitals under study have been checked for the status of cleanliness and maintenance of the premises (floors, walls, ceilings, lighting, ventilation, insect and vermin protection), conditions and cleanliness of kitchen equipment, presence of sanitary facilities and water supply,

waste management, storage and refrigeration and personal hygiene of the food handlers. The full content of the questionnaires are included in Annex 3.

3.3.3 MICROBIAL ANALYSIS OF FOOD SERVED TO PATIENTS

All test samples have been analyzed for total aerobic plate count, total fecal coliforms, total coliform count, *E.coli* type I and Coagulase positive staphylococci (CNS). Food samples have been analyzed based on the methods described in the Manual of Food Quality Control of FAO (Andrews, 1992). Microbial safety standards for specific types of foods have been taken from international regulations, like the public health laboratory service guidelines for the microbiological quality of ready to eat foods (PHLS, 2000) and NSW Food Authority microbiological quality guide for ready-to-eat foods (NSW, 2009) .

3.4 STATISTICAL ANALYSIS

The statistical analysis of all data was conducted using SPSS software (version 15.0). One-sample t-test was used to compare acceptable ranges of ACC, total coliform, *E.coli* type I, Coagulase positive staphylococci and microbiological results of the samples. In, addition chi-square test was used to compare food hygiene knowledge among food handlers between the three hospitals. Values of $p < 0.05$ were taken as statistically significant.

3.5 DEFINITION OF OPERATIONAL TERMS

Ready-to-eat food: are perishable refrigerated/frozen items such as luncheon meats, frankfurters, cooked patties and other fully cooked products and meals that do not require further heating before consumption.

Food safety: The assurance that food will not cause harm to the consumer when it is prepared and/ or eaten according to its intended use.

Food handler: any person who directly handles packaged or unpackaged food, food equipments and utensils, or food contact surfaces and is therefore expected to comply with food hygiene requirements.

Food Hygiene: All conditions and measures to ensure the safety and suitability of food at all stages of the food chain.

Hazard analysis critical control point (HACCP): A system that identifies, evaluates, and controls hazards that are significant of food safety.

Vulnerable people: Specifically defined, it is a person who is in care in a healthcare facility or a client of a delivered meals organization.

3.6 ETHICAL CONSIDERATION

Ethical clearance was obtained from The Addis Ababa Administration Health Bureau. Formal letters were given to each medical director informing the purpose of the study and consent was obtained. Confidentiality of the respondents and the hospitals has been maintained.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 GENERAL FOOD SAFETY CHARACTERISTICS AND CAPACITIES OF THE HOSPITALS

38 of the 43 food service staff, one medical director and two sanitary department heads returned the compiled questionnaire making a response rate of 88.37% and 100% respectively. The capacity and overall food safety control measures of the three hospitals studied are presented in Table 2.

Table 2. Capacity and food safety control measures of the hospitals

General Hospital Characteristics	HP-1	HP-2	HP-3
Number of beds	261	98	121
Number of food service staff	24	8	11
Number of meals served daily	783	294	324
Adoption of food hygiene practice manual	-	-	-
Developed food storage procedures	yes	-	-
Developed personal hygiene procedures of food service staff	yes	yes	yes
Developed cleaning and disinfection procedures	-	-	Yes
Temperature monitoring of food	-	-	-
Hazard analysis of food	-	-	-
Inspection of raw materials	yes	yes	yes
Microbial testing of food	-	-	-
Microbial testing of surfaces	-	-	-
Educational training on HACCP for food handlers	-	-	-

The number of food service staff was 24 for HP-1, 8 for HP-2 and 11 for HP-3, the number of hospital beds was 261 for HP-1, 98 for HP-2 and 121 for HP-3 and the number of meals served daily to patients were 783 for HP-1, 294 for HP-2 and 324 for HP-3.

None of the three hospitals under study adopted the HACCP system, none of them gave educational courses or trainings on HACCP to food service staff and none of them adopted a food hygiene practice manual. Only HP-3 has developed food storage, cleaning and disinfection procedures. Microbial testing of surfaces and food samples and temperature monitoring of food was carried out by none of the studied hospitals. However, personal hygiene procedures and inspection of raw materials used for food preparation was carried out by all hospitals. The latter

results can be taken as prerequisite practices to lay the foundation of a successful HACCP system. Points of concern remain the absence of microbiological testing of food and surfaces, temperature monitoring of food and a developed food storage and hygiene practice manuals.

4.2 KNOWLEDGE AND PRACTICE OF FOOD HANDLERS WITH REGARD TO FOOD HYGIENE IN THE HOSPITALS

4.2.1 Socio-demographic characteristic of food service staff

Table 3 gives a description of the respondents of the three hospitals involved in the study. Out of the 38 food service staff who returned the filled questionnaire, 37 (97.36%) are cooks, their mean age was 43.29 (range 27-60) years and 76.32% of them had only attained elementary school education level. The gender split of the respondents was of 100% female.

Table 3. Socio-demographic characteristics of the survey respondents among food service staff in the three hospitals

Socio-demographic characteristics	Frequency	Percentage
Gender		
Male	-	-
Female	38	100
Age		
<30	5	13
31-45	17	45
46-50	9	24
>51	7	18
Type of work		
Nurse	-	-
Cook	37	97.6
Dietitian/nutritionist	1	33
Level of education		
Elementary	29	76.32
High school	7	18.42
Diploma	2	5.26

No statistically significant difference in age and educational level was noticed between hospitals ($p>0.05$).

4.2.2 Knowledge of food handlers regarding food hygiene

Responses regarding knowledge on food hygiene are shown in Tables 4 and 5. The majority of the food handlers (86.8%) were not aware of the correct temperature for a refrigerator and 78.9% of them thought that chilling and freezing eliminates harmful germs in food. In addition to that, 71.1% of them were unaware of the best way to wash fresh fruits and vegetables to keep them free from food poisoning microorganisms and only 5.3% of them knew the correct answer for the question "If you have a sore on the back of your hand, should you prepare food for other people".

Table 4. Respondents' knowledge regarding food hygiene in the studied hospitals

Questionnaire statement	Responses out of 38 (Percentage)	
	Correct	Not correct
Which one is the correct temperature for a refrigerator	5 (13.2)	33 (86.8)
What is the best way to keep from getting food poisoning from fresh fruits and vegetables	11 (28.9)	27 (71.1)
When should kitchen counters be washed, rinsed and sanitized	28 (73.7)	10 (26.3)
Which procedures for cleaning kitchen counters is most likely to prevent food poisoning	32 (84.2)	6 (15.8)
If you have a sore on the back of your hand, should you prepare food for other people	2 (5.3)	36 (94.7)
When preparing food, you should wash your hands after touching which of these	36 (94.7)	2 (5.3)
To prevent food poisoning, how should leftover foods be heated	37 (97.4)	1 (2.6)
Chilling or freezing eliminates harmful germs in food	8 (21.1)	30 (78.9)
To prevent food poisoning, which of the following people should not prepare food	33 (86.8)	5 (13.2)

In these set of questions a generalized lack of adequate knowledge of the correct responses about safe food storage temperature was observed. Comparing the results of this study with similar studies conducted in Italy and Turkey (Angelillo *et al.*, 2001; Buccheri *et al.*, 2007; Tokuç *et al.*, 2008) the level of food safety awareness in this study was found to be very low. This might possibly be due to differences in educational levels. Most of the participants in the other studies

have attained high school or above educational levels when compared to those in this study and some have had educational trainings on food safety.

The great majority of the respondents (97.4%) were aware of how leftover foods should be reheated, 94.7% were aware of when hands should be washed while preparing food, 84.2% were aware of procedures for cleaning kitchen counters to prevent food poisoning and 73.7% were aware of when kitchen counters should be washed, rinsed and sanitized. In addition, food handlers had adequate knowledge on some hygienic practices such as the correct application of cleaning procedures of equipment decreases the risk of infection transmission to patients (97.4%), washing of hands before handling food reduces the risk of contamination (100%), the importance of the use of caps, masks, protective gloves and adequate closing reduce the risk of food contamination (92.1%) and the importance of knowing the temperature of the refrigerator to reduce the risk of food contamination (97.4%). Moreover, 100% of them were aware that raw foods have to be kept separate from cooked foods and that food service staff with cuts and abrasions on hands should not touch unwrapped foods. Chi-square tests show that there is no statistically significant difference in food hygiene knowledge between the three hospitals.

Food service staff knowledge concerning diseases linked with foods is depicted in Table 5. The results show that high level of awareness about certain food pathogens and a very low awareness about other types. High scores were obtained for *Vibrio cholera* or other *Vibrio* spp. (89.5%), *Salmonella* spp. (97.4%) and 60.5% were aware of Hepatitis A as a pathogen related to food. On the other hand questions about *Clostridium botulinum* (100%) and *Staphylococcus aureus* (97.4%) were most frequently answered with 'I don't know' option. Comparing results with the study in Italy (Angelillo *et al.*, 2001), food service staff in the Italian hospitals showed a slightly higher awareness for *Vibrio* spp. and *Salmonella* spp. and a very high level of awareness towards the rest of the pathogens (Angelillo *et al.*, 2001). On the other hand comparing it with another study made in Italy (Buccheri *et al.*, 2007) and India (Malhotra *et al.*, 2008) higher levels of knowledge were observed in the present study for *Vibrio cholera*. Similar results were obtained for the rest of the pathogens. These differences in knowledge concerning disease microorganisms associated with food between this study and those in Italy (Angelillo *et al.*, 2001; Buccheri *et al.*, 2007) were probably due to the general awareness on foodborne diseases and educational levels, as most food service staff of the latter have attained high school and above education levels.

Table 5. Respondent's knowledge regarding pathogens linked with foods

Questionnaire statement	Response frequency (Percentage)		
	Yes	No	Don't know
Which of the following pathogens is related to foodborne diseases? Hepatitis A	23 (60.5)	13 (34.2)	2 (5.3)
<i>Clostridium botulinum</i>	-	-	38 (100)
<i>Salmonella</i> spp	37 (97.4)	1 (2.6)	-
<i>Vibrio cholera</i> or other <i>Vibrio</i> spp	34 (89.5)	2 (5.3)	2 (5.3)
<i>Staphylococcus aureus</i>	1 (2.6)	-	37 (97.4)
Does correct application of cleaning procedures of equipment decrease the risk of infection transmission to patients?	37 (97.4)	1 (2.6)	-
Does washing hands before handling food reduce the risk of contamination?	38 (100)	-	-
Does the use of caps, masks, protective gloves and adequate closing reduce the risk of food contamination?	35 (92.1)	3 (7.9)	-
Do raw foods have to be kept separate from cooked foods?	38 (100)	-	-
Is it important to know the temperature of the refrigerator to reduce the risk of food contamination?	37 (97.4)	1 (2.6)	-
Food service staff with cuts and abrasions on hands should not touch unwrapped foods.	38 (100)	-	-

4.2.3 Foodborne disease control measures

All 38 food handlers either have direct contact and/or distribute food to patients but none of them use gloves and/or masks while touching and/or distributing food items. On the other hand, caps are worn by 100% of the food service staff during distribution or touching food. 65.8% of the food handlers have given a positive response about washing their hands before touching unwrapped raw food, 68.4% wash their hands after touching unwrapped raw food, 100% of them wash their hands before touching unwrapped cooked foods and only 47.4% of them wash their hands after touching unwrapped cooked food. No statistically significant difference was observed between the three hospitals.

Table 6. Respondent's self-reported food disease control measures in HP-1, HP-2 and HP-3

Questionnaire statement	Response frequency (Percentage)	
	Yes	No
Do you touch or distribute food to patients	38 (100)	-
Do you use gloves when you touch or distribute food to patients	-	38 (100)
Do you use a mask when you touch or distribute food to patients	-	38 (100)
Do you wear a cap when you touch or distribute food to patients	38 (100)	-
Do you wash your hands before touching unwrapped raw foods	25 (65.8)	13 (34.2)
Do you wash your hands after touching unwrapped raw foods	26 (68.4)	12 (31.6)
Do you wash your hands before touching unwrapped cooked foods	38 (100)	-
Do you wash your hands after touching unwrapped cooked foods	18 (47.4)	20 (52.6)

Self-reported food hygiene practices and disease control measures generated better results even though some improper practices such as not wearing gloves and masks when touching and/or distributing food items and not washing hands after touching unwrapped cooked foods arose from the results. More or less analogous behaviors were portrayed in previous studies confirming the notion that cross-contamination is a poorly perceived food safety issue (Buccheri *et al.*, 2007; Tokuç *et al.*, 2008). This is a very critical issue in hospitals as they deal with vulnerable people. Food handlers that do not use gloves and masks or with poor personal hygiene can inoculate the food item with infected excreta, pus, respiratory drippings or other infectious discharges being a major source of contamination and ultimate sources of health risks (Kaferstein, 2003). All food service staff, especially in the hospital, should be aware that a careful personal hygiene is a key measure to prevent food contamination and spread of enteric diseases. This is particularly of

paramount importance when pathogens have a low minimum infective dose (Buccheri *et al.*, 2007).

4.2.4 HACCP information

None of the hospital food handlers have ever heard about HACCP and 89.5% of them think that they need more information on HACCP and food hygiene in hospitals. Previous studies suggest that knowledge alone is an insufficient tool to promote food safety and hygienic behaviors since some studies have shown that there were no differences between the staff who attended an educational course and those who did not (Angelillo *et al.*, 2001; Tokuç *et al.*, 2008). In other words, designing food hygiene training as an isolated domain with the sole purpose of providing information and producing certificated personnel is unlikely to result in significant changes in food hygiene practices. There is, therefore a need for alternative educational strategies, such as those based on motivational health education and promotion models (Angelillo *et al.*, 2001; Tokuç *et al.*, 2008).

4.3 KITCHEN CONDITIONS

4.3.1 Floors, walls, ceilings, lighting, ventilation and insect/vermin protection

All of the three hospitals studied have their own kitchen. All of the hospitals have plastered floor types, 67% of them were in average condition while 33% of them had floors in a bad condition and only 67% of them had clean floors at the time of visit. None of the three hospitals' walls and ceilings were free from visible dust, soot, holes and cracks. As far as lighting, ventilation and insect and/or vermin infestation are concerned, all of them had adequate lighting system, none had an adequate ventilation system and 67% were infested by insects, mainly flies and cockroaches.

4.3.2 Kitchen equipments and food handlers

In all cases (100%) easily cleanable kitchen equipments were used and equipments were kept clean. On the other hand, only 33% of the hospital equipments were free from cracks. All hospitals had basins for the washing of utensils and preparation of food and 67% of them have fixed smooth and rough surface with tap water type of basin while 33% have a fixed smooth surface with tap water type of basin. Cleanliness of the basin and surrounding area is kept only in

the case of 33% of the hospitals. Utensils are cleaned and sanitized by using hot and cold water with detergent in all cases. None of the hospitals use drying racks for the cleaned and sanitized equipments and none of them store the utensils under conditions which prevent contamination.

All the food handlers of all the hospitals (100%) wear appropriate clothing in the kitchen but none had clean clothing. Food handlers of the 67% hospitals had short trimmed and clean nails, none of them had discharges from the nose and eyes and visible skin rash, boil, cut or wound at the time of visit. In addition in all hospitals food handlers were wearing jewelry. Managerial supervision of workers was conducted by all hospitals and all of them had a separate room for clothing.

Table 7. Equipment and personnel standard status in the three hospitals

Items	% of hospitals
Kitchen equipments	
Clean equipments	100
Equipments free from cracks	33
Easily cleanable equipments	100
Presence of basin for washing utensils	100
Type of basin	
Fixed smooth surface with tap water	33
Dish bowls	
Fixed rough concrete with tap water	
Fixed smooth and rough surface with tap water	67
Cleanliness of basin and surrounding area	33
Modes of cleaning and sanitizing utensils	
Hot and cold water with detergent	
Only cold water with detergent	
Sanitization of equipments and utensils soaked in sedex	100
Presence of drying racks for sanitized and cleaned utensils	-
Storage of utensils under conditions which prevent contamination	-
Food handlers	
Wearing appropriate clothing	100
Cleanliness of food handler's clothing	-
Short trimmed and clean nails	67
Discharges from nose and eyes	-
Visible skin rash, boil, cut or wound	-
Wearing jewelry	100
Managerial supervision of workers	100
Presence of a separate room for clothing	100

4.3.3 Waste management

All hospitals had an appropriate refuse receptacle and no overfilling was observed, but all receptacles in all hospitals did not have a proper covering. Transportation of the refuse before overfilling is carried out by all hospitals. 67% of the hospitals dispose the refuse by supplying it to municipal services while in one hospital it is burnt onsite.

As far as liquid wastes are concerned all hospitals have a drainage system for the collection and handling of liquid waste and in all cases it is a closed type drainage system. The liquid waste is finally disposed in municipal sewages and no stagnation of liquid waste was observed in all three hospitals. Table 10 depicts waste management in all three hospitals.

Table 8. Waste management in the three hospitals

Items	% of hospitals
Solid waste	
Presence of appropriate refuse receptacles	100
Proper covering of the refuse receptacle	-
Overfilling of receptacles	-
Transportation of refuse before overfilling	100
Final disposal of the refuse	
Supplied to municipal service	67
Burnt at site	33
Disposed on streets or rivers	
Liquid waste	
Presence of a drainage system for collection and handling of liquid waste	100
Type of drainage system	
Closed type	100
Open trench	
Final disposal of liquid waste	
Open dumping in the area	
Septic tank	
Municipal sewage	100
Discharged into river	
Presence of liquid waste stagnation	-

4.3.4 Storage and refrigeration

A refrigerator used to store perishable food items was available in all hospitals. No overfilling was observed and storage of highly perishable and non perishable food was not observed in all hospitals. A fixed thermometer reading was only available for 33% of the studied hospitals. Storage of cooked and raw foods was in the same refrigerator with cooked and raw separate in 33% of the cases while the rest used the refrigerator storing only meat.

There is separate storage room for raw materials in all hospitals and the floor type is plastered in all cases. No contact between stored chemicals with equipment and/or food was observed. Table 11 shows storage and refrigeration conditions in all three hospitals.

Table 9. Storage and refrigeration status of the three hospitals

Item	% of hospitals
Refrigeration	
Availability of a refrigerator for perishable foods	100
Storage of highly perishable and non perishable together	-
Overfilling of the refrigerator in such a way that it prevents circulation of air	-
Storage of cooked and raw foods	
Same refrigerator (cooked and raw separate)	33
Separate refrigerators for cooked and raw	
Same refrigerator (cooked and raw side by side)	
Store only meat	67
Presence of a fixed thermometer reading	33
Storage	
Presence of a separate storage room	100
Type of floor	
Concrete	
Plastered	100
Brick	
Wooden	
Presence of contact of stored chemicals with equipment and/or food	-

4.3.4 Sanitary facilities and water supply

Source of water in 67% of the hospitals is privately installed from municipal supply while 33% of the hospitals use tanker water. The presence of tanker for water shortage times was observed

in 67% of the hospitals. All of the hospitals have a flush type toilet but with no water. No separation between male and female toilet exists in any of the three hospitals. The latrines of 67% of them were clean and comfortable at the time of visit, no fly infestation was observed in any of the hospitals and no hand wash basin is present near the toilet in any of the hospitals.

Table 10. Water supply in the hospitals

Item	% of hospital
Water supply	
Source of water	
Privately installed from municipal supply	67
From communal distribution	
Buy from privately installed pipe	
From tanker	33
Presence of a storage tanker for water shortage times	67

4.4 MICROBIOLOGICAL ANALYSIS OF FOOD

Sauce types, number of samples, number/percentage and count ranges in log cfu/g of aerobic colony count, total coliforms, fecal coliforms, *E.coli* type I and Coagulase positive staphylococci detected in samples are provided in Table 11 to 12.

The mean microbial count (log cfu/g) for aerobic colony count of meat sauces was 4.90, 4.00 for vegetable sauces and 4.66 for legume based sauces. Mean microbial count (log cfu/g) for total coliform count of meat, vegetable and legume based sauces was 2.73, 1.90 and 2.33 respectively.

Table 11. Mean microbial count (log cfu/g) of aerobic colony count, total coliforms, fecal coliforms, *E.coli* type I and CNS in the ready-to-eat foods sampled at the three hospitals.

Samples	N ^o of samples	ACC	Total Coliform	Fecal Coliforms	<i>E.coli</i> Type I	CNS
Meat	15	4.90	2.73	2.70	-0.57	0.45
Vegetable	15	4.00	1.90	1.91	-	0.54
Legume	15	4.66	2.33	2.19	-1.15	-0.10

Table 12. Number and percentage of good, acceptable and unsatisfactory samples in the three hospitals.

Microbial Parameter	Sauce type	N° of samples	N° of good samples (%)	N° of acceptable samples (%)	N° of unsatisfactory samples (%)
ACC	Meat	15	8 (53 %)	6 (40 %)	1 (7 %)
	Vegetable	15	8 (53 %)	6 (40 %)	1 (7 %)
	Legume	15	6 (40 %)	6 (40 %)	3 (20 %)
Total coliforms	Meat	15	9 (60 %)	4 (27 %)	2 (13 %)
	Vegetable	15	11 (73 %)	4 (27 %)	-
	Legume	15	10 (67 %)	3 (20 %)	2 (13 %)
<i>E.coli</i> Type I	Meat	15	11 (73 %)	-	4 (27 %)
	Vegetable	15	15 (100 %)	-	-
	Legume	15	14 (93 %)	-	1 (7 %)
CNS	Meat	15	15 (100 %)	-	-
	Vegetable	15	15 (100 %)	-	-
	Legume	15	15 (100 %)	-	-

Ranges according to the public health laboratory service guidelines for the microbiological quality of ready to eat foods (PHLS, 2000) and NSW Food Authority microbiological quality guide for ready-to-eat foods (NSW, 2009):

ACC: Good $<10^4$; Acceptable $<10^5$; Unsatisfactory $\times 10^5$

Total coliform: Good $<10^2$; Acceptable $<10^4$; Unsatisfactory $\times 10^4$

E. coli type I: Absent

CNS: Good $<10^2$; Acceptable $<10^3$; Unsatisfactory $<10^4$

The study has shown that the majority of the meat sauces prepared in the hospital kitchens were of good and acceptable ACC (53% and 40% respectively) quality, while one sample was found to be of unsatisfactory quality. The borderline limit of aerobic colony count (10^5 cfu/g) was not exceeded in the majority of the vegetable sauces as 53% and 40% of the vegetable sauces were of good and acceptable ACC quality. Legume based sauces showed similar results as well except in 20% of the cases where they were found to exceed the acceptable level for ACC standards.

Total coliform counts showed that 60% of the meat sauces were of good microbial quality, 27% were of acceptable quality and 13% were of unsatisfactory quality. For the same microbial parameter 73% and 27% of the vegetable sauces were found to be of good and acceptable microbial quality respectively. Total coliform count for legume based sauces showed that the majority were of good and acceptable microbial quality (67% and 20% respectively) while 13% of them were of poor quality.

All food types had good CNS microbial quality ($<10^3$ cfu/g) with respect to the public health laboratory service guidelines for the microbiological quality of ready to eat foods (PHLS, 2000) and NSW Food Authority microbiological quality guide for ready-to-eat foods (NSW, 2009). Indicator microorganism *E. coli* was detected in the case of 4(27%) meat samples and 1(7%) legume sample only.

Based on the values depicted in Table 11, the highest number of aerobic mesophilic bacteria, total coliforms, fecal coliforms and *E.coli* type I was observed in meat based sauces. Even though all sauce types were of good CNS microbial quality, higher numbers were recorded in vegetable sauces. Significant difference ($p<0.05$; One-sample t-test) was observed between acceptable ranges of ACC, total coliform, *E.coli* type I, Coagulase positive staphylococci and microbiological results of the samples.

Contact with the surrounding environment might be a major reason for microbial contamination of food. This includes contaminated food containers, unclean utensils and equipments, hands and cloth of the food handlers or pests (Dugassa, 2007). Assessment of kitchen conditions in this study have shown that utensils were stored under conditions which did not prevent contamination and that working clothes of the food handlers were not kept. These might have contributed for microbial contamination of food. Accordingly, the incidence of fecal coliforms and *E.coli* type I may indicate a mediocre or even scanty food handling practices and/or cross-contamination during distribution or in the kitchen (Ayçiçek *et al.*, 2004). Presence of these microorganisms in food samples tested from the hospitals maybe due to the absence of hand wash basin near to the toilets. On top of that the fact that not all of the handlers kept short trimmed and clean nails might also have contributed to unsatisfactory microbial qualities. Although the majority of the food handlers had reported to comply with good hand washing

practices, faulty practices may exist among some food handlers and as a result may contribute to poor food microbial quality.

The presence of Coagulase positive staphylococci in the ready-to-eat sauces of this study indicates also poor personal hygienic practices (Ayçiçek *et al.*, 2004). This may be because handlers do not use gloves or use masks during food preparation and distribution. No published studies on microbiological quality of hospital foods in Ethiopia were found and therefore results of this study could not be compared. However, comparing the findings of this study to studies made in France (Poupet-Réglier *et al.*, 2005) and Turkey (Ayçiçek *et al.*, 2004) we find that similar results were obtained.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

On the basis of the findings of this study, it was concluded that the microbial quality of the majority of the sauce types were satisfactory as most results fell within the good and acceptable range but the presence of coliforms, fecal coliforms, *E.coli* type I and Coagulase positive staphylococci indicate a possible post-cooking contamination. A better management and control is therefore, required. Consequently, changes should also be made in the distribution conditions of meals in order to improve their microbial safety.

In addition, assessment of the Good Hygienic Practices and Good Kitchen Practices has identified gaps with regard to status of the premises, status and storage of equipments, some aspects of personal hygiene and sanitation and pest control. It is a well known fact that a well designed premises and reliable equipments are the foundations for the prevention and control of food safety hazards and thus, improvements in these areas should also be done.

As far as food handlers' knowledge is concerned a frequent unawareness of some foodborne pathogens and control measures were observed and this might have contributed to the presence of coliforms, fecal coliforms, *E.coli* type I and Coagulase positive staphylococci in samples.

A Hazard Analysis and Critical Control Points (HACCP) system has not been implemented in any of the three health care facilities. Results from this study underlined the importance and need of a full implementation of the HACCP system for proper hygiene and proper handling of food items.

5.2 RECOMMENDATION

In view of the findings of this study the following recommendations can be made:

1. This study has focused on the prerequisite programs and microbiological quality analysis of foods. Further studies should be conducted on chemical and physical hazards. In addition, microbial analysis of equipment surfaces and screening food handlers for hand contamination should be carried out.
2. This study focused on only three governmental hospitals in Addis Ababa. Thus, further studies should be done on other governmental and private hospitals in order to generate more data on GHP, GKP and microbiological quality of food for implementing HACCP.
3. Food services staffs in hospitals represent a potential source of nosocomial foodborne outbreaks since they can contaminate food with pathogens at any stage of the food chain purchasing, preparing and distributing process. Therefore to prevent unintentional contamination due to lack of adequate knowledge, educational/training programs need to be established in order to continually strengthen food safety principles.
4. In a country where adequate foodborne disease surveillance system lacks, adoption of the Hazard Analysis and Critical Control Points (HACCP) approach is probably the most cost effective approach and will definitely ensure the quality and safety of the served meals. It follows that sound approaches to food safety management in hospital foods must be implemented.
5. Food laws, legal requirements and/or standards should be introduced for microbial quality criteria of ready-to-eat foods. Moreover, the inspection and enforcement mechanisms on healthcare settings should be strengthened.

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ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES FOOD SCIENCE AND NUTRITION PROGRAM

ANNEX 1: QUESTIONNAIRE FOR FOOD-SERVICE STAFF

This questionnaire is prepared to assess food hygiene practices of the food service staff and their knowledge of HACCP (Hazard Analysis and Critical Control Points). You are kindly requested to read the questions carefully and respond in the manner clearly indicated for each. The information you provide is very crucial for the success of the study. You are, therefore, kindly requested to be honest towards all the items provided. Your responses will only be used for research purpose and therefore be kept confidential.

A. Sociodemographic characteristics

1. Male _____ Female _____
2. Age _____
3. Type of work: Nurse _____ Cook _____ Dietitian _____ Other (please specify) _____
4. Level of education: Elementary _____ High school _____ Diploma _____
 Degree _____ Masters _____ None _____

B. Knowledge

5. Does correct application of cleaning procedures of equipment decrease the risk of infection transmission to patients? _____ Yes _____ No _____ I don't know
6. Does washing hands before handling food reduce the risk of contamination? _____ Yes _____ No _____ I don't know
7. Does the use of caps, masks, protective gloves and adequate closing reduce the risk of food contamination? _____ Yes _____ No _____ I don't know
8. Which of the following is the correct temperature for a refrigerator?
 _____ <1°C _____ 1-4°C _____ 5-8°C _____ 9-12°C _____ 13-16°C
9. Do raw foods have to be kept separate from cooked foods? _____ Yes _____ No _____ I don't know
10. Is it important to know the temperature of the refrigerator to reduce the risk of food contamination?
_____ Yes _____ No _____ I don't know
11. Food service staff with cuts and abrasions on hands should not touch unwrapped foods.
_____ Yes _____ No _____ I don't know

12. The best way to keep from getting food poisoning from fresh fruits and vegetables is to wash them with: _____regular soap _____hot water _____anti bacterial soap _____cool running water

Which of the following pathogens is related to food-borne diseases?

	Yes	No	Don't know
13. Hepatitis A virus	_____	_____	_____
14. Clostridium botulinum	_____	_____	_____
15. Salmonella spp	_____	_____	_____
16. Vibrio cholera or other Vibrio spp	_____	_____	_____
17. Staphylococcus aureus	_____	_____	_____

18. When should kitchen counters be washed, rinsed and sanitized?

_____after each use _____when you begin working with another type of food_____at four hour intervals if the counter is in constant use _____all of the above

19. Which procedures for cleaning kitchen counters is most likely to prevent food poisoning?

_____spray with a strong sanitizing solution _____wash with a detergent _____wipe with a sanitizing solution _____brush off any dirt or food piece

20. If you have a sore on the back of your hand, should you prepare food for other people?

_____Yes, if it isn't infected _____Yes, if you put a bandage on it _____Yes, if you wear a glove
_____Yes, if you bandage the sore and wear a glove _____ No, you should not prepare until the sore heals

21. To prevent food poisoning, which of the following people should not prepare food? (Check all that apply) _____a person with diarrhea _____a person with a fever _____a person with HIV

_____a person with bandage burns on his /her hands that are covered with gloves

_____a person with itching _____a person who smokes

_____a person with sore throat _____a person with vomiting

22. When preparing food, you should wash your hands after touching which of these? (Check all that apply) _____your face _____utensils that are being used to prepare food _____clothing

_____fresh fruit _____a pimple _____hair

23. To prevent food poisoning, how long should leftover foods be heated? _____ reheating is not necessary _____until they are boiling hot _____ just until they are hot _____at room temperature

24. Chilling or freezing eliminates harmful germs in food? _____Yes _____No

C. Foodborne diseases control measure

25. Do you touch or distribute food to patients? _____yes _____No

26. Do you use gloves when you touch or distribute food to patients? _____Yes _____No

27. Do you use a mask when you touch or distribute food to patients? _____Yes _____No

28. Do you wear a cap when you touch or distribute food to patients? _____Yes _____No

29. Do you wash your hands before touching unwrapped raw foods? _____Yes _____No

30. Do you wash your hands after touching unwrapped raw foods? _____Yes _____No

31. Do you wash your hands before touching unwrapped cooked foods? _____Yes _____No

32. Do you wash your hands after touching unwrapped cooked foods? _____Yes _____No

D. Information regarding HACCP

33. Have you ever heard of HACCP? _____Yes _____No

34. From where did you get the information? _____Audiovisual material _____Mass media
_____Training courses _____Other (specify)

35. Do you think you need more information about HACCP and food hygiene in hospitals?
_____Yes _____No

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**ANNEX 2: QUESTIONNAIRE FOR HOSPITAL MEDICAL DIRECTORS OR SANITARY
DEPARTMENT HEADS**

Please read the questions and respond in the manner clearly indicated for each. Thank you for taking your time to complete the questionnaire. Your responses will only be used for research purpose and therefore be kept confidential.

1. Number of beds in the hospital _____
2. Number of food service staff in the hospital for each of the following:
_____cooks _____nurses _____dietitians
_____domestic staff _____other (please specify)
3. Are meals prepared in the hospital? Yes_____ No_____
4. Estimated number of meals served daily to patients. _____
5. Are food hygiene practices manual been adopted? Yes_____ No_____

Indicate which of the following guidelines have been developed in your hospital (check all that apply)

6. _____Food storage procedures
7. _____Procedures for personal hygiene of food service staff
8. _____Cleaning and disinfection of surfaces and equipment
9. _____Temperature monitoring of foods

Indicate which of the following food hygiene practices are carried out in your hospital (check all that apply)

10. _____ Hazard analysis of food practices
11. _____ Inspection of raw materials
12. _____Microbial testing of food
13. _____Microbial testing of surfaces
14. Have educational courses or trainings on HACCP (Hazard Analysis and Critical Control Points) and food hygiene for food service staff been given? Yes_____ No_____

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ANNEX 3: CUSTOMIZED SCORING SCHEME DESIGNED FOR COMPARING STANDARDS THAT EVALUATE KITCHEN CONDITIONS AND IF CONTROL MEASURES EXIST AND ARE IMPLEMENTED AS OBSERVED BY THE RESEARCHER AT THE TIME OF VISIT.

Kitchen condition

Floors, walls and ceilings

1. Type of floor: Concrete/ cement Earthen Brick Plastered
 Wooden Other(specify)
2. Is the floor clean at time of visit? Yes No
3. Floor status: In good condition Average condition Bad condition
4. Is the wall free from visible dust, soot, dirt or spider web? Yes No
5. Is the wall free from holes and cracks? Yes No
6. Does the kitchen space serve for other additional purpose? Yes (specify) No

Lighting and ventilation

7. Is the kitchen provided with adequate lighting systems? Yes No
8. Is the kitchen provided with adequate ventilation systems? Yes No

Insect and vermin protection

9. Is any infestation of kitchen observed at time of visiting? Yes (specify) No

Kitchen equipments and food handlers

10. Are the equipments kept clean and free from visible dirt and filth? Yes No
11. Are equipments free from cracks? Yes No
12. Are equipments easily cleanable? Yes No
13. Is there basin for washing utensils used for food preparation? Yes No
14. If present, how many compartments does it have? _____
15. What type of basin is it? fixed smooth surface with water tap dish bowls/bucket
 fixed rough concrete with water tap other (specify)
16. Cleanness of the basin and its surrounding area: kept not kept
17. Modes of cleaning and sanitizing of utensils:
 Hot and cold water and detergent used for cleaning
 Only cold water with detergent used
 Only hot and cold water used
 Only cold water used
 Only local soap and cold water used
 Sanitization of equipments & utensils soaked in sedex
18. Are there drying racks for sanitized and cleaned utensils? Yes No

19. Are utensils and equipments stored in containers or on shelves under conditions which prevent contaminations? Yes No
20. Do all food handlers wear appropriate clothes? Yes No
21. Are food handlers' clothing clean? Yes No
22. Are food handlers' nails short trimmed and clean? Yes No
23. Do food handlers have discharges from nose and eye and cough during visit? Yes No
24. Is any kind of visible skin rash, boil, cut and wound observed at time of visit? Yes No
25. If any visible cut and wound has been observed, is it:
 Plastered with water impermeable bandage Openly left Other (specify)
26. Do handlers wear any type of jewelry at time of visit? Yes No
27. Do managers supervise workers on their normal work? Yes No
28. Is cooked food handled properly in kitchen/ kept in sealed conditions to prevent access to insect and environment? Yes No

Waste management

Solid waste

29. Are appropriate refuse receptacles present in the kitchen? Yes No
30. Are the receptacles properly covered and tight? Yes No
31. Are the receptacles overfilled at the time of visit? Yes No
32. Are the refuse transported to final disposal before over filling? Yes No
33. Final disposal of the refuse is: Supplied to municipal service Burnt at site (open burn)
 Disposed on street or in rivers Other (specify)

Liquid waste

34. Is there a drainage system for collection and handling of liquid waste? Yes No
35. What type of drainage system is it?
 Closed type which can collect all generated liquid waste
 Open trench that can collect fraction of generated waste
 Other (specify)
36. Where is the liquid waste disposed finally?
 Open dumping in the area Septic tank Dumped in latrine
 Discharged into the river Other (specify)
37. Is there any stagnation of liquid waste due to blockage or careless handling? Yes No

Storage and refrigeration

38. Is a refrigerator available for storage of perishable foods? Yes No
39. Are highly perishable and non perishable foods stored together? Yes No
40. Is the refrigerator over filled in such a way that it limits circulation of air? Yes No
41. Storage of cooked foods and raw foods:
 a. Separate refrigerators for raw and cooked foods.
 b. Same refrigerator (cooked food in different compartment).
 c. Same refrigerator (raw and cooked side by side).
 d. Other (specify)
42. Does the refrigerator have a fixed thermometer reading? Yes No
43. If present, what is the reading of temperature at time of visit? _____
44. Is there a separate storage room? Yes No

45. If yes, type of floor: Concrete/ cement Plastered Bricks Wooden
 Earthen Other (specify)
46. Is the storage room free from moisture and dust? Yes No
47. Do stored chemicals come in contact with equipments and/or foods? Yes No

Sanitary facilities and water supply

48. Source of the water: privately installed from municipal supply
 from communal distribution buy from privately installed pipe
 others (specify)
49. Is there any tanker for storage of water for shortage time? Yes No
50. Type of toilet: flush type dry pit latrine other (specify) no latrine
51. Its services at time of visit: giving service locked and not giving service
 out of service as failed other (specify)
52. Separation for male and female toilets? Yes No
53. Is the latrine clean & comfortable to use at time of visit? Yes No
54. Fly infestation at time of visit? Yes No
55. Is hand wash basin provided to use after toilet near toilet? Yes No

Cloak room

56. Is there separate room for clothing, resting and placing of clothes for workers? Yes No