

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

**PREVALENCE OF INTESTINAL PARASITIC INFECTIONS AMONG FOOD  
HANDLERS AND MICROBIAL SAFETY OF READY-TO-EAT FOODS IN  
SELECTED ORPHANAGE CENTERS IN ADDIS ABABA**

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## LIST OF ABBREVIATIONS

- ÉAIDS ó Acquired Immunodeficiency Syndrome  
ÉANOVA ó Analysis of Variance  
ÉAPC ó Aerobic Plate Count  
ÉCDC ó Center for Disease Control  
ÉCFU ó Colony Forming Units  
ÉCV ó Coefficient of Variance  
ÉDFS ó Direct Fecal Smear  
ÉECSA ó Ethiopian Central Statistics Authority  
ÉEHNRI ó Ethiopian Health and Nutrition Research Institute  
ÉGI ó Gastrointestinal  
ÉHACCP ó Hazard Analysis and Critical Control Points  
ÉHIV ó Human Immuno Deficiency Virus  
ÉRTE ó Ready-to-eat  
ÉSPSS ó Statistical Products and Service Solutions  
ÉUSDA ó United States Department of Agriculture  
ÉUSDHHS ó United States Department of Health and Human Services  
ÉWHO ó World Health Organization



## ABSTRACT

According to the Ethiopian Central Statistics Authority report, in 2004; there were about 436,726 orphan children by both parents throughout the country. Among those, Addis Ababa had 29,926 orphan children by both parents in the same year (ECSCA, 2004) though recent statistical information could not be found. This indicates that a significant proportion of the total population have problem of having adequate food, shelter and clothes. However, in the capital city of Ethiopia, there are 99 orphanage centers that have signed agreement with the Bureau of Women & Children's Affairs of A.A. Plenty of children orphan by both parents are still in trouble of having their basic necessities. In most cases the centers might give attention only to the availability of food but not of its safety. Thus, this study was designed to determine the microbiological safety of the RTE foods, the prevalence of intestinal parasitic infections among food handlers and the overall hygienic practices/facilities in food preparation.

A cross-sectional study was conducted from February to May 2010. Four orphanage centers were recruited for the study by simple random sampling technique. Standardized and structured questionnaire was used to gather information on the overall sanitary conditions of the centers. For the prevalence of intestinal parasitic infections, all (40) food handlers were participated in stool examination through DFS technique. A total of thirty six RTE food samples were also collected from the centers and examined for microbial quality at EHNRI food microbiology laboratory in Addis Ababa. Standard methods were used to determine APC, total and fecal Colforms, *Staphylococci*, Enterobacteriaceae, *Enterococci*, and Lactic acid bacteria. Predominant colonies isolated from APC plates were characterized to different bacterial groups by morphological and physiological tests. EPI Info version 6 and SPSS statistical packages were employed for data management.

The findings of this study showed that 14(35%) of the food handlers from all (four) orphanage centers were infected with one of either protozoan or helminthic parasites. The most common intestinal parasitic infections encountered among these infected individuals were *A. lumbricoides* (50%), followed by *E. histolytica* (42.86%), *G. lamblia* (21.43%) and

*Taenia* species (7.14%). Improper food storage, poor personal hygiene and food handling practices of the food handlers and poor sanitary facilities were also the major defects observed. Fifty percent of the floor and 75% of the walls and ceilings of the kitchens were found in poor sanitary conditions. Accordingly, the predominant groups of bacteria isolated from the APC plates were *Bacillus*, *Staphylococcus* and *Enterobacteriaceae*.

Finally it was concluded that the unacceptable limit of *Staphylococcus* and *enterobacteriaceae* in RTE foods indicating poor hygienic practices of the food handlers with improper temperature control and high prevalence of intestinal parasites among food handlers were of unacceptable quality and safety of food in the centers.



## 1 - INTRODUCTION

Food borne disease is defined as any disease of an infectious or toxic nature caused by consumption of contaminated food. Foodborne disease outbreak is the occurrence of two or more cases of a similar foodborne disease resulting from the ingestion of a common food (WHO, 2008).

Food can be contaminated by physical, chemical and microbiological agents. The microbial agents responsible for food borne diseases are bacteria, viruses, parasites and fungi (Stewart, 1997). However the sources of food contamination are diverse. It may be contaminated by polluted water, flies, animals and pets, unclean utensils and pots, dust and dirt. Unhygienic food handlers can also inoculate the food with infected excreta, pus, respiratory droppings or other infectious discharges (Dugassa, 2007). A study conducted in Malaysia showed that approximately 10-20% of food-borne disease outbreaks are due to contamination by the food handlers (Zain & Naing, 2002).

Food-borne illnesses have an impact in both developing and developed countries. However, most of the annual 1.5 billion episodes of diarrhoea in children under five years of age occur in developing countries. A significant proportion of diarrhoeal cases are food-borne in origin, and the more than 3 million resultant deaths per year are an indication of the magnitude of this problem. Moreover, in developing countries, up to an estimated 70% of cases of diarrheal disease are associated with the consumption of contaminated food (WHO, 1979 & 2000). Though reliable statistics on foodborne

diseases are not available due to poor or non-existent reporting systems in most developing countries, such diseases take a heavy toll in human life and suffering, particularly among infants and children, the elderly and other susceptible groups. They also create an enormous social, cultural and economic burden on communities and their health systems (T. Van de Venter, 2003).

Food borne disease is caused mainly by the oral ingestion of viable microorganisms (infection) or of the toxins they produce (intoxication) in sufficient amounts to develop pathology (Ana, et al., 2008). Food may be the means for the spread of infectious disease in several ways, in some cases it can act as a medium for the growth of disease organisms, producing large number of bacteria or bacterial toxins (Purdon, 1980). Thus, studies determining the microbial load of the ready-to-eat foods need to be conducted to understand the potential risk of foodborne disease outbreaks that might be faced by the children in orphanage centers.

Furthermore, the transmission of enteric pathogens including helminthes, protozoa, and enteropathogenic bacteria occurs directly or indirectly by food, water, nails, and fingers contaminated with feces indicating the importance of fecal-oral person-to-person transmission (Onyango, et al., 2009). Consequently, food handlers with poor personal hygiene working in food serving establishments are potential sources of infection with enteric pathogens (Onyango, et al., 2009). Food handlers harboring and excreting enteric pathogens may contaminate foods with fecal material via their fingers to food processing system and eventually to healthy individuals (Onyango, et al., 2009). A study conducted

in Malaysia showed that approximately 10-20% of food-borne disease outbreaks are due to contamination by the food handlers (Zain & Naing, 2002). Thus, it requires proper screening procedure in order to monitor the hygienic practices of the food handlers to preventing possible morbidity.

Intestinal parasitic infections are among the major diseases of concern to public health throughout the world (WHO, 1987). Some of the parasite species are associated with severe morbidity often resulting in mortality, particularly in less developed tropical and subtropical countries. Amoebiasis, giardiasis, ascariasis, hook worm infection, and trichuriasis are among the most common intestinal parasitic infections worldwide and are closely related to socio-economic status, poor sanitation, inadequate medical care and absence of safe drinking water supplies (WHO, 1987, 1999).

In developing countries where financial resources are scarce, food control issues usually receive low priority in public health programs. Food-borne illnesses are perceived as mild, self-limiting diseases and their health and economic consequences are often overlooked. A lack of information leads to underestimation of the health significance of unsafe food; at times, no resources at all are assigned to food safety, and food control measures and food-borne disease investigation and surveillance are neglected. As no data on food-borne illnesses or other health and economic effects of unsafe food are generated, policy-makers continue to give the subject low priority, and so the cycle continues (T. Van de Venter, 2003).

When there is a serious food-borne disease outbreak, food control matters receive attention for a few days and are highlighted by the media ((T. Van de Venter, 2003); as the case was with the recent food and waterborne disease outbreak here in Ethiopia (Addis Ababa). Once the incidence is over, however, it is soon forgotten and the experience gained is not translated into management decisions.

In fact, childhood is a time of active growth in terms of physical, size, mental, emotional, sexual maturation and psychological development. Normal growth is dependant on adequate nutrition and encompasses major transformations from birth to adulthood, progressing in an ordered stepwise fashion. Human body can use carbohydrates, fats, proteins as a source of energy. When the intake of energy is not optimum, this can lead to malnutrition in the long run (Nuha, 2005). Furthermore nutritional status of a child not only depends on food availability and access to it but also affected by the presence of parasites. Carbohydrates as well as other nutrients such as protein, fats and vitamins are found to be less absorbed during diarrhoeal and other gastrointestinal (GI) infections. Diarrhoea, including that of parasitic origin, remains one of the most common illnesses in children, and one of the major causes of infant and childhood mortality in developing countries (Simona, et al., 2006). Because of their particular vulnerability and the long-term adverse consequences of malnutrition, children should have safe, nutritious and adequate food services. To this effect, this study was designed to evaluate the prevalence of intestinal parasitic infections among food handlers in selected orphanage centers in Addis Ababa and also to analyze the microbial safety of foods collected from the same environment (food establishments).

This study has therefore been designed to determine the prevalence of intestinal parasitic infections among food handlers and the microbial safety of the ready-to-eat foods served to orphan children in relation to the overall hygienic facilities of selected orphanage centers located in Addis Ababa. Finally, the research findings may suggest increasing the awareness of the food handlers and responsible officials about the importance of good hygienic practices in their food preparation and services indicating the possible risks of foodborne disease outbreaks and their safety measures to reduce microbiological contamination and in turn protect the health of the consumers and the food handlers as well. Moreover, it might also be used as information source for further research works in related fields and as a basis for improvement or establishment of Operational Guidelines of the Sanitation Code in the orphanage centers in Ethiopia.



## **2 - STATEMENT OF THE PROBLEM**

According to the Ethiopian Central Statistics Authority report, in 2004 there were about 436,726 orphan children by both parents. (i.e., they lost both their fathers and mothers throughout the country. Among those, Addis Ababa had 29,926 orphan children by both parents in the same year (ECSA, 2004). This indicates that a significant proportion of the total population have problem of having adequate food, shelter and clothes though recent statistical information could not be found.

However, in the capital city of Ethiopia, there are 99 orphanage centers that have signed agreement with the Bureau of Women & Children's Affairs of Addis Ababa. Plenty of children orphan by both parents are still in trouble of having their basic necessities. Based on the preliminary survey done, most of the children had been obtained in main streets of Addis Ababa. In most cases the centers might give attention only to the availability of food but not of its safety. As a result, those children may easily be threatened by foodborne diseases of the enteric pathogens and other disease causing agents contaminating the food.

Though reliable statistics on food borne diseases are not available due to poor or non-existent reporting systems in most developing countries (Kinfu, 2005), such diseases take a heavy toll in human life and suffering, particularly among children. Foodborne bacterial infections are particularly prevalent, children in developing countries may experience five episodes of diarrhoea per year and 800,000 children die each year from diarrhoea

and dehydration (WHO, 1996). Furthermore, young children are at most risk to foodborne diseases because their immune systems are still developing and the protection afforded by the resident gut flora is not as effective as in adults (WHO, 2002). In addition, children consume more food in proportion to their weight than adults; hence they absorb more toxins and contaminants. Thus, studies in relation to food safety issues need to be conducted where people, especially children are living together having food services in mass catering establishments. Because food prepared in large quantities is more liable to contamination, there is a greater potential for the occurrence of food borne disease outbreaks if basic sanitary practices are not maintained (Charles, 1983).

The transmission of enteric pathogens including helminthes, protozoa, and enteropathogenic bacteria occurs directly or indirectly by food, water, nails, and fingers contaminated with feces indicating the importance of fecal-oral person-to-person transmission. Consequently, food handlers with poor personal hygiene working in food serving establishments are potential sources of infection with enteric pathogens (Abel, 2009). Studying the microbial load of the ready-to-eat foods and the prevalence of these pathogens among the food handlers has paramount importance to understand the health status of the children in relation to the hygienic facilities of the centers.

### **3 - OBJECTIVES OF THE STUDY**

#### **3.1 - General objective:**

To determine the prevalence of intestinal parasitic infections among food handlers and to determine the microbial load of the ready-to-eat food in relation to the hygienic practices (facilities) in selected orphanage centers in Addis Ababa.

#### **3.2 - Specific objectives:**

1. To determine the prevalence of intestinal parasitic infections among food handlers in selected orphanage centers,
2. To determine the microbial load of the RTE (ready-to-eat) foods being served to the children in the centers,
3. To characterize the micro flora of the food samples to the genus level and various bacterial groups and
4. To assess the overall hygienic practices of the food handlers and sanitary qualities of facilities of the centers.

## **4 – REVIEW OF LITERATURE**

### **4.1. Food Contamination**

Food for human consumptions is expected to be clean, wholesome and sanitary, it should be nourishing and attractive, it must be visibly clean and free from noxious materials (Dugassa, 2007). But food can be contaminated by: physical, chemical and microbiological agents (Stewart, 1997). However the sources of food contamination are diverse. It may be contaminated by polluted water, flies, animals and pets, unclean utensils and pots, dust and dirt (Dugassa, 2007). And contamination can occur at any point in the food chain: in processing plants, at supermarkets and restaurants or in the consumer's kitchen – in short, from the farm to fork (USDA, 2009). Hazards can be introduced into foodservice operations in numerous ways: by employees, food, equipment, cleaning supplies and customers. The hazards may be biological (including bacteria and other microorganisms), chemical (including cleaning agents) or physical (including glass chips and metal shavings) (Julie, 2007).

### **4.2. Foodborne Disease and Its Outbreak**

Foodborne disease is defined as any disease of an infectious or toxic nature caused by consumption of food. And foodborne disease outbreak is the occurrence of two or more cases of a similar foodborne disease resulting from the ingestion of a common food (WHO, 2008). Many different disease causing microbes, or pathogens, can contaminate foods, so there are many different foodborne infections. In addition, poisonous chemicals, or other harmful substances can cause foodborne diseases if they are present in food

(CDC, 2005). The Centers for Disease Control and Prevention (CDC) of the U.S Food and Drug Administration has identified more than 400 food-related illnesses. Some are rare while others occur frequently (CDC, 2005). People are continually exposed to various pathogens, yet illnesses usually develop only when large quantities are ingested except for virulent microbes such as *Listeria* and *E. coli* O157:H7 (USDA, 2009).

### 4.3. Sources of Microbial Foodborne Diseases

The organisms responsible for foodborne illnesses are found throughout nature in plants, animals, people and even in soil. The ecology of pathogens varies. Some pathogens, such as *Listeria monocytogens*, are pervasive in natural environment and may contaminate food during production and distribution. Others are found in new ecological niches, such as *Salmonella* serotype Enteritidis in eggs (Jean et al., 2001). Raw foods are the most common source of foodborne illnesses because they are not sterile; examples include raw meat and poultry that may have become contaminated during slaughter (USDHHS, 2007).

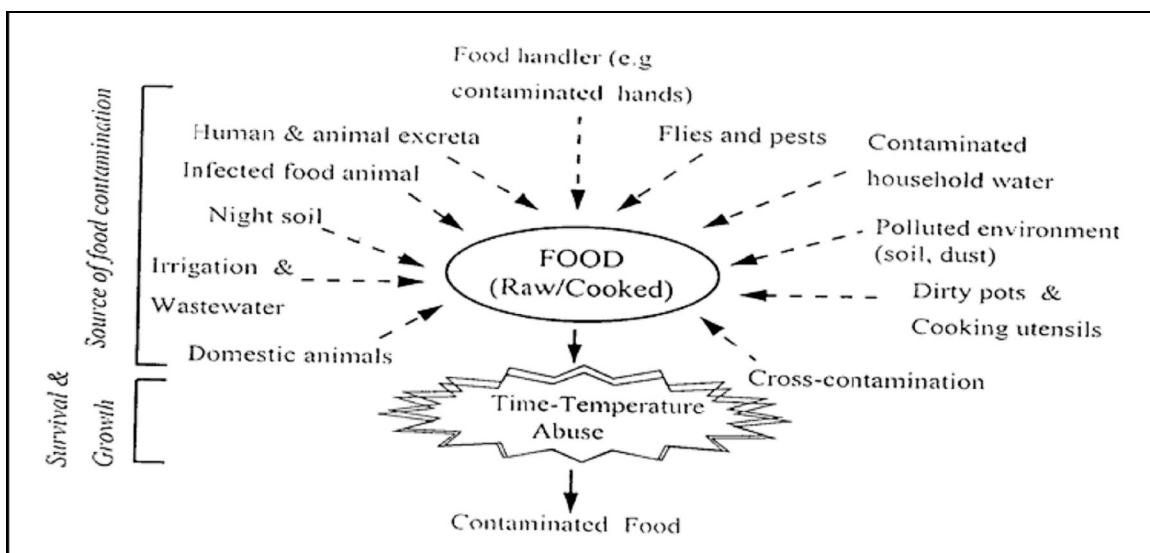


Fig 1, Sources of food contamination (USDHHS, 2007)

## Parasites

Parasites are organisms that obtain their food from other living creatures. A well-adapted parasite does not kill its host because it depends on the host for a steady supply of food over a long period of time. It has been estimated that humans harbor about 300 species of parasitic worms and over 70 species of protozoa. Not all parasites are foodborne and some are very rare. Parasites of concern to food safety professionals include several worms, ranging in size from a few centimeters to several meters in length, and protozoa, single celled organisms. Many parasitic infections are asymptomatic, others cause acute short lived effects, and still others may persist in the body causing chronic effects (Ellin, 2003). These parasites are commonly transmitted through ingestion of contaminated food or water as a result of poor sanitation and hygiene (Donato, 2003).

Parasitic intestinal infections continue to be an important cause of morbidity and mortality in the developing world. The most common intestinal helminths leading to digestive disorders include *Taenia saginata*, *Hymenolepis nana*, *Ascaris lumbricoides*, *Strongyloides stercoralis*, *Trichuris trichiura*, *Enterobius vermicularis* and hookworms, and are usually transmitted from contaminated food or water or from the environment. The most common protozoans reported to lead to digestive disorders include *Giardia lamblia* and *Entamoeba histolytica*. Outbreaks of protozoan infections in humans have been linked to contaminated food from improper environmental sanitation and to inadequate personal hygiene by food-handlers. In countries where the infection is widespread, most cases infected with *G. lamblia* were found to be asymptomatic. *E. histolytica* is associated with poor socioeconomic conditions and unhygienic habits, as

well as malnutrition in developing countries. According to the World Health Organization (WHO), approximately 500 million people worldwide suffer from amoebiasis, with an annual mortality between 40 000 and 110 000. Man is undoubtedly the most important reservoir of *Enta. histolytica*, passing virulent cysts that are transmitted chiefly by ingestion of contaminated food or water or through direct contact (Babiker, 2009).

#### **4.3.1.1. Protozoa**

Protozoan parasites may be present in freshwater sources that have been contaminated with human or animal feces; fruits and vegetables grown or washed with such contaminated water may have parasites on their surface and be sources of infection. *Toxoplasma* is sometimes present in raw meat, particularly pork, and thorough cooking is needed to destroy it. Some protozoa are very species specific and can survive in only one species of animal, but others, including many human pathogens, can live in humans and in other animals and these animals may act as reservoirs continually shedding parasites into the environment. Protozoan parasites have a resistant resting stage (cyst or oocyst) which can withstand some drying and disinfectants (Ellin, 2003).

#### **4.3.1.2. Helminthes (Parasitic Worms)**

Helminthes/human parasitic worms are macroscopic, multicellular, eukaryotic worms found throughout the natural world, some in parasitic associations with other animals and categorized into three:

**Cestodes (tapeworms):** Meat and fish may contain larval tapeworms that can develop into adults in the human intestine. The pork and beef tapeworms are the best known (*Taenia solium* and *T. saginata*, respectively) but there are also other species with larval stages in fish muscles. Tapeworm eggs may be present on fruits or vegetables fertilized with human wastes or washed with contaminated water. If humans consume the eggs of *T. solium*, the larvae hatching from the eggs burrow out of the intestine and travel to the muscles, brain, and other parts of the body where they encysted and may cause serious problems (Ellin, 2003).

**Nematodes (round worms):** include the following human parasites: *Trichinella*, *Ascaris*, and *Anisakis*, *Angiostrongylus* and *Gnathostoma*. Some nematodes, such as *Ascaris*, have a simple life cycle that does not require an intermediate host but may be passed from one human to another by fecally contaminated water or vegetables. Others, including *Trichinella*, *Gnathostoma*, and *Anisakis*, exist as cysts in muscles of meat or fish and may (*Trichinella*) or may not (*Anisakis* and *Gnathostoma*) develop into adults in humans who consume infected meat. *Angiostrongylus* utilizes two intermediate hosts and may be present in snails and on leafy vegetables (Ellin, 2003).

**Trematodes (flatworms or flukes):** usually have two or more intermediate hosts. Some may be present on aquatic vegetables or foods washed in contaminated water (*Fasciola* and *Fasciolopsis*) while others encyst in fish (*Clonorchis*) or crabs and wild boar (*Paragonimus*). Worldwide, parasites infect millions of people. In some underdeveloped



regions, they are a major cause of childhood diarrhea and stunting of growth and cause significant economic losses related to human health and to agriculture (Ellin, 2003).

#### **4.3.2. Bacteria**

Because food is biological in nature and is capable of supplying consumers with nutrients, it is equally capable of supporting the growth of contaminating microorganisms. Three types of bacterial foodborne diseases are recognized: intoxications, infections, and toxicoinfections. Foodborne bacterial intoxication is caused by the ingestion of food containing preformed bacterial toxin, such as the toxins produced by *Staphylococcus aureus* and *Clostridium botulinum*, resulting from bacterial growth in the food. Foodborne infection, on the other hand, is caused by ingestion of food containing viable bacteria such as *Salmonella* or *Listeria* which then grow and establish themselves in the host, resulting in illness. Foodborne toxicoinfections result when bacteria present in food, such as *Clostridium perfringens*, are ingested and subsequently produce a toxin in the host (Jennifer, 2004).

Many bacteria can contaminate food. The most common include the following:

É *Campylobacter jejuni* Mishandling of raw poultry and consumption of undercooked poultry are the main causes of *C. jejuni* contamination.

É *Clostridium botulinum* Bacteria producing a toxin in food responsible for botulism, the deadly paralytic nerve illness

É *Escherichia coli*. A leading cause of food contamination. Based on a 1999 estimate, 73,000 cases of infection and 61 deaths occur in the United States each

year. The *E. coli*0157:H7 strain is found in ground beef, raw milk, chicken, vegetables, and fruit.

É *Salmonella typhimurium* Salmonella contamination can occur in meats, poultry, eggs or milk products

É *Shigella* The most common food that these bacteria can contaminate include: salads (potato, chicken, seafood and vegetable), raw vegetables, milk and other dairy products, and meat products especially poultry.

É *Staphylococcus aureus*. Can be found in custard or cream-filled baked goods, ham, poultry, eggs, potato salad, cream sauces, sandwich fillings.

É *Vibrio cholera*. These bacteria cause the well-known disease cholera that has caused many outbreaks all over the world. It can be transmitted by water or food.

É *Vibrio vulnificus*. Free-living ocean bacteria that can cause food borne illnesses from contaminated seafood. Especially dangerous in the warm weather months when eating shellfish that are undercooked or raw (Wilson, 2000).

When food is cooked and left out for more than 2 hours at room temperature, bacteria can multiply quickly. Most bacteria grow undetected because they don't produce a bad odor or change the color or texture of the food. Freezing food slows or stops bacteria's growth but does not destroy the bacteria. The microbes can become reactivated when the food is thawed. Refrigeration also can slow the growth of some bacteria. Thorough cooking is needed to destroy the bacteria (USDHHS, 2007).

#### 4.4. Causes of Microbiological Foodborne Diseases

More than 40 foodborne microbial pathogens are known to cause human illness, including bacteria, parasites, viruses, fungi and their toxins. Several pathogens were recognized only recently as a cause of foodborne illness. Some foodborne pathogens have not yet been scientifically identified. Epidemiological investigations of foodborne illness provide some information about the specific pathogens and foods that caused illness. Animal products such as meat, poultry, seafood, dairy products and eggs are the foods most likely to cause outbreaks of human illness in the United States (Jean et al., 2001).

Foodborne diseases are contracted by ingesting contaminated food. About two thirds of all outbreaks involve bacteria. The rest are caused by viruses, parasites, fungi and chemicals. The illnesses can be caused either by the microorganisms themselves or by toxins they release. The foodborne pathogens that scientists consider most hazardous are the bacteria *Campylobacter jejuni*, *Clostridium botulin*, *Clostridium perfringens*, *E. coli* O157:H7, *Listeria monocytogenes*, *Salmonella*, *Staphylococcus* and *Vibrio vulnificus*; the *Hepatitis A* and *Norwalk*-like viruses; and the parasites *Cryptosporidium* and *Cyclospora* (USDA, 2009).

Over recent decades, parasitic protozoa have been recognized as having great potential to cause waterborne and foodborne disease. The organisms of greatest concern in food production worldwide are *Cryptosporidium*, *Cyclospora*, *Giardia*, and *Toxoplasma*. Although other parasitic protozoa can be spread by food or water, current epidemiological evidence suggests that these four present the largest risks (David, 2005).

Epidemiological investigations of foodborne illnesses also identify the kinds of errors in food production, distribution and preparation that allow microbial pathogens to contaminate food. Some food handling errors introduce pathogens in to uncontaminated food. Other errors permit the pathogenic organisms already present in raw food to survive or multiply to dangerous levels in prepared foods. Potential errors include: the use of contaminated food, cross-contamination of prepared food by contaminated raw food, poor personal hygiene by infected food handlers, inadequate cleaning of equipment, improper holding temperatures, cooling food too slowly after heating, eating food too long after preparation, insufficient fermentation, acidification, salting or sweetening during processing (Jean et al., 2001).

The four most common mistakes in handling and preparing food at home are the inappropriate storage of food (including inadequate refrigeration), the failure to attain a required cooking and/or reheating temperature, any actions that result in cross-contamination, and the presence of an infected food handler. In a study of 101 home-based outbreaks, it was determined that inappropriate food storage and cross - contamination were the most prevalent mistakes, accounting for 50% and 28% of reported causative factors, respectively (Scott, 2003).

Food handlers may be a major source of food contamination and ultimate sources of health risks either as carriers of pathogens or through poor hygienic practices. Workers can carry microbial pathogens on their skin, in their hair, on their hands, and in their digestive systems or respiratory tracts. Unless-workers understand and follow basic food

protection principles; they may unintentionally contaminate foods, water supplies and equipment, and thereby create the opportunity to transmit food borne illness (Dugassa, 2007).

Additionally, food workers' poor personal hygiene is an important contributor to foodborne illness outbreaks. For example, Olsen et al. found that annually from 1993 to 1997, poor personal hygiene of food workers was a contributing factor in 27 to 38% of foodborne illness outbreaks, and Guzewich and Ross found that in 89% of outbreaks caused by food contaminated by food workers, pathogens were transferred to food by workers' hands (Laura, et al., 2007). When food handlers do not practice proper personal hygiene or correct food preparation, they may become vehicles for microorganisms, through their hands, cuts or sores, mouth, skin and hair, among others. The presence of fecal coliforms in foods indicates post-sanitization or post-process contamination, often caused by a lack of hand hygienization on the part of food handlers (Ana, et al., 2008).

There is strong statistical evidence that the incidence of food poisoning caused by caterers is greater than in any other food sector, accounting for 70% of all bacterial food poisoning outbreaks. Seventy per cent of these food poisoning outbreaks are due to the inadequate time and temperature control of food, while the remaining 30% are the result of cross-contamination (Wilson et al., 1997).

The hands of food service employees can be vectors in the spread of foodborne diseases because of poor personal hygiene or cross-contamination. For example, an employee might contaminate his hands when using the toilet, or bacteria might be spread from raw meat to salad greens by food handler's hands, point out that data on risk factors for foodborne diseases imply that most outbreaks result from improper food handling practices. A study in the USA suggested that improper food handler practices contributed to approximately 97% of foodborne illnesses in foodservice establishments and homes (Murat, et al., 2006).

The public health challenges of food borne diseases are changing rapidly as a result of newly identified pathogens and vehicles of transmission, changes in food production, and an apparent decline in food safety awareness (Angulo, 1998). In many countries, the subject of food safety was traditionally taught as a part of the home economics curriculum in schools, but in recent years the teaching of home economics has largely disappeared from many national education programs and, as a result, food safety is not taught (Scott, 2003).

The proportion of foodborne illnesses due to separate food-handling errors by firms and consumers is unknown due to the limitations of the data on foodborne illness (Powell, 1999). But the most common cause of recent mass outbreaks of foodborne illness reported to the CDC (Center for Disease Control and Prevention of the United States) was improper holding temperatures, but many outbreaks involved more than one error (Jean et al., 2001).

#### **4.5. Factors Leading to Microbiological Foodborne Diseases**

Three key factors generally contribute to outbreaks of microbial foodborne illness are: contamination (pathogens must be present in the food); growth (in some cases they must also have the opportunity to multiply in the food in order to produce an infectious dose or sufficient toxin to cause illness) and survival (when present at a dangerous level they must be able to survive in the food during its storage and processing).

Temperature and time are the two most controllable factors for preventing foodborne illness. The temperature range between 41<sup>0</sup> F and 140<sup>0</sup> F is considered the "danger zone" because these temperatures are very conducive to bacterial growth. Within this range, bacteria grow most rapidly from 60<sup>0</sup> F to 120<sup>0</sup> F. When the conditions are right, bacteria double in number every 10 to 30 minutes. For instance, in three hours one bacterium can grow into thousands of bacteria. Cooking food to safe temperature and cooling food quickly, therefore, are critical steps in the prevention of foodborne illness (Julie, 2007).

#### **4.6. Transmission of Foodborne Diseases**

Poor sanitary practices in food storage, handling, and preparation can create an environment in which bacteria such as camphylobacter, salmonella, and other infectious agents are more easily transmitted (Murat, et al., 2006).

Food handlers may transmit pathogens passively from a contaminated source, for example, from raw poultry to a food such as cold cooked meat that is to be eaten without further heating. They may also, however, themselves to be sources of organisms either

during the course of gastrointestinal illness or during and after convalescence, when they no longer have symptoms. During the acute stages of gastroenteritis large numbers of organisms are excreted and by the nature of the disease are likely to be widely dispersed; clearly, food handlers who are symptomatically ill may present a real hazard and should be excluded from work. Good hygiene, both personal and in food handling practices, is the basis for preventing the transmission of pathogens from food handling personnel to consumer (Murat, et al., 2006).

Moreover, transmission of intestinal parasites and enteropathogenic bacteria is affected directly or indirectly through objects contaminated with faeces. These include food, water, nails, and fingers, indicating the importance of faecal-oral human-to-human transmission. Accordingly, food-handlers with poor personal hygiene working in food-serving establishments could be potential sources of infections of many intestinal helminths, protozoa, and enteropathogenic bacteria. Food-handlers who harbour and excrete intestinal parasites and enteropathogenic bacteria may contaminate foods from their faeces via their fingers, then to food processing, and finally to healthy individuals (Gashaw et al., 2008). In some instances, transmission occurs through close contact between infected and uninfected individuals as in infected food handlers and consumers, respectively (Donato et al., 2003).

#### **4.7. Who is at the Greatest Risk Group?**

Children deserve added attention in the study of microbial foodborne illness because the risks of some foodborne illnesses, such as salmonellosis, are relatively higher for children than for other demographic groups (Jean, 2001). Canadian statistics shows that children



from birth to four years of age are more likely to be reported with an infection from *Campylobacter*, *Giardia*, *Salmonella* and *Shigella* species and Verotoxigenic *Escherchia Coli* than any other groups (Sockett & Rodgers, 2001). Children's immune systems are not fully developed, placing them at a relatively higher risk for some foodborne illnesses. A child's lower weight means that it takes a smaller quantity of pathogens to make a child sick than it would a healthy adult. Also, children have limited control of food safety risks because their meals are usually prepared by others (Jean, 2001).

Foodborne illnesses, however, can be quite serious and even fatal for some older people, infants, children and people suffering from illnesses that weaken the immune system, such as cancer, liver disease and AIDS (USDA, 2009).

Foodborne bacterial infections are particularly prevalent, children in developing countries may experience five episodes of diarrhoea per year and 800,000 children die each year from diarrhoea and dehydration (WHO, 1996). Furthermore, young children are at most risk to foodborne diseases because their immune systems are still developing and the protection afforded by the resident gut flora is not as effective as in adults. In addition, children consume more food in proportion to their weight than adults; hence they absorb more toxins and contaminants (WHO, 2002).

#### **4.8. Symptoms of Foodborne Diseases**

The symptoms of foodborne illnesses range from mild to life-threatening. Studies indicate that parasitic infections cause malabsorption, diarrhoea, and other states of poor

health (Donato et al., 2003). While nausea and diarrhea are the most common, kidney and liver failure, brain and neural disorders, and even death can also result. For example, *Listeria monocytogenes* infection, which mainly affects the elderly and pregnant women, has a mortality rate of 20-30 percent. The debilitating long-term complications of foodborne diseases also include reactive arthritis and paralysis (Caroline, 2005). In most cases of foodborne illnesses, symptoms resemble intestinal flu and may last a few hours or even several days. Symptoms can range from mild to serious and include: abdominal cramps, nausea, vomiting, diarrhea, which is sometimes bloody, fever and dehydration (USDHHS, 2007).

Intestinal protozoan parasites in humans typically cause mild to moderate diarrhea although malnourished children, the elderly, and the immunocompromised may suffer prolonged and intense gastrointestinal symptoms that can be life threatening (Ellin, 2003).

Most of the pathogenic organisms known to cause diarrhoea are transmitted by the faeco-oral route. The WHO scientific group on the changing pattern of food hygiene problems, which met in Geneva in 1978, highlighted that many of the risks connected with microbial or parasitic contamination had diminished because of the concerted efforts of food hygiene services and producers. Nonetheless, parasitic infections in food-handlers, which are often asymptomatic, may pose a real threat to those who are more susceptible to infection (Babiker, 2009).

#### **4.9. Improving Food Safety**

The measures to be taken to maintain high standards of catering whether in home or in community at large will include;(i) the control of primary sources of foods; (ii) inspection of relevant premises, (iii) supervision of food handlers, (iv) health education, (v) laboratory examination of foodstuffs; and (vi) legislations (Dugassa). In addition in the foodservice sector, education of the food preparer and server, with emphasis on good personal hygiene, is the best preventive measure (Jennifer, 2004).

In general, it has been said that there are three major lines of defense against foodborne disease. The first aims at improving the hygienic quality of raw foodstuffs; the second utilizes food processing technologies such as pasteurization and irradiation, and employs hazard analysis and critical control point (HACCP) concepts; and the third line of defense concerns the education of all food handlers, including home-based food handlers (Scott, 2003).

## **5 - METHODS AND MATERIALS**

### **5.1 – Analysis of Intestinal Parasites**

#### **5.1.1 – Sample Collection and Sampling Technique**

Four orphanage centers were selected to be included in the study using simple random sampling technique (lottery method) from among 99 orphanage centers that have signed agreement with the Bureau of Women and Children Affairs of Addis Ababa. In each of the centers, all the food handlers (8 from center ~~01~~, 6 from center ~~02~~, 6 from center ~~03~~ and 20 from center ~~04~~) who agreed to participate in the study were included. The participants were given an overview concerning the study. A local study in Philippines (Manila) had shown that two stool examinations done on separate days increased the recovery rate of intestinal parasites by 19% (Donato et al., 2003). Thus, two stool cups were given to each participant for specimen storage, on two separate days. The maximum interval of time between the first stool sample and the second stool sample should not exceed one week. This time period was set with the assumption that there might be no significant difference in the participant's health status (infected or not infected). Instruction was given to the participants not to mix stool samples with urine or even water. Each sample was examined immediately after collection in the nearby clinical laboratory through direct fecal smear technique (DFS). Because, the direct wet film is most useful for detecting the trophozoite stage of amoebae and flagellates and it enables the observer to study the motility of the organism; it can only be seen in unfixed samples ideally observed within 30 minutes of passage (not arrival).

### **5.1.2– Procedure for the Analysis of Intestinal Parasites**

The samples were prepared by mixing about 2 mg of feces with one to two drops of normal saline placed on a clean glass slide using an applicator stick. A uniform suspension was made and covered with a 22 mm<sup>2</sup> glass cover slip then mounted on the light/compound microscope for observation. Finally, data obtained from stool examination were entered and analyzed using the EPI Info (version 6) statistical packages. Dysenteric (watery) stools were examined before solid stools. This is necessary because protozoan trophozoites are more likely to be present in watery stool, and trophozoites have a shorter survival time in feces than cysts (Donato et al., 2003).

## **5.2 – Microbiological Study of the RTE Food Samples**

### **5.2.1 Sample Collection**

The commonly served RTE foods in the centers were first categorized into three groups:

1. Meat based products (soupe) coded as 0100
2. Legume based products (soupe) coded as 0200 and
3. Vegetables (cooked soupe) coded as 0300

Then a total of 36 RTE (ready-to-eat) food samples (12 legume-based soups, 12 vegetables and 12 meat-based soups, 100grams each) were collected aseptically from four randomly selected orphanage centers in Addis Ababa using pre-sterilized spoon and plastic cups during February to May, 2010. The average temperature of the food samples was 26 °C. The samples were collected in the morning (7:00-7:45) while the children were

preparing to take their lunch to their schools and at lunch time from three randomly selected children's dishes. The sample temperatures were recorded at time of sampling using thermometer and then transported to the EHNRI (Ethiopian Health and Nutrition Research Institute) Food microbiology laboratory, using cold chain. And microbiological Analysis was conducted within 3 to 4 hours of collection.

### **5. 2.2. Microbiological Analysis**

About 10 g of each samples were placed aseptically in a sterile stomacher bag and homogenized in 90 ml of sterile 0.1% (w/v) peptone water using a stomacher lab blender (model 400, Seward JAC, London) for 30 seconds. Serial ten-fold dilutions were prepared to count the following microbial groups:

***Aerobic mesophilic bacteria:*** From appropriate serial ten fold dilutions, 0.1ml aliquots were spread-plated in duplicates on pre-dried surfaces of Plate Count Agar (Oxoid) plates. Colonies were counted after incubation at 30-32<sup>o</sup> C for 48 hours.

***Coliforms:*** A volume of 0.1 ml of appropriate serial ten fold dilutions was spread-plated in duplicates on pre-dried surfaces of Violet Red Bile Agar (Oxoid) plates. The plates were incubated at 30-32<sup>o</sup> C for 24 hours after which purplish red colonies surrounded by reddish zone of precipitated bile were counted as total coliforms. And the same procedure was carried out for faecal coliforms and incubated at 44<sup>o</sup> C for 24 hours after which purplish red colonies were counted as faecal coliforms. Then, confirmatory test had been done using EC broth and Brilliant Green Bile agar plates for faecal coliforms and

coliforms respectively. The plates were incubated at 30-32 °C for 24 hours and all the colonies were considered as the respective microorganisms.

***Enterobacteriaceae:*** A volume of 0.1 ml of appropriate serial ten fold dilutions was spread-plated in duplicates on pre-dried surfaces of Violet Red Bile Glucose Agar (Oxoid) plates. The plates were incubated at 30-32 °C for 20-24 hours after which pink to red purple colonies with or without halos of bile precipitation were enumerated as members of *Enterobacteriaceae*.

***Staphylococci:*** A volume of 0.1 ml of appropriate serial ten fold dilutions was spread-plated in duplicates on pre-dried surfaces of Mannitol Salt Agar (Oxoid) plates. The plates were incubated at 30-32 °C for 36 hours. Yellow colonies were counted as staphylococci.

***Enterococci:*** A volume of 0.1 ml of appropriate serial ten fold dilutions were spread-plated in duplicates on pre-dried surfaces of Bile Aesculin Agar consisting of (g/l distilled water) peptone 8, bile salts 20g, ferric citrate 0.5g, aesculin 1g, agar 15g, pH 7.1±0.2). The plates were incubated at 30-32 °C for 24 hours. Colonies surrounded by blackened zone were counted as enterococci.

***Lactic acid bacteria:*** A volume of 0.1 ml of appropriate serial ten fold dilutions was spread-plated in duplicates on pre-dried surfaces of MRS (De man, Rogosa, Sharpe)

(Oxoid) agar plates. The inoculated plates were incubated anaerobically, using anaerobic jars, at 30-32°C for 48 hours. All colonies were then counted as lactic acid bacteria.

### **5.3. Flora Analysis (Characterization of Predominant Isolates)**

About 5 colonies were picked randomly from countable Plate Count Agar plates and transferred to Nutrient Agar plates after incubating under 30-32°C for 18-24 hours in test tubes containing 5ml of Nutrient Broth. These were then incubated at 30-32°C overnight. Cultures were purified by repeated plating and characterized to the genus level and various bacterial groups using the following tests: Cell morphology, KOH test (Gregerson, 1978), Oxidation Fermentation (O/F) test (Hugh and Leifson, 1953), Catalase test and Cytochrome Oxidase test (Kovacs, 1956).

### **5.4. Measurement of pH**

The pH of each food sample was determined by blending 10 grams of ready-to-eat (RTE) food sample in a stomacher bag with 90 ml distilled water. The pH of the homogenate was measured using a digital pH-meter.

### **5.5. Statistical Analysis**

Coefficient of variation (CV) was calculated to see if there was significant variation in counts within the food samples analyzed. Mean values of food samples from different centers were compared using one way ANOVA and the significance of differences were considered at p. value of 0.05. The data obtained from the respondents were analyzed by SPSS statistical package.



## **5.6. Questionnaire**

### **5.6.1. Data Collection:**

Standardized and structured questionnaire was developed for the purpose of data collection after reviewing relevant literature and modified to be used in the specified study area. It was prepared originally in English and then translated into Amharic by the researcher and a sanitarian in order to obtain content validity. Finally the questionnaire was administered in Amharic. The questionnaire was designed to obtain information on socio-demographic characteristics of owners/managers and food handlers, repair condition of kitchens and dining rooms for the children, availability of sanitary facilities like water supply, latrine facility, refuse management, food utensil washing facility, and shower services, storage system of food and food utensils as well as to measure the knowledge and practice of food handlers through observation and interview.

### **5.7. Ethical Consideration**

Ethical clearance was obtained from ethical committee of Food Science and Nutrition Program, Faculty of Science, Addis Ababa University. Formal letter was written to all 4 of the orphanage centers and concerned officials were informed about the purpose of the study. Informed consent was obtained from owners/managers of the orphanage centers and food handlers after a brief explanation of the objectives and benefits of the study. Confidentiality of the respondent was maintained. On the other hand advise were given for managers and food handlers of the centers to improve hygienic preparation of food in the centers where gross unsanitary conditions encountered during the survey. With the

same manner food handlers found to be ova positive during stool examination were advised to take anti-helminthic and anti-protozoan drugs.

### **Operational Definitions (Kinfе, 2005, NSW, 2009, Donato et al., 2003)**

1. **Food handlers:** Food handlers are persons who have contact with food from the time of preparation up to the time of serving of such to the consumers.
2. **Ready-to-eat food:** Food that is ordinarily consumed in the same state as that in which it is sold and does not include nuts in the shell and whole, raw fruits and vegetables that are intended for hulling, peeling or washing by the consumer
3. **Personal hygiene:** refers to those protection measures primarily with the responsibility of the individual, which promote and limit the spread of infectious disease, like hand washing using soap and water, keep body clean etc.
4. **Good repair condition:** - shall mean absence of big cracks or detached areas, holes and lack of painting for food preparation areas/kitchens, dining room or service room; and being free of breaks (open seams), corrosion, and cracks and easily cleanable for food utensils and equipments.
5. **Adequate lighting:** is to mean that a healthy person (without major visual problem) can see or easily identify objects in the room comfortably without straining of the eye.
6. **Cleanliness/clean:** shall mean absence of dust particles, grease, finger and other marks for food utensil and being free of spider webs, dust and smoke particles for kitchen and dining/service room.

## **Variables**

### **Dependent Variables:**

É Sanitary facilities like water supply, toilet facility, utensil cleanliness, hand washing basin availability

É Knowledge about food safety and hygienic practices of the food handlers

É Microbiological quality of food utensils and raw food materials

É Prevalence of enteric pathogens among the food handlers/health status

### **Independent Variables:**

É Socio-economic characteristics like educational status, marital status, service year and building ownership of the centers

### **Dissemination of results**

Final copy of this study finding will be submitted to Food Science and Nutrition Program, Faculty of Science, Addis Ababa University and selected orphanage centers in which the study was conducted. In addition, the finding of the research will be presented on seminar and publication will be attempted on scientific Journals.

## 6. RESULTS AND DISCUSSION

### General information

Based on the data collected during a preliminary survey, there were about 99 orphanage centers in Addis Ababa, having signed agreement with the Bureau of Women and Children's Affairs of Addis Ababa. But the exact number of the children in the orphanage centers could not be known due to lack of well documented information in the bureau. Of the total 99 orphanage centers in Addis Ababa, four (one governmental and three non governmental orphanage centers), only those giving food services in the center's campus to the children were included in the study. Those giving support to orphan children living with their relatives out of the campus were not included in the study. Accordingly, only four orphanage centers among in-campus service giving centers were randomly selected by lottery method.

The orphanage centers included in the study were coded as:

É:01= Abebech Gobena Children's Care and Development Association

É:02= AHOPE Children's Home

É:03= Kebebe Tsehay Orphanage Center

É:04= SOS Children's Village

## **6.1. Sanitary Conditions of the Centers and Hygienic Practices of the Food Handlers**

### **Characteristics of Study Unit**

All of the centers provided services for the children to achieve their basic necessities inside the campus. Only one of the orphanage centers had periodic physical examination for the food handlers, once per year. One of the centers was managed by the founder of the association while the others 3(75%) were managed by recruited persons.

The total number of children, having services of the basic necessities in the centers was 350(207 male & 143 female). Among them, 111(31.7%) (66 male & 45 female) orphan children were HIV positive. The majority 212(60.6%) of the children were in the age range of 6-14, 129(36.9%) in 0-5 and 9(2.6%) of them were greater than 14 years old.

### **Socio-demographic Characteristics of the Center Managers**

As shown in Table 1, of the total four owners/managers, three of them were females. The mean age was found to be 42.1 years ranging from 30-75. Two Of the managers were married, one widowed and one single. All the managers were literate, including elementary school (6th grade) to second degree. In food service establishments, managers must be trained in the principles of food hygiene so that they can in turn train and supervise the workers responsible for processing, preparation, storage and service of food (Dugassa, 2007). But none of the managers had got any training about food safety in these centers.

**Table 1,** Socio-demographic characteristics of the owners/managers of selected orphanage centers in Addis Ababa, 2010 (n=4)

<b>Characteristics</b>	<b>Frequency</b>
<b>Sex</b>	
- Male	1
- Female	3
<b>Age Range</b>	
- 21-30	1
- 31-40	2
- greater than 70	1
<b>Educational Status</b>	
Illiterate	0
Literate - Elementary	1
- Degree and above	3
<b>Marital Status</b>	
- Single	1
- Married	2
- Widowed	1

### **Socio-demographic Characteristic of the Food Handlers**

All of the food handlers were females. The mean age was found to be 41.11 ranging from 26-60 years. About 27(67.5%) of them were not married (single = 14(35%), divorced = 5(12.5%), widowed = 6(15%) and separated = 2(5%)). 36(90%) of them were literate (elementary school to diploma level). Table 2 also presents that the average service year of the food handlers in food preparation practices was 13 years.

**Table 2,** Socio-demographic characteristics of the food handlers engaged in food preparation in selected orphanage centers in Addis Ababa, 2010 (n=40)

<b>Characteristics</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Sex - Male</b>	0	0
- Female	40	100
<b>Age Range - 21-30</b>	9	22.5
- 31-40	17	42.5
- 41-50	8	20
- 51-60	6	15
<b>Educational Status</b>		10
- Illiterate	4	32.5
- Literate - elementary	13	32.5
- high school	13	17.5
- 12th grade completed	7	7.5
- diploma	3	
<b>Marital Status - single</b>	14	35
- married	13	32.5
- divorced	5	12.5
- widowed	6	15
- separated	2	5
<b>Service year/experience in food preparation practices</b>		42.5
<b>0-5</b>	17	15
<b>6-10</b>	6	12.5
<b>11-15</b>	5	30
<b>&gt;15 years</b>	12	

### **Physical Conditions of Kitchens and Food Preparation Practices**

All 4 of the orphanage centers had kitchens with floor constructed either from bricks/plastered in two or concrete/cement in the other two centers. In two of the centers

cleanliness of floor in the kitchen was not kept at time of visit. Cleanliness of wall and ceiling of the kitchens was also not kept in 3(75%) of the centers and had poor repair conditions. Only 2(50%) of the centers had kitchens with adequate lighting system. In 1(25%) of the kitchens chimney was not installed for ventilation. Two of the centers kitchen room was infested with insects like flies and cockroach. In one of the kitchens all the food handlers did not wear appropriate overcoat. And it was found that only in 1(25%) of the kitchens, food handlers were advised by the manager/owner on safe handling of food though themselves did not have any training about food safety. In 2(50%) of the kitchens, food handlers were regularly supervised while in the other 2(50%), they were intermittently supervised by the managers/owners on their normal work of food preparation. In 2(50%) of the kitchens all equipments used for processing were not smooth, free from crack and easily cleanable type. In 3(75%) of the kitchens, cleanliness of processing equipments was not kept at time of visit while in 2(50%) of the kitchen, cooked foods were not stored in proper manner that can prevent contamination of food.

### **Refrigerator**

Refrigerators were available in all (100%) of the centers for storage of perishable food. This was found to be a better condition when compared to other findings of studies conducted in the sanitary conditions of food catering establishments in Addis Ababa (only 40.2% of the establishment had refrigerators) followed by the report from Mekelle of 66.3% and Awassa 90.3% (Kinfе and Abera, 2005).



The temperature range between 41<sup>0</sup> F and 140<sup>0</sup> F is considered the "danger zone" because these temperatures are very conducive to bacterial growth. Within this range, bacteria grow most rapidly (Julie, 2007). Though in all of the centers refrigerators were available for storage of perishable foods, the refrigerators had fixed temperature reading, adjusted to be <10<sup>0</sup> C only in one of the centers. Regarding the manner of food storage in it, perishable and non perishable foods were stored together in all centers. This indicates that the centers have poor storage of food in the refrigerators. In two of the centers cooked and raw foods were stored in the same refrigerator, cooked foods in the upper compartment and in the other two, cooked and raw foods were stored in the same refrigerator side by side. This indicates the possibility of cross-contamination between cooked and raw foods at storage.

### **Physical Conditions of the Dining Rooms**

The dining rooms in all the four orphanage centers had floors constructed from bricks/plastered and did not have cracks in which dirt can lodge. In all of the centers, the wall of the dining rooms were maintained in good conditions and kept clean, having smooth and easily cleanable surfaces. The ceiling of the dining room was not kept clean and free from dust, soot and web of spider with poor repair condition in one of the centers. In one of the centers, all the workers engaged in delivering food did not wear appropriate overcoat; and in three of them, they did not wear hair cover.

## **Store Room & Water Supply**

All the orphanage centers had a separate store rooms which were free from any insect infestation during visit. And only in one of the centers, cleanliness of the store room was not kept. The entire orphanage centers had water pipe installed from municipal services; and water storage tankers for shortage time.

## **Sanitary Facilities of the Centers**

**1. Latrine facility:** The entire orphanage centers had privately owned toilet rooms; two of them had flush type toilets and the other two had dry pit latrines. In all of the centers the toilets were separated for male and female usage. In two of the centers, 2 seats were available. In one of the centers there were 4 seats; and 6 in the other center. In two of the centers, the toilets were not clean and comfortable to use at time of visit. In one of the centers, flies were observed and hand wash basin was not provided to use after toilet near the toilet room and were improperly managed. Thus poorly managed latrines create a favorable medium for the breeding and multiplication of insects that can carry microorganisms and contaminate food and food utensils and equipment and reach the mouth of a healthy individual (Kinfu and Abera, 2005).

**2. Hand washing facility/lavatory:** In two of the orphanage centers, hand wash basins were not present near the dining room and the children use the same basin before meal and after toilet in these centers and soap was not provided for hand washing in one of these centers. This may result in transmission of enteric pathogens through faeco-oral contamination of infected individuals to a healthy

one. In three of the centers, there was closed type; properly designed receptacles of liquid wastes from the hand wash basin while the other center had open trench that can collect fraction of generated liquid waste.

**3. Shower services:** Only in one of the centers, shower service was available for the workers (food handlers). There was also a separate room for clothing, resting and placing of clothes and other materials for the workers only in one of the centers.

**4. Washing basin for utensils and method of cleaning:** One of the most widely used and accepted methods of food utensil washing method is the three compartments sink or vat system. This system is used to wash, rinse and sanitize food utensils and equipments (Kinfе and Abera, 2005). But in all of the centers, washing basins for washing utensils had only two compartments fixed with smooth surface metal in two and fixed rough surface cement/concrete type basins in the other two of the centers. In majority, three of the centers, cleanness of washing basin and area around it were not kept during visit. Thus, it requires an integrated effort of the regulatory body and owners to reach a universally used three compartment-washing device as clean and sanitized food utensils are crucial both aesthetically for the presentation of appetizing food and to safeguard the health of consumers (children) in the centers.

In one of the centers, hot and cold water with detergent used, while in the other three, only cold water with detergent used for cleaning of utensils. But the utensils were soaked with chemicals after wash only in one of the centers intermittently. About two

of the centers did not have drying racks for sanitized utensils and were stored in containers or shelves under conditions which could not protect against contamination.

**5. Solid waste handling and disposal:** Appropriate refuse receptacles were placed in the appropriate place in all of the centers but in one of them the receptacle was not durable. Garbage and refuse generated from kitchens and other work areas should be collected and stored in proper container or receptacle. The receptacles should be durable, easily lifted and transported, (Kinfе and Abera, 2005). Nevertheless, in three of the centers, the receptacles were not fit to cover and tight and in one of these centers, the receptacles were filled and splashed in the area in a manner that can aid spreading of flies as observed during visit. But the refuses were transported to final disposal before overflowing in the majority of the centers. And in all centers solid wastes were disposed by municipal services.

**6. Liquid waste handling and disposal:** In all of the centers, liquid waste disposing drainage system was installed. The type of drainage systems were found to be closed which can collect all generated liquid wastes in three and open trench in one of the centers. In one of the centers, the liquid wastes were disposed to open dumping area which can aid breeding of flies and affect sanitary conditions of the center and in turn cause contamination of foods by microbes.

### **Knowledge of food handlers**

The over all strategy for reducing food borne illness is to place emphasis on education about proper food storage and preparation practice along with strict and more targeted enforcement (Dugassa, 2007). As shown in Table 3, all the food handlers heard about

foodborne diseases. Mass-media was the first source of information followed by health professionals while formal training and written displays were the least, accounting for 30(75%), 16(40%) and 4(10%), respectively. But as shown in Table 3, 4 (10%) of them did not know any of the ways through which a foodborne disease can be transmitted and only 1(2.5%) did know that a foodborne disease can be transmitted through contaminated water while 17 (42.5%), 10(25%) and 5(12.5%) knew that it can be transmitted through contaminated hands, contaminated foods and vectors respectively.

**Table 3**, Knowledge of food handlers and source of information in selected orphanage centers in Addis Ababa, 2010

<b>Knowledge</b>	<b>frequency</b>	<b>Percent (%)</b>
<b>Have you ever heard about foodborne diseases?</b>		
- yes	40	100
- no	0	0
<b>What is your source of information?</b>		
- mass media	30	75
- health professionals	16	40
- formal training and written display	4	10
<b>How can foodborne diseases be transmitted?</b>		
- contaminated foods	10	25
- contaminated hands	17	42.5
- contaminated water	1	2.5
- vectors	5	12.5
- I do not know	4	10
<b>How can food be contaminated?</b>		
- when exposed to flies	20	50
- handling in contaminated environment or air	15	37.5
- using of dirt equipment	21	52.5
- using of contaminated water for cleaning and food preparation	5	12.5
- dirt hands	18	45
- using of the same container for cooked and raw foods	3	7.5

It is also found that only 5 (12.5%) of the food handlers knew foods can be contaminated by using of contaminated water for cleaning of equipments and food preparation. Majority 37 (92.5%) of them did not know that food can be contaminated by using of the same container for storage of cooked and raw foods. Among them all answered for multiple questionnaire, 15 (37.5%), 18(45%), 20(50%) and 21(52.5%) knew that food can be contaminated with handling food in contaminated environment, dirt hands, when exposed to flies and using a dirt equipment respectively. This shows that the food handlers had different degree of awareness and hence the cares they take during handling also vary. The hygiene quality of food handlers and cooks are key elements of food safety. Thus, improving the awareness of food handlers should be the priority issues of the centers. The greatest challenge to protect population from food-borne infection is to spread information and knowledge about the sources and routes of transmission of pathogens into food products (Gun Wirtanen and Satu Salo, 2007).

### **Practices of Food Handlers**

As shown in Table 4, only 13(32.5%) of the food handlers had hair cover and 27(67.5%) did wear appropriate overcoat. Among them, cleanliness of the overcoat was kept only in 13(48.1%) of the food handlers. Moreover, 9(22.5%) of them did not keep their finger nails trimmed and cleaned during visit.

Food handlers may be the source of food contamination either as carriers of pathogen or through poor hygienic practices. All food handlers have a basic responsibility to maintain a high degree of personal cleanliness and observe hygienic and safe food handling

practices. Keeping hands clean, shortening fingernails, wearing clean working garment and hair cover (hair net and cap) are some of the precautions that a food handler must maintain (Kinfe and Abera, 2005). But in this study food handlers practice towards personal hygiene and sanitary food handling is found unsatisfactory. A total of 27(67%) of the food handlers were found wearing working outer garments which are lower than the result of a study conducted in sanitary conditions of mass catering establishments in Awassa (86%) but higher than the finding at Addis Ababa (54.2%) in the same case; on the other hand, the proportion of clean outer garments/overcoat were much lower than the 74% case in Awassa, (Kinfe and Abera, 2005).

Majority, about 28(70%) of the food handlers did wear jewelry on their hands, ear and different body parts which was much higher than in similar study conducted at Mekele town(35.7%) and Awassa (28.7%) (Kinfe and Abera, 2005). In 22(55%) food handlers, it was observed that their finger nails were painted. The over all practice of food handlers towards personal hygiene and food handling is not to the acceptable level. Because food handlers are expected to have a high degree of personal cleanliness and safe food handling practices especially those serving children and immunocompromised people as these are more vulnerable groups.

Food handlers known or suspected to be suffering from infectious diseases like diarrhea, visible infected skin lesions (boils, cuts), respiratory infection and discharges from ear, eye and nose should be suspended from food handling and preparation until they become cured. The purpose of this measure is to prevent food contamination and thereby the spread of infectious disease through the ingestion of contaminated food. But in this

study, any visible skin rash, skin boils, cut and wound were not observed in any of the food handlers while preparing foods except one (2.5%) having discharges from the eyes and nose. *Staphylococcus aureus* is an opportunistic pathogen, which is a Gram-positive, aerobic, nonspore-forming catalase positive rod. Nasal and skin carriage are frequent vehicles in the transportation of *S. aureus*. The source of *Staphylococcus aureus* almost always originated from food handlers or from utensils previously contaminated by humans (Gun Wirtanen and Satu Salo, 2007). All 40(100%) of them had washed their hands before work on day of interviewing. In addition, it was found that none of the food handlers smokes cigarette.

**Table 4,** Distribution of practice of food handlers in relation to food safety in selected orphanage centers, Addis Ababa, 2010

Practices	Frequency	percent
<b>Wear of appropriate over coat</b>		
- yes	27	67.5
- no	13	32.5
<b>Wear of appropriate hair cover</b>		
- yes	13	32.5
- no	27	67.5
<b>Over coat and visible body part</b>		
- clean	13	48.1
- not clean	14	51.9
<b>Short trimmed and cleaned nail</b>		
- yes	31	77.5
- no	9	22.5
<b>Wear of jewelry</b>		
- yes	28	70
- no	12	30
<b>Nail paint during visit</b>		
- observed	18	55
- not observed	22	45
<b>Washing of hands before work on day of interviewing</b>		
- yes	40	100
- no	0	0



Since source of food contamination are diverse (Dugassa, 2007), controlling the over all sanitary condition of the centers, health status of workers and raising the awareness of managers and food handlers has great roles in improving of food safety and prevention of food borne illness and its transmission.

## **6.2. Prevalence of Intestinal Parasitic Infections among Food Handlers in Selected Orphanage Centers**

During the study period (February-May, 2010), a total of 80 fecal samples from 40 food handlers of the selected orphanage centers in Addis Ababa were examined. Of these, 14 (35%) harbored parasitic ova, cyst and/or trophozoites. This was almost similar to the result observed during Sanitary Survey of food and Drinking Establishments in Ambo Town West Showa Zone Oromia Region, Ethiopia. According to the report, the overall prevalence of intestinal parasites among food handlers working in mass catering establishments in Ambo town was 34.7% (Dugassa, 2007).

Studies indicate that parasitic infections cause malabsorption, diarrhea, and other states of poor health. These parasites are commonly transmitted through ingestion of contaminated food or water as a result of poor sanitation and hygiene. In some instances, transmission occurs through close contact between infected and uninfected individuals as in infected food handlers and consumers, respectively (Donato et al., 2003). The high prevalence of parasites among the food handlers is thus an indication of poor hygienic practices, low awareness on food safety and poor supervision from the management body.

### Species Wise Prevalence

As shown in Table 5, evidence was found in stool samples for the prevalence of two protozoan and two helminthic parasitic infections. The helminthic infections with 20% detection rate include nematode infections i.e, *Ascaris lumbricoides* 7 (17%). Among cestodes, *Taenia* species 1 (2.5%) were observed while none of the trematodes was seen; this may be due to their necessity to have two or more intermediate hosts (Ellin, 2003). The most common protozoans reported to lead to digestive disorders include *Giardia lamblia* and *Entamoeba histolytica* (Babiker, 2009). In this study, there was a total of 9 (22.5%) cases of protozoan infections harbored *Giardia lamblia* 3 (7.5%) and 6 (15%) *Entameba hstolitica* out of all the food handlers examined indicating the validity of the report.

**Table 5**, Prevalence of intestinal parasites among food handlers in selected orphanage centers in Addis Ababa, 2010.

Parasites	frequency	Percent (%)
<i>E. histolytica</i>	6	15
<i>G. lamblia</i>	3	7.5
<i>A. lumbricoides</i>	7	17.5
<i>Taenia species</i>	1	2.5

In this study, the most common intestinal parasitic infections encountered among infected individuals were *A. lumbricoides* (50%) this might be due to their simple life cycle that does not require an intermediate host but may be passed from one human to another by fecally contaminated water or vegetables (Ellin, 2003), followed by *E. histolytica* (42.86%), *G. lamblia* (21.43%) and *Taenia* species (7.14%) showing similarity with the result obtained in Ambo town with detection rate of 37.2%, 32.6% and 9.3% for *A.*

*lumbricoides*, *E. histolytica*, *G. lamblia* respectively, excluding *Taenia* species (Dugassa, 2007).

A local study in Philippines (Manila) had shown that two stool examinations done on separate days increased the recovery rate of intestinal parasites by 19% (Donato et al., 2003). As is presented in Table 6, among the total number of 40 food handlers examined, 8(20%) of them were positive for any intestinal parasites in the first diagnosis and 9(22.5%) of them were known to be positive in the second stool examination by DFS technique indicating an increase in the recovery rate of parasitic infections by 2.5%.

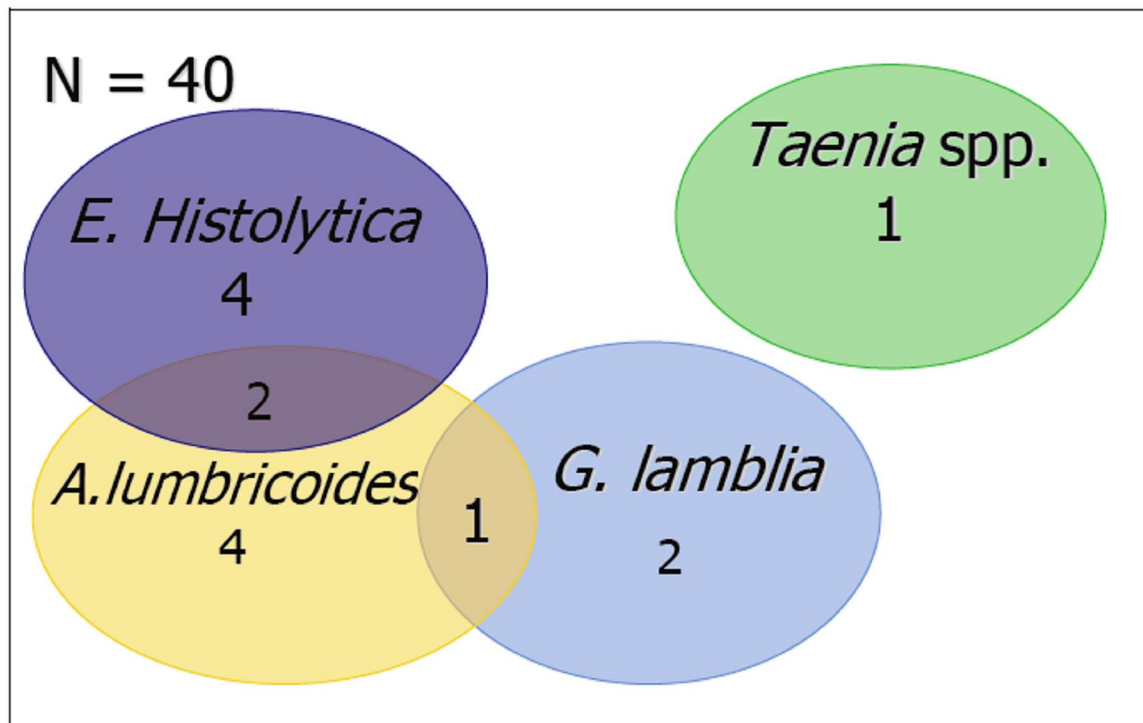
**Table 6**, Parasite/organism infection rates among food handlers according to diagnostic procedure employed in selected orphanage centers in Addis Ababa, April 2010.

Positive for parasites	
Diagnostic procedure	No. Percent Total
DFS 1 <sup>st</sup> stool examination	8 20 40
DFS 2 <sup>nd</sup> stool examination	9 22.5 40

According to the results obtained from the stool examination, (Table 7); in the first orphanage center coded as :-0100, 4, 2 and 1 of the food handlers were infected with *A. lumbricoides*, *E. histolytica* and *G. lamblia*, respectively, and 2 were infected with two or mixed intestinal parasites. In the second orphanage center which is coded as :-0200, 3 different individuals were infected with three different parasites, *E. histolytica*, *A. lumbricoides* and *Taenia* species. In the third one coded as :-0300, one food handler was infected with *E. histolytica* while another had *A. lumbricoides*. In the fourth orphanage

center, 2, 1, and 2 of the food handlers were infected with *E. histolytica*, *G. lamblia* and *A. lumbricoides*, while one of these were mixed infected.

From the Venn diagram (Fig. 2), there were about 11 (78.6%) food handlers who carried one parasite and 3 (21.4%) food handlers who had mixed infections. Among the mixed infected individuals 3 food handlers had two parasitic infections, 2 (66.6%) were infected with *E. histolytica* and *A. lumbricoides* and 1 (33.4%) were infected with *A. lumbricoides* and *G. lamblia*.



**Fig 2**, Venn diagram of parasites detected. Numbers in circles indicated the number of positive cases, N = Total number of the food handlers examined

In general, Table 7 shows that out of 8 food handlers in orphanage center 5 (62.5%) of them were infected with at least one of either the protozoan or helminthic intestinal parasites while 3 (50%), 2 (33.3%) and 4 (20%), in 2001, 2002 and 2003 respectively.

centers containing 6, 6 and 20 food handlers respectively. The food handlers in the center coded as ÷01øø demonstrated the highest prevalence (62.5%) followed by ÷02øø (50%), ÷03øø (33.3%) and ÷04øø (20%) orphanage centers. This indicates that there might be high possibility of oocyst or cyst transmission of the parasites from infected food handlers to healthy children thorough contaminated food if proper hygienic practices can not be maintained.

**Table 7.** Distribution of intestinal parasites among food handlers classified by orphanage centers in Addis Ababa, April, 2010.

<b>Orphanage centers (coded)</b>					
<b>Parasites/organisms</b>	01	02	03	04	Total (%)
<i>Protozoan parasites</i>	2	1	1	2	6 (15)
<i>E. histolytica</i>	1	1	0	1	3 (7.5)
<i>G. lamblia</i>					
<i>Helminthes</i>	4	0	1	2	7 (17.5)
<i>A. lumbricoides</i>	0	1	0	0	1 (2.5)
<i>Taenia species</i>					
<b>Total</b>	7	3	2	5	17 (42.5)

### 6.3. Microbiological analysis of the RTE foods

As shown in Table 8, the APC of RTE food samples obtained from the selected orphanage centers coded ÷01øø, ÷02øø, ÷03øø and ÷04øø were 1.18~4.36, 1.52~4.51, 1.99~4.51 and 1.86~3.30 with mean value of 3.93, 3.72, 3.82 and 2.94 respectively, whereas total coliforms were present in amount of 2.66, 1.67, 2.04 and 1.63 log CFU/g of food samples with the detection rate of 66.67%, 55.56%, 55.56% and 44.44%

respectively. In one of the centers coded as 04, prevalence of *Enterobacteriaceae* was as high as 66.67% detection rate indicating poor personal hygiene of the food handlers. The highest detection rate (55.56%) of *Staphylococci* species was recorded in the center coded as 02 followed by 04 (44.44%), 03 (33.33%) and 01 (11.11%).

Table 9 shows the range of microbial counts of hygiene indicator bacteria and pathogenic indicator *Staphylococci* species from different food categories (meat souse, legume souse and vegetables). APC was 2.48~3.70 log CFU/g for meat souse, 1.80~4.51 log CFU/g for legume souse and 1.61~4.51 log CFU/g for vegetables with mean value of 3.28, 3.84 and 3.85 log CFU/g respectively. Among the samples, detection rate over 50% of the vegetable products contained 0.30~2.81 (1.95) log CFU/g contamination with fecal coliforms higher than the other food categories. The detection rate of total coliforms in vegetable products was 58% ranging from 0.78~3.49 log CFU/g with mean value of 2.52 log CFU/g. The detection rate of *Enterobacteriaceae* was as high as 66.67% in meat souses followed by legume souses (58.33%) and vegetables (41.67%) ranging from 0.00 ~ 2.91 (2.02), 0.9~2.48 (1.77) and 0.48~1.83(1.52) logs CFU/g respectively. About 41.67% of legume products were tested positive for *Staphylococcus* species with mean value of 1.08 log CFU/g, representing the most contaminated food category while 33% of each meat and vegetable products with mean value of 0.88 and 1.64 log CFU/g were contaminated with these bacteria. This indicates that the legume based souses might have been contaminated with pathogenic microorganisms as *Staphylococcus* species are indicator pathogenic bacteria.

Based on the mean value of the microbial counts shown in Table 10, highest number of Aerobic mesophilic bacteria and total coliforms was detected in vegetable products 3.85 and 2.52 logs CFU/g respectively, while the number of fecal coliforms and *Enterobacteriaceae* detected was as high as 2.44 and 2.02 log CFU/g respectively in meat souse. In all of the food categories, *Staphylococci* were detected, however; the detection rate differed among the RTE food categories and the centers. On the other hand the mean value of *Staphylococci* count was of the highest (1.64 log CFU/g) in vegetable souses exceeding the unsatisfactory rate.

### **Unsatisfactory Rates for Microbiological Qualities of the RTE Food Samples**

According to the NSW Food Authority guide for interpreting microbiological analysis of RTE foods (NSW, 2009), APC exceeding 5 log CFU/g was taken as the reference value to identify poor food microbiological quality. As shown in Table 10, mean value of APC in all food categories did not exceed this standard. And the presence of *Staphylococcus aureus* and other coagulase-positive *Staphylococci* exceeding 1.30 logs CFU/g is unsatisfactory, indicating that it is likely evidence for poor handling, processes and temperature control (HPA, 2009). In this study, staphylococcus species was detected in vegetable products in 1.64 logs CFU/g with detection rate of 33.33%. But in one of the centers coded as 0101 *staphylococcus* was demonstrated as below detectable level as shown in Table 11. This indicates that there is likely evidence for poor handling, processing and temperature control of foods in the centers and the potential risk of foodborne disease transmission including intestinal parasitic infections from infected food handlers to the children through contaminated food products.

The *Enterobacteriaceae* family is a large group of bacteria with similar properties that is used to assess the general hygiene status of a food product. This group includes species that originates from the intestinal tract of animals and humans as well as plants and the environment. All *Enterobacteriaceae* are killed by the heat process used in food production and should be readily removed from the factory, equipment and surfaces by appropriate cleaning procedures. Their presence, therefore, signifies inadequate cleaning or post-processing contamination. *Enterobacteriaceae* count exceeding 4 log CFU/g of samples is unsatisfactory, and 2~4 log CFU/g is borderline for unsatisfactory rate as stated by HPA guideline for interpreting microbiological analysis of RTE foods (HPA, 2009). In this study, *Enterobacteriaceae* detected in meat souces was found to be in the borderline, 2.02 log CFU/g with detection rate of 66.67% indicating that possible evidence of poor hygiene, due to undercooking, or cross-contamination from raw meat, staff or food contact surfaces as well as poor temperature and time control.

### **Comparison of Significant Difference**

There was insignificant difference among the four orphanage centers in mean counts of all microbial groups at 95% CI. The difference among the mean values of various food categories was also insignificant ( $p > 0.05$ ).



**Table 8,** Distribution of microbial count in range (log CFU/g) in RTE food samples among selected orphanage centers in Addis Ababa, 2010

Centers (coded)	Number of samples	Range of microbial count CFU/g (percent detection)						
		APC	Total Coliform	Fecal Coliform	Staphylococci	Enterobacteriaceae	Enterococci	Lactic Acid Bacteria
<b>01</b>	9	1.18~4.36(100%)	0.00~3.49(66.67%)	1.20~3.48(55.56%)	0.00~0.00(11.11%)	0.00~2.40(55.56%)	0.48~2.63(44.44%)	0.48~2.32(55.56%)
<b>02</b>	9	1.52~4.51(100%)	1.11~2.48(55.56%)	1.00~2.36(55.56%)	0.48~2.72(55.56%)	1.11~1.99(44.44%)	0.30~2.32(66.67%)	0.48~1.78(44.44%)
<b>03</b>	9	1.99~4.51(100%)	0.78~2.54(55.56%)	0.30~1.72(55.56%)	0.00~1.26(33.33%)	0.00~2.91(55.56%)	0.90~2.49(55.56%)	0.60~2.30(66.67%)
<b>04</b>	9	1.86~3.30(100%)	0.48~2.43(44.44%)	0.48~2.11(44.44%)	0.00~1.96(44.44%)	0.30~2.33(66.67%)	0.48~2.82(33.33%)	0.00~1.83(44.44%)

**Table 9,** Range of microbial count (log CFU/g) in various RTE food samples based on their categories, in selected orphanage centers, in Addis Ababa, 2010.

Samples	Number of samples	Range of microbial count CFU/g (percent detection)						
		APC	Total Coliform	Fecal Coliform	Staphylococci	Enterobacteriaceae	Enterococci	Lactic Acid Bacteria
<b>Meat souse</b>	12	2.48~3.70(100%)	0.70~2.70(50%)	0.48~3.48(50%)	0.48~1.80(33.33%)	0.00~2.91(66.67%)	0.30~2.82(58.33%)	0.00~2.32(50%)
<b>Legume souse</b>	12	1.80~4.51(100%)	0.00~2.75(58.33%)	1.20~2.48(41.67%)	0.00~1.96(41.67%)	0.78~2.40(58.33%)	0.90~2.48(50%)	0.30~2.30(50%)
<b>Vegetable souse</b>	12	1.61~4.51(100%)	0.78~3.49(58.33%)	0.30~2.81(66.67%)	0.00~2.72(33.33%)	0.00~2.56(41.67%)	0.48~2.49(41.67%)	0.48~1.83(58.33%)

**Table 10,** Mean microbial count (log CFU/g) in various RTE food samples based on their categories in selected orphanage centers in Addis Ababa, 2010

Centers	Number of samples	APC	Total Coliform	Fecal colifrms	Staphylococci	Enterobacteriaceae	Enterococci	Lactic Acid Bacteria
<b>01</b>	9	3.93	2.66	2.65	-0.95	1.73	1.71	1.54
<b>02</b>	9	3.72	1.67	1.87	1.84	1.39	1.58	1.11
<b>03</b>	9	3.82	2.04	1.14	0.42	2.15	1.94	1.66
<b>04</b>	9	2.94	1.63	1.35	1.05	1.61	2.03	1.05

**Table 11,** Distribution of mean microbial count (log CFU/g) in RTE food samples among selected orphanage centers, Addis Ababa, 2010

Samples	Number of samples	APC	Total Coliform	Fecal colifrms	Staphylococci	Enterobacteriaceae	Enterococci	Lactic Acid Bacteria
<b>Meat souse</b>	12	3.28(100%)	1.77(50%)	2.44(50%)	0.88(33.33%)	2.02(66.67%)	2.07(58.33%)	1.49(50%)
<b>Legume souse</b>	12	3.84(100%)	2.02(58.33%)	1.78(41.67%)	1.03(41.67%)	1.77(58.33%)	1.59(50%)	1.48(50%)
<b>Vegetable souse</b>	12	3.85(100%)	2.52(58.33%)	1.95(66.67%)	1.64(33.33%)	1.52(41.67%)	1.74(41.67%)	1.23(58.33%)

### **Flora analysis (characteristics of predominant bacteria)**

For all three categories of the RTE food samples *Bacillus* species, *Staphylococcus* species and *Enterobacteriaceae* were predominant groups of the microbes. In ready-to-eat foods that are fully cooked, *Enterobacteriaceae* are used as an indication of either post-processing contamination or inadequate cooking (NSW, 2009). The predominance of *Bacillus* isolates on aerobic plate count plates was possibly due to the presence of spores in the raw material as they are spore forming bacteria. These heat-resistant spores may have survived cooking while vegetative bacteria were eliminated. *Staphylococcus* species are common bacteria on human body and hand processed foods and could thus have been introduced into the food after cooking through cross-contamination, for instance from utensils used by the food handlers to serve food for the children. *Staphylococcus* species may also have originated from the food handlers' hands when touching food preparation areas, dish clothes, or the water during dish washing or hand washing.

### **Measurement of PH**

The mean value of PH was about 6.5 ranging from 5.4~7.6 and the temperature reading at sampling point of the RTE food samples analyzed was 26<sup>o</sup> C. This indicates that most of the RTE food samples were within the temperature range at which different bacteria can grow rapidly.

## 7. CONCLUSION

The study has shown that intestinal parasitic infections among food handlers are not uncommon with a detection rate of 35%. This finding is of particular significance since infected food handlers may be at risk of developing illness themselves, and may pose a threat to the health of the children. For instance all protozoans discussed in this study are transmitted via the fecal-oral route from infected food handlers to healthy children.

Based on the findings of this descriptive cross sectional study, the following could be concluded:

1. Most of the orphanage centers were found with poor repair and sanitary condition of the kitchens, unclean conditions of processing equipments, inappropriate use of refrigerators (temperature reading and storage of raw and cooked foods together), improperly managed toilet facilities, absence of hand washing basin near the dining room, inappropriate solid waste storage receptacles and lack of the standard three compartment food utensil washing facility.
2. The knowledge and practice of Food handlers towards foodborne disease, personal hygiene and food handling practices were found to be unsatisfactory in all of the orphanage centers.
3. The results obtained from the microbiological analysis of the RTE foods also revealed gross unhygienic condition of food utensils, poor personal hygiene of the

food handlers, and poor temperature control or ineffectiveness of washing and sanitizing procedures, as well as improper handling and/or storage of foods.

4. Most of the food handlers did not get any training in relation with food safety and most of them did not have a clear image of how food can be contaminated and resulting in foodborne diseases. This may cause foodborne disease outbreak in the centers as many of them did not know how these diseases can be transmitted.

5. The predominance of *Staphylococcus* species and the poor hygienic practices of the food handlers in the centers may result in foodborne disease outbreaks unless the sanitary facilities of the centers and personal hygiene of the food handlers can be improved.

6. The isolation of *enterobacteriaceae* in cooked RTE foods is good indicator of the risk of transmission of fecally contaminated pathogens, including intestinal parasites, from infected individuals to the healthy children.

7. The predominance of *Bacillus*, *Staphylococcus* and *Entarobacteriaceae* in bacterial populations of all three food categories studied indicates poor hygienic practices of the food handlers in the centers.

## **8. RECOMMENDATION**

1. All the centers that provide food services need to have a guideline for inspection of food preparation in the centers.
2. Health sectors, municipalities and Non Governmental Organizations should work together to improve the sanitary facilities of the centers and in turn protect the health of the children to reduce the economic burden of the country due to foodborne diseases.
3. The food handlers having direct contact with foods need to have periodic physical examinations including stool test for enteric pathogens at least twice a year to prevent the health defects of the food handlers and avoid transmission of these pathogens through contaminated foods.
4. The food handlers and the responsible officials need to have training on basic principles of food handling and preparation practices.
5. The orphanage centers should be supported by concerned bodies and also monitored regularly whether their activities are to the standard or not.
6. Integrated effort need to be made to reduce the spread of HIV/AIDS which has been contributing to the nations high number of orphans.

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ANNEX

English Version Questionnaire for Data Collection on the Overall Hygienic Practices & Facilities of Selected Orphanage Centers in Addis Ababa

Identification

Type of establishment \_\_\_\_\_ Name of Establishment \_\_\_\_\_
Address of establishment \_\_\_\_\_ Establishment code no. \_\_\_\_\_

Verbal consent form before conducting interview

Introduction; My name is \_\_\_\_\_ I am a post graduate student in Addis Ababa University & working a research, entitled Prevalence of Intestinal Parasitic Infections among Food Handlers and Microbial Safety of the Ready-to-eat Foods in Selected Orphanage Centers in Addis Ababa. Your center has been selected to be included in this study. The finding of the study will be used as a basis for better planning of sanitary conditions and safe food preparation in the center. Therefore, I am requesting you to respond honestly for interview questions and I need your willingness to enter and observe some area of the center and condition of the equipments used for food preparation and service; your response is completely confidential; your name will not be written and the result will not be given to a third body. Your participation is voluntary and you are kindly requested to answer every question and you may stop at any time you want however your honest answers to interview questions and willingness to observe the status of the food preparation establishments will help us better understand at what condition the orphanage centers are found in Addis Ababa.

Are you willing to participate?

- 1. If yes, proceed to the next page,
2. If no pass to the next participant.

Name of interviewer \_\_\_\_\_ signature \_\_\_\_\_
Date of interview \_\_\_\_\_ time started \_\_\_\_\_ time finished \_\_\_\_\_
Supervisors name \_\_\_\_\_ signature \_\_\_\_\_

INSTRUCTION

The questionnaires have interview and observational types. For interview questions which were pre coded response, only read (ask) as it is written and record the response of the respondents and for observational types go and observe each of the requested items and record your observations exactly.

1 - General information

Table with 3 columns: Question, Response, Code. Rows include: 101 - Sex of manager/owner, 102 - Age of manager/owner, 103 - Educational/ literacy/ status of manager/owner, 104 - Marital status of manager/owner.

- 105 - Manager of the center 5. separated /\_\_/  
 1.Owner 2. Relatives  
 3. Employed /\_\_/  
 106 - Owner of center 1. Individual 2. Organization  
 3. Others (specify \_\_\_\_\_) /\_\_/  
 107 - Owner ship of the center building 1. Private 2. Rented /\_\_/  
 108 - Number of workers 1. Male \_\_\_\_\_ 2. Female \_\_\_\_\_ Total \_\_\_\_\_ /\_\_/  
 109 - Number of children having food services in the center  
 1. Male \_\_\_\_\_ 2. Female \_\_\_\_\_ Total \_\_\_\_\_ /\_\_/  
 110 - How many of the children are HIV +ve?  
 1. Male \_\_\_\_\_ 2. Female \_\_\_\_\_ Total \_\_\_\_\_ /\_\_/  
 111 - Age range of the children 1. 0-5 \_\_\_\_\_ 2. 6-14 \_\_\_\_\_ >14 \_\_\_\_\_ /\_\_/  
 112 ó Does the center have periodic physical examination for the food handlers?  
 1. Yes 2. No /\_\_/  
 113- If yes, how many times per year?  
 1. Once a year  
 2. Twice a year  
 3. More than twice a year /\_\_/

**2 - Condition of kitchen for the center in which food is prepared for services.**

- 201 - Does the center have a kitchen? 1. Yes 2. No /\_\_/  
 202 - Had all food handlers wear over coat? 1. Yes 2. No /\_\_/  
 203 - Had food handlers been given in house training about proper sanitary practices?  
 1. Yes 2. No /\_\_/  
 204 - Do managers supervise workers on their normal work? 1. Yes 2. No /\_\_/  
 205 - Types of floor 1. Concrete/ cement 2. Earthen  
 3. Brick/plastered stone 4. Other (specify \_\_\_\_\_) /\_\_/  
 206 - Is the floor clean at time of visit? 1. Yes 2. No /\_\_/

**2.1 - Cleanness and repair conditions of wall and ceiling**

- 207 - Is cleanness kept and free from visible dirt, dust, soot, and web of spider?  
 1. Yes 2. No /\_\_/  
 208 - Is it maintained in good conditions which have no joint, hole and crack in which dirt  
 and insects can lodge? 1. Yes 2. No /\_\_/  
 209 - Is the kitchen provided with adequate lighting systems? 1. Yes 2. No /\_\_/

**2.2 - Ventilation of the kitchen**

- 210 - Is chimney installed for ventilation? 1. Yes 2. No /\_\_/  
 211 - Does the kitchen space serve for other purpose? 1. Yes 2. No /\_\_/  
 212 - If yes (specify it \_\_\_\_\_) /\_\_/

**2.3 - Insect and vermin protection**

- 213 - Is any infestation of pests observed at time of visiting? 1. No 2. Yes,  
 If yes, type 1. Flies 2. Rat  
 3. Cockroach 4. Other (specify \_\_\_\_\_) /\_\_/

**2.4 - Conditions of processing equipment and handling of food in kitchen**

- 214 - Are smooth, non observant, free from crack and easily cleanable materials provided for processing? 1. Yes 2. No /\_\_/  
 215 - Is processing equipment cleanness kept and free from visible dirt and filth? 1. Yes 2.No /\_\_/  
 216 - Is there connection of running water in the kitchen for preparation and washing of equipments? 1. Yes 2. No /\_\_/  
 217 - Are cooked foods handled properly in kitchen/ kept in sealed conditions to prevent access from insect and open environment? 1. Yes 2.No /\_\_/

**Waste handling in kitchen**

- 218 - Are there appropriate refuse receptacles which are tight and fight for cover proved in the kitchen? 1. Yes 2.No /\_\_/

**3 - Store room and refrigerators**

- 301 - Is a refrigerator available for storage of perishable foods? 1. Yes 2. No /\_\_/  
 302 - If refrigerator available, are perishable and non perishable foods stored together? 1. Yes 2.No /\_\_/  
 303 - Is the refrigerator in over filled manner which limits circulation of air? 1. Yes 2.No /\_\_/  
 304 - Manner of storage of raw and cooked foods  
 1. in separate refrigerators for raw and cooked foods.  
 2. In the same refrigerators cooked food in upper compartment.  
 3. in the same refrigerators side by side or raw food in upper compartment.  
 4. Other (specify\_\_\_\_\_ ) /\_\_/  
 305 - Does the refrigerator have fixed thermometer reading? 1. Yes 2.No /\_\_/  
 306 - If the refrigerator have fixed thermometer, what is the reading of temperature at time of visit? \_\_\_\_\_ /\_\_/  
 307 - Does the center have a separate store room? 1. Yes 2.No /\_\_/  
 308 - If there is a separate store, room type of floor  
 1. Concrete/ cement. 2. Plastered stone /bricks.  
 3. Wooden. 4. Earthen.  
 5. Others (specify\_\_\_\_\_ ) /\_\_/  
 309 - Is the room free from moisture and dust? 1. Yes 2. No /\_\_/  
 310 - Does the class infested with insect during visit? 1. Yes 2. No /\_\_/

**4 - Dining room**

- 401 - Types of floor 1. Tile 2. Concrete  
 3. Wooden 4. Plastered stone/bricks  
 5. Earthen. /\_\_/  
 402 ó Is the floor repaired in conditions which have no cracks in which dirt can lodge? 1. Yes 2. No /\_\_/  
 403 - Lighting of dining room 1.adequate 2.inadequate /\_\_/  
 404 - Wall type  
 1. Smooth easily cleanable 2.Rough surface  
 3. Others (specify\_\_\_\_\_ ) /\_\_/  
 405 - Is the wall maintained in good conditions? 1. Yes 2.No /\_\_/

- 406 - Is cleanness of the wall kept at time of visit? 1. Yes 2.No /\_\_/  
 407 - Is the ceiling maintained in good conditions? 1. Yes 2. No /\_\_/  
 408 - Is cleanness of ceiling kept and free from dust, soot and web of spider? 1. Yes 2. No /\_\_/  
 409 - Do all workers engaged in delivering food wear appropriate over coat? 1. Yes 2. No /\_\_/  
 410 - Do all workers engaged in food handling wear hair cover? 1. Yes 2. No /\_\_/  
 411 - Do all workers engaged in delivering food handle money? 1. No 2.Yes /\_\_/

## 5 - For selected/ sampled food handlers

### 5.1 - General information

- 501 ó Sex 1. Male 2. Female /\_\_/  
 502 ó Age year \_\_\_\_\_ /\_\_/  
 503 - Marital status 1. Single 2. Married /\_\_/  
 3. Divorced 4. Widowed  
 5. Separated /\_\_/  
 504 - Educational status 1. Illiterate 2. Literate (grade\_\_\_\_\_) /\_\_/  
 505 - For how long have you been practicing food preparation? Year \_\_\_\_\_ month \_\_\_\_\_ /\_\_/  
 506 - Had you been given any training about sanitary handling of food? 1. Yes 2. No /\_\_/  
 507 - It you had been given any training, who gave you the training? 1. Formal certification from approved organizations  
 2. Town health office  
 3. Manager/owner of the center  
 4. Others (specify\_\_\_\_\_ ) /\_\_/  
 508 - Have you ever suffered from disease symptoms like vomiting, diarrhea, skin infection and continuous coughing during the period of your food handling? 1. Yes 2. No /\_\_/  
 509 - If you have suffered from any of these disease symptoms, have you reported to your managers? 1. Yes 2.No /\_\_/  
 510 - Status of sick leave and resting after suffer of these diseases. 1. Taken sick leaves till become free of sign & symptoms  
 2. Not taken rest and have been on their normal work  
 3. Others \_\_\_\_\_ /\_\_/  
 511 - How do you supervised with manager /owner on normal work of food handling practice? 1. Regularly supervised  
 2. Intermittently Supervised  
 3. Never supervised /\_\_/

### 5.2 - Observational type of practice related question for selected food handler

- 512 - Does the worker wear appropriate over coat? 1. Yes 2. No /\_\_/  
 513 - Does the worker wear appropriate hair cover? 1. Yes 2.No /\_\_/  
 514 ó Are nails short, trimmed and clean? 1. Yes 2.No /\_\_/  
 515 - Cleanness of over coat and visible body during visit 1.Kept 2.Not kept /\_\_/





- 1. Privately instilled from municipal supply
  - 2. from communal distribution
  - 3. Buy from privately instilled pipe
  - 4. Others (specify\_\_\_\_\_)
- 602 - Is there any tanker for storage of water shortage time? 1. Yes                      2.No                      /\_/\_/

**6.2 - Toilet**

- 603 - Types of toilet
- 1. Flush type    2. Dry pit latrine
  - 3. No latrine    4. Other (specify\_\_\_\_\_)
- 604 - Its services at time of visits
- 1. It gives services    2. Locked and not gives service
  - 3. Not give service as filed/ fire of fall                      4. Others (specify\_\_\_\_\_)
- 605 - Separation for male and females?                      1. Yes                      2. No                      /\_/\_/
- 606 - Number of seats \_\_\_\_\_                      /\_/\_/
- 607 - Owner ship of the latrine
- 1. Privately owned by the establishment                      2. In communal services
  - 3. Installed for public    4. Others (specify\_\_\_\_\_)
- 608 - Is the latrine clean & comfortable to use at time of visit? 1. Yes                      2. No                      /\_/\_/
- 609 - Flies infestations at time of visit?                      1. Not seen                      2. Seen                      /\_/\_/
- 610 - Is hand wash basin provided to use after toilet near toilet room?
- 1. Yes                      2. No                      /\_/\_/

**6.3- hand washing facility for dining**

- 611 - Is hand washing facility present?                      1. Yes                      2. No                      /\_/\_/
- 612 - If present, type of hand washing facility?
- 1. Piped fountains    2. Welded metals
  - 3. Discarded object    4. Other (specify\_\_\_\_\_)
- 613 - Is soap provided for hand washing?                      1. Yes                      2. No                      /\_/\_/
- 614 - Receptacles of liquid waste from hand washing basin
- 1. Properly designed, drained and connected to main sewerage system of the establishment
  - 2. Not drained and the site is filth and dirt.                      /\_/\_/

**6.4 - Shower services**

- 615 - Is shower available for workers?                      1. Yes                      2. No                      /\_/\_/

**6.5 - Cloakroom**

- 616 - Is there separate room for clothing, resting and placing of clothes for workers?                      1. Yes                      2. No                      /\_/\_/

**7 - Washing basins/facility for utensils and conditions of equipment**

- 701- Is there basin for washing of utensils used for food and drinking displaying and preparation?                      1. Yes                      2. No                      /\_/\_/
- 702 - What type of basin present?
- 1. Fixed with smooth surface                      2. Fixed rough concrete with water tap water tap
  - 3. Dish bowls/bucket    4. Other (specify\_\_\_\_\_)
- 703- Cleanness of the basin and area around it                      1.kept                      2.not kept                      /\_/\_/

- 704 - Way of Cleaning and sanitizing of utensils  
 1. Hot and cold water and detergent used for cleaning  
 2. Only cold water with detergent used  
 3. Only hot and coldwater used  
 4. Only cold water used  
 5. Only local soap and cold water used /\_\_/  
 705 - Are sanitized equipments & utensils soaked with chemicals (E.g. Sedex) at the end?  
 1. Yes 2. No /\_\_/  
 706 - Is there drying racks for sanitized and cleaned utensils? 1. Yes 2. No /\_\_/  
 707 - Are utensils and equipment stored in containers, on shelves under conditions which can protect against contaminations?  
 1. Yes 2. No /\_\_/

**8 - Waste handling and disposal**

**8.1 - Solid waste handling and disposal**

- 801 - Are appropriate refuse receptacles placed in appropriate place?  
 1. Yes 2. No /\_\_/  
 802 - If refuse receptacles placed, is it durable type? 1. Yes 2. No /\_\_/  
 803 - Are the receptacles fit to cover and tight? 1. Yes 2. No /\_\_/  
 804 - Are the receptacles filled and splashed in the area in a manner that can aid spreading of flies?  
 1. No 2. Yes /\_\_/  
 805- Is the refuse transported to final disposal before over filing?  
 1. Yes 2. No /\_\_/  
 806 - Where is the refuse disposed at final?  
 1. Supplied to municipal service 2. Burn at site (open burn)  
 3. Disposed on street 4. Thrown in to rivers  
 5. Other (specify \_\_\_\_\_) /\_\_/

**8.2 - Liquid waste collection and disposal system**

- 807 - Is there installation of drainage system for collection and handling of liquid waste?  
 1. Yes 2. No /\_\_/  
 808 - If drainage system present, what type?  
 1. Closed type which can collect all generated liquid waste  
 2. Open trench that can collect fraction of generated waste  
 3. Other (specify \_\_\_\_\_) /\_\_/  
 809 ó Where is liquid waste disposed at final?  
 1. Open dumping in the area 2. To septic tank  
 3. Dump in Latrine 4. Discharge in to the river  
 5. Other (specify \_\_\_\_\_) /\_\_/  
 810 - Is there stagnation of liquid waste due to blockage or careless handling which can aid fly breeding and can affect sanitary condition of the center?  
 1. Yes 2. No /\_\_/

**Remarks** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

### Amharic Version of the Questionnaire

በአዳስ አበባ ዩኒቨርሲቲ ሳይንስ ፋኩልቲ  
የምግብ ሳይንስ እና ኑትሪሽን ሎጂስቲክስ

በአዳስ አበባ ከተማ በምግብ የተሰጠው የሕጻናት ማስደገፊያ ማዕከላት የጠፍቶ የምግብ ደህንነት ሁኔታ ለማጥናት የተዘጋጀ ቃለ  
መጠይቅ 2002 ዓ.ም.

**ሙያ**

የደርጅቱ ዓይነት \_\_\_\_\_ የደርጅቱ ስም/መደብ \_\_\_\_\_  
የደርጅቱ አድራሻ \_\_\_\_\_ የደርጅቱ መሥሪያ ቤቅ \_\_\_\_\_

**ቃለመጠይቅ ከመደረግ በፊት የተሳታፊዎች ፈቃደኝነት መጠየቂያ ቅፅ**

ሰላም፡- ስሜ \_\_\_\_\_ ይባላል፡፡ በአዳስ አበባ ዩኒቨርሲቲ ሳይንስ ፋኩልቲ የምግብ ሳይንስና ኑትሪሽን ሎጂስቲክስ የድንረ ምረቃ ተማሪ ስሆን የመሠረታዊ የምርምር ሥራዬን 'prevalence of Intestinal Parasitic Infections among Food Handlers and Microbial Safety of the Ready-to-eat Foods in Selected Orphanage Centers in Addis Ababa' በሙሉ ርዕስ በመሥራት ላይ እገኛለሁ፡፡ ይህ ደርጅትም በጥናቱ ወስጥ ሊከተት ተመርጧል፡፡ በዚህ መሠረት በደርጅትዎ ወስጥ በምግብ ዝግጅት እና አገልግሎት ሥራ ላይ የተሰማሩ ሠራተኞችን የጠቅላይ ሁኔታ ለምግብና የተዘጋጀውን ምግብ ደህንነት እንዲገምገሙ ከምግብ ዝግጅት ጋር በተያያዘ ያለውን የንፅህና ሁኔታ ለማጥናት ይህ መጠይቅ ተዘጋጅቶአል፡፡ በመግቢያው የጥናቱ ወጠት በሙሉ የምግብ ዝግጅትና አጠቃላይ የንፅህና ሁኔታ የሚገኝበትን መገደብ ለመደለግና በንፅህና ጉዳት በተመዘገቡ ሆነ በምግብ ዝግጅት ሠራተኞች ላይ ሊከሰቱ የሚችሉትን ምግብ ወለድ በሽታዎች ለመለየት ለመለከት ለመቀነስ እንዲያገለግል ያለመ ነው፡፡ ስለዚህ የጥናቱን ዓላማ ተገንዝው ደርጅትዎን በሚሞክሩት ለሚሱ ጥያቄዎች ትክክለኛ መልስ በመስጠትዎ ደርጅትዎን በግንብጥና ቀና ትብብር ያደርጉልኝ ዘንድ በትዕታዎን እጠይቃለሁ፡፡ ደርጅትዎን በሚሞክሩት የምግብ ማጥናት ሰራተኛ ለማጥናት ማስተኛ አካል/ወገን የሚይዩበት በምርመራ የሚደረግ መግቢያ ግልጽ ማድረግ እወዳለሁ፡፡ ለመጠየቅ ጥያቄዎ መልስ ያለመስጠት መቻሉ አከብራለሁ፡፡

በዚህ መሠረት የመቀርቡልዎን ጥያቄዎች ለመሙላት ደርጅትዎን ለግንብጥና ፈቃደኛ ነዎትን፤

- 1- አዎን ከሆነ መልሳቸው ወደመጠይቅዎ ገፅ ይለፉ/ይሂዱ
- 2- መልሳቸው የለም ከሆነ ወደመጠይቅዎ ተሳታፊ ይሂዱ

መጠይቁን ያደረገው ሰው ስም \_\_\_\_\_ ፊርማ \_\_\_\_\_  
መጠይቁ የተደረገበት ቀን \_\_\_\_\_ የተጀመረበት ሰዓት \_\_\_\_\_ ያለቀበት ሰዓት \_\_\_\_\_  
የተቆጣጠረው ስም \_\_\_\_\_ ፊርማ \_\_\_\_\_

**የመጠይቅ አጠቃላይ መግቢያ**

ለአብዛኞቹ መጠይቆች መልስ ለሆኑ ይኖራሉ ተብሎ የታወቀባቸው አሜሪካኛ በገርገር ተቀምጠዋል፡፡ ስለዚህ መጠይቆችን በምግብ ገዢ ጊዜ የሚከተሉትን መሠሪያዎች ተከትለህ መጠየቅና መልስን ማጠፈር አስፈላጊ ነው፡፡

- እያንዳንዱ ጥያቄ መጠይቁ ላይ እንደሰፈረው መጠየቅ አለበት፡፡
- መጠይቅ የሚደረግላቸው ሰዎች መልስ ብቻ በቂ አይደለም፡፡ መጠየቅ ወይም መፈተሽ ያለባቸው ቦታዎች በሙሉ መጠየቅ አለባቸው፡፡
- ለያንዳንዱ ጥያቄ መልስ ይሆናሉ ተብሎ የተጻፉ አሜሪካኛ መልሶች መጠይቅ ለሚደረግላቸው ሰዎች መጠየቅ አስፈላጊ አይደለም፡፡
- ተጠያቂዎች የሚሰጡትን መልስ በትክክል ማግኘት ለተሰጠው መልሶች ከተቀመጠው አሜሪካኛ በበለጠ የሚሞክሩበትን በመሠረት የክብ ምልክት መደረግ አለበት፡፡

- 1- ጠቅላላ መረጃ
- 1.1. ማኅበራዊ ሁኔታ

ተራ ቁ	ጥያቄ	የተሰጠ መልስ	መሥሪያ ቤ.
101	የደርጅቱ አስተዳዳሪ ጾታ	1. ወንድ 2. ሴት	/ /
102	የደርጅቱ አስተዳዳሪ ዕድሜ	_____ ዓመት	/ /
103	የደርጅቱ አስተዳዳሪ የትምህርት ደረጃ	1. ያልተማረ 2. የተማረ ክፍል	/ /
104	የአስተዳዳሪው የጋብቻ ሁኔታ	1. ያለገባ 2. ያገባ 3. የፊታ 4. የሞቱበት 5. የተለያየ	/ /
105	የደርጅቱ አስተዳዳሪ	1. ባለቤት 2. ዘመድ 3. ቅጥረኛ	/ /
106	የደርጅቱ ባለቤት	1. ግለሰብ 2. ደርጅት 22. ሌላ (ይገለጽ)	/ /
107	የደርጅቱ ሕንፃ ይዘታ	1. የግል 2. ከራይ	/ /
108	የሠራተኞች ቁጥር	1. ወንድ _____ 2. ሴት _____ 3. ጠቅላላ _____	/ /
109	በማዕከሉ ወስጥ የሚኖሩ ሕጻናት ቁጥር	1. ወንድ _____ 2. ሴት _____ 3. ጠቅላላ _____	/ /
110	ምን ያህሉ ሕጻናት ከእኛ አይ ሺ ጋር ይኖራሉ?	1. ወንድ _____ 2. ሴት _____ 3. ጠቅላላ _____	/ /

111	የሕዝብና የእድሜ ክልል	1. ከ1-5 _____ 2. ከ6-14 _____ 3. ከ14 በላይ _____	/___/
112	ማኅበሩ ለምግብ ዝግጅት ሠራተኞች ወቅታዊ የጠፍ ምርመራ አለው?	1. አዎ 2. የለም	/___/
113	አዎ ከሆነ በዓመት ምን ያህል ጊዜ	1. በዓመት አንድ ጊዜ 2. በዓመት ሁለት ጊዜ 3. በዓመት ከሁለት ጊዜ በላይ	/___/

2. የምግብ ማዘጋጃ ክፍል/ኮሽና አጠቃላይ ሁኔታ

201	ማኅበሩ የምግብ ማዘጋጃ ሴት/ኮሽና አለው?	1. አዎ 2. የለም	/___/
202	በጉብኝቱ ወቅት ሁሉም ምግብ አዘጋጆች የደንብ ልብስ አደርገው ነበር?	1. አዎ 2. የለም	/___/
203	የኮሽናው የወለል ንጣፍ ዓይነት	1. ኮንክሪት/ሰሜቶ 2. አፈር 3. ጠብ/ማዕኔላ 22. ሌላ _____	/___/
204	በጉብኝቱ ወቅት ወለሉ ንጹህ ነበር?	1. አዎ 2. የለም	/___/

2.1. የኮሽና ሴቱ ግድግዳና ወስጠኛ ክፍል የደህንነትና ንጽህና ሁኔታ

205	የኮሽና ሴቱ ንጽህና ተጠቅልጎ፤ ከአብዮታዊ ክቆሻሻ፤ ጥላሽትና የሽረራት ደር ነፃ ነው?	1. አዎ 2. የለም	/___/
206	የኮሽና ሴቱ ግድግዳና ኮርኒስ ያልተሰነጠቁ፤ ክፍተት የሌለውና ከሦስት አጽቄዎችና ቆሻሻ የፀዳ ነው?	1. አዎ 2. የለም	/___/
207	ኮሽናው በቂ ብርሃን ያገኛል?	1. አዎ 2. የለም	/___/

2.2. የኮሽና ሴቱ የአየር ዝግጠራ ሁኔታ

208	ኮሽናው የጭነት ማስወገጃ አለው?	1. አዎ 2. የለም	/___/
209	የኮሽናው ክፍት ቦታ ለሌላ አገልግሎት ይውላል?	1. የለም 2. አዎ	/___/

2.3. የሦስት አጽቄና ጎጂ እንስሳት ቁጥጥር

210	በጉብኝቱ ወቅት የታዩ ጎጂ እንስሳት ወይም ሦስት አጽቄ አለ?	1. የለም 2. አዎ	/___/
211	አዎ ከሆነ ዓይነቱ	1. ዝንብ 2. አይጥ 3. በረሮ 22. ሌላ _____	/___/

2.4. የምግብ ዝግጅት ቁሳቁሶች/መልገያ መሪዎችና የምግብ አይደዝ በኮሽና ወስጥ

212	የምግብ ማዘጋጃ ቁሳቁሶቹ ስንጥቅ የሌላቸው፤ ለስላሳና በቀለሉ ለይዳ የማይሉ ናቸው?	1. አዎ 2. የለም	/___/
213	የምግብ ማዘጋጃና መልገያ መሪዎች ንፅህና የተጠበቀ ነው ከሆነ ቆሻሻስ የጸዱ ናቸው?	1. አዎ 2. የለም	/___/
214	የተዘጋጁ ምግቦች በኮሽናው ወስጥ በአግባቡ ተያዘዋል፤ ሦስት አጽቄዎችና ጎጂ እንስሳትን ለመከላከል በሚገባ ተከደዋል?	1. አዎ 2. የለም	/___/

3. የምግብ መዘንና ማኅበራዊ ስነ-ምግባር

301	የምግብ ማኅበራዊ/ማዕኔሪ የሚሆን ማኅበራዊ አለ?	1. አዎ 2. የለም	/___/
302	ማኅበራዊ ክለ ቶሎ የሚሰጡት ቶሎ የማይሰጡ ምግቦች ባንድ ላይ ተቀምጠዋል?	1. የለም 2. አዎ	/___/
303	ማኅበራዊው አየር በማይዘገዝበት ሁኔታ ከአቅም በላይ የሞላ ነው?	1. የለም 2. አዎ	/___/
304	የበሰሉና ያልበሰሉ/ጥሬ ምግቦች የተቀመጡት ሁኔታ	1. ለበሰሉና ያልበሰሉ ምግቦች የተለያዩ ማኅበራዊዎችን በመጠቀም 2. በአንድ ማኅበራዊ የበሰሉ ምግቦችን በላይኛው የማኅበራዊ አካል/ክፍል 3. በአንድ ማኅበራዊ ወስጥ ጎንጎን 22. ሌላ _____	/___/
305	ማኅበራዊው ቋሚ የመቅት መኪና መጠን ንብብ ያሳያል?	1. አዎ 2. የለም	/___/
306	ክለው የመቅት መኪና መጠን/ ንብብ ስንት ነበር?	ዲግሪ ሴልሲስ	/___/
307	ማኅበራዊ የተለየ የምግብ መዘን ክፍል አለው?	1. አዎ 2. የለም	/___/
308	ክለው የመዘን የወለል ንጣፍ ዓይነት	1. ኮንክሪት/ሰሜቶ 2. የደንጋይ ንጣፍ 3. የጠብ ንጣፍ/ማዕኔላ 4. የአንጨት ንጣፍ 5. የአፈር 22. ሌላ _____	/___/
309	የመዘን ክፍሉ ከዕርግትና ከቆሻሻ/አባራ የጸዳ ነው?	1. አዎ 2. የለም	/___/
310	በጉብኝቱ ወቅት ክፍሉ በሦስት አጽቄ ተወራ ነበር?	1. የለም 2. አዎ	/___/

4. የመጣቢያ አዳራሽ ሁኔታ

401	የመጣቢያ አዳራሹ የወለል ዓይነት	1. ኮንክሪት/ሰሜቶ 2. የደንጋይ ንጣፍ 3. የጠብ ንጣፍ/ማዕኔላ 4. የአንጨት ንጣፍ 5. _____	/___/
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		የአፈር 22. ለሌ	
402	የከፍሎ ወለል ቆሻሻ የማይጠራቀምበትና ስንጥቅ የለለው ነው?	1. አዎ 2. የለም	/ /
403	የመጣቢያ አዳራሾች በቂ ብርሃን ያገኛል?	1. አዎ 2. የለም	/ /
404	የመጣቢያ አዳራሾች ግድግዳ ዓይነት	1. ለስላሳና በቀላሉ ለጸዳ የማይቻል 2. ሸካራ 22. ለሌ	/ /
405	ግድግዳው በጣባ የተሠራ/የተጠበነ ነው?	1. አዎ 2. የለም	/ /
406	በጉብኝቱ ወቅት የግድግዳው ንጽህና የተጠበቀ ነበር?	1. አዎ 2. የለም	/ /
407	የመጣቢያ አዳራሾች ኮርኒስ በጣባ የተሠራ/የተጠበነ ነው?	1. አዎ 2. የለም	/ /
408	የኮርኒሱ ንጽህና የተጠበቀና ከአብዮታዊ ከግላሽት እንዳይሆን ከሸረራት ደር የጸዳ ነው?	1. አዎ 2. የለም	/ /
409	ሁሉም የምግብ አስተናጋጆች የደንብ ልብ/የሥራ ልብ ለብሰዋል?	1. አዎ 2. የለም	/ /
410	ሁሉም የምግብ አስተናጋጆች የጸገር መሸፈኛ አደርገው ነበር?	1. አዎ 2. የለም	/ /
411	ሁሉም የምግብ አስተናጋጆች ገንዘብ(ብር/ገንቲም) በአጃቸው ይዘው ነበር?	1. የለም 2. አዎ	/ /

5. የምግብ ገዢዎች ሠራተኞችን በተመለከተ

5.1. ጠቅላላ መረጃ

501	ፆታ	1. ወንድ 2. ሴት	/ /
502	ዕድሜ	ዓመት	/ /
503	የጋብቻ ሁኔታ	1. ያለገባ 2. ያገባ 3. የፊታ 4. የሞተበት 4. የተለያየ	/ /
504	የትምህርት ደረጃ / ሁኔታ	1. ያልተማረ 2. የተማረ (ክፍል )	/ /
505	ለምን ያህል ጊዜ የምግብ ገዢዎች ሥራ ሠርተዋል?	ዓመት _____ ወር _____	/ /
506	ስለ ምግብ አያያዥ ንጽህና ስልጠና ወስደው ያወቃሉ?	1. አዎ 2. የለም	/ /
507	አዎ ከሆነ ስልጠናው ያገኙት/የሰጠው አካል	1. ሕጋዊ ሰርተፊኬት ዕውቀት ካለው ደርጅት 2. ከጠፍ ቤር 3. ከሞከሮ አስተዳዳሪ/ባለቤት 22. ለሌ	/ /
508	ምግብ በማዘጋጀት ጊዜ በተለያዩ በሽታዎች ለምሳሌ በትወኪያ ተቅማጭ የቆዳ በሽታና ተከታታይ ሳል ተይዘው ያወቃሉ?	1. የለም 2. አዎ	/ /
509	በነዚህ በሽታዎች ተይዘው ከነበረ ለአስተዳዳሪው ሪፖርት አደርገው ነበር?	1. አዎ 2. የለም	/ /
510	ከህመም-በሀዋላ የነበረ የዕረፍት ጊዜና የህመም ፈቃድ ሁኔታ	1. ከህመም አስኪያጅ ደረሰ የህመም ጊዜ ፈቃድ አግኝተዋል 2. የህመም ጊዜ ፈቃድ አላገኘም፤ ይልቁንም በመደበኛ ሥራቸው ላይ ነበሩ 22. ለሌ	/ /
511	በመደበኛ የምግብ ገዢዎች ሥራ ወቅት የመከላከያ አስተዳዳሪ/ባለቤት ሠራተኞችን የማቆጣጠሩ ሁኔታ	1. በየጊዜው/መደበኛ በሆነ መንገድ ይቆጣጠራሉ፤ 2. አልፎ አልፎ ይቆጣጠራሉ፤ 3. ፈጽሞ አይቆጣጠሩም፤	/ /

5.2. ከሞከሮ የምግብ ገዢዎች ሠራተኞች ተግባራዊ እንቅስቃሴ ጋር በተያያዘ የተዘጋጀ በሞት የሚሞላ መጠይቅ

512	ሠራተኛው ተገቢውን የደንብ ልብ/ጋዎ/አሸር ኮት አደርጎአል?	1. አዎ 2. የለም	/ /
513	ሠራተኛው ተገቢውን የፀገር ሽፋን አደርጎአል?	1. አዎ 2. የለም	/ /
514	የሠራተኛው ጥፍሮች አገር ተደርገው የተቆረጠ ንጽህና ናቸው?	1. አዎ 2. የለም	/ /
515	የደንብ ልብ/የኮቱ ንጽህና ተጠብቆአል?	1. አዎ 2. የለም	/ /
516	በጉብኝቱ ወቅት ሠራተኛው ያስለዋልን ከአይኖቹ፣ ከአፍንጫና ከጆሮዎቹ ፈሳሽ (እነደ ዕንባና ንፍጥ) ይታይበታል?	1. የለም 2. አዎ	/ /
517	በሠራተኛው ሰውነት/ቆዳ ላይ የሚታዩ ማንኛውም ሽፈፍ፣ እከክ፣ ወሃ የቻላረ ዕበጥ ወይም ቁስል ይታይበታል?	1. የለም 2. አዎ	/ /
518	ማንኛውም ቁስለት ከታየ	1. በግላስተር ታሸጓል፤ 2. አልታሸገም እንዲሁ ተተቆላል 22. ለሌ	/ /
519	ሠራተኛው አንዳች ጌጫጥ እንደ ቀለበት አደርጓል?	1. የለም 2. አዎ	/ /
520	በሠራተኛው ጥፍሮች ላይ ቀለም ይታያል?	1. የለም 2. አዎ	/ /

5.3. ከተግባር ጋር የተያያዘ መጠይቅ

521	ዛሬ ሥራ ከመጀመሪያ በፊት እጅቼን ታየህህ?	1. አዎ 2. የለም	/ /
522	ሰጋራ ታጨለህ?	1. የለም 2. አዎ	/ /
523	ከሆነ በመደበኛ የምግብ ገዢዎች ሥራ ወቅት ታጨለህ?	1. የለም 2. አዎ	/ /
524	ከጨከ በኋላ ምግብ ከመጥጠል/ከመካከት በፊት እጅቼን ታታለህ?	1. አዎ 2. የለም	/ /

5.4. ለምግብ ዝገጅት ሠራተኞች ከዕውቀት ጋር የተያያዘ ማጠቃለያ

525	ስለምግብ ወለድ በሽታ ስምተኛ ታወቃለህ?	1. አዎ 2. የለም	/___/
526	ስለምግብ ወለድ በሽታ ስምተኛ የምግብ ክፍት የሚገኝ ምንጭ ምንድን ነው?	1. መደበኛ የሰልጠና ተቋም/ሰራተኛነት 2. ክፍት ባለሙያዎች 3. ከበራሪ ጽሑፎች 4. ከግብ ማደያ 22. ሌላ	/___/
527	ምግብ ወለድ በሽታዎች የሚጠቀሙት/የሚከለኩት እንዴት ነው?	1. በተበከለ ምግብ 2. በተበከለ እጅ 3. በተበከለ ማሳ 4. በተሸካሚዎች 5. አላውቅም 22. ሌላ	/___/
528	ምግብ እንዴት ለበከለ ይኖራል?	1. ለገዢዎች ሲጋራዎች 2. በተበከለ አካባቢ/ከባቢ አየር ያለ የምግብ አያያዝ 3. ቆሻሻ የምግብ ቁሳቁሶችን መጠቀም 4. የተበከለ ማሳ ለመጣቢያ ዕቃዎች ማጠቃለያ ማድረግ ለምግብ ዝገጅት መጠቀም 5. ቆሻሻ እጆች 6. የበሰሉና ያልበሰሉ ምግቦችን አንድ እቃ ወሰዋ ማጠቃለያ 22. ሌላ	/___/

6. የሠራተኞች አቅርቦትና የሥራ ሁኔታ

6.1. የሠራተኞች አቅርቦት

601	መካከላዊ ሠራተኛዎች/ የሠራተኞች ምንጭ	1. ከመንግስት አቅርቦት በግል የተቀረጸ 2. ከሕዝብ አገልግሎት ሥርዓት 3. ከግለሰቦች በሞንቡዎ በግዥ 22. ሌላ	/___/
602	በሠራት ዕድል ጊዜ የሚጠቀሙት ማህበራዊ ገንዘብ አለን?	1. አዎ 2. የለም	/___/

6.2. የሥራ ሁኔታ

603	መካከላዊ የሥራ ሁኔታ አለመሆን?	1. አዎ 2. የለም	/___/
604	የሥራ ሁኔታ በሌላ ዓይነት	1. ዘመናዊ የሥራ ሁኔታ 2. ባሕሪዎ የተደገፈ 22. ሌላ	/___/
605	በጉብኝቱ ወቅት የሥራ ሁኔታ አገልግሎት	1. አገልግሎት ይሰጥ ነበር 2. ቁልፍ ነበር/አገልግሎት አይሰጥም	/___/
606	የሥራ ሁኔታ በጸታ የተከፈለ ነው?	1. አዎ 2. የለም	/___/
607	የሥራ ሁኔታ ስንት መቆጣጠር አለው?		/___/
608	የሥራ ሁኔታ ባለበትነት	1. በመካከላዊ ደረጃ ሥራ 2. ለሕዝብ የተገነባ 3. ሌላ	/___/
609	በጉብኝቱ ወቅት የሥራ ሁኔታ ምን ዓይነት ነው?	1. አዎ 2. የለም	/___/
610	በጉብኝቱ ወቅት የሥራ ሁኔታ የገዢዎች ሁኔታ	1. አልታዩም 2. ታይተዋል	/___/
611	የሥራ ሁኔታ አቅርቦት የሥራ ሁኔታ ምን ዓይነት ነው?	1. አለ 2. የለም	/___/

6.3. ከመጣብ በፊት የሚጠቀሙት የሥራ ሁኔታ አቅርቦት

612	ከመጣብ በፊት የሥራ ሁኔታ አቅርቦት የሥራ ሁኔታ ምን ዓይነት ነው?	1. አዎ 2. የለም	/___/
613	ካለ ዓይነት	1. ደረጃውን የጠበቀ የሥራ ሁኔታ ምን ዓይነት ነው? 2. ከሰራተኞች የተሠራ የሥራ ሁኔታ ምን ዓይነት ነው? 3. በሠራተኞች የተሞላ ባለሙያ/ቆራቆራ 22. ሌላ	/___/
614	ለእኛ የሥራ ሁኔታ የሥራ ሁኔታ አቅርቦት አለን?	1. አዎ 2. የለም	/___/
615	ከእኛ የሥራ ሁኔታ ምን ዓይነት የሥራ ሁኔታ ምን ዓይነት ነው?	1. ከፍተኛ ማህበራዊ ገንዘብ በአግባቡ የተገኘ ነው 2. በአግባቡ የማይገኝና አካባቢውን ቆሻሻ ነው	/___/

6.4. የሰው ሀብት መቆጣጠር አገልግሎት

616	ለሠራተኞች አገልግሎት የሚጠቀሙት የሰው ሀብት መቆጣጠር አለን?	1. አዎ 2. የለም	/___/
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6.5. የሥራ ሁኔታና የሥራ ሁኔታ ክፍል

617	ለሠራተኞች ልሳን ማህበራዊ ገንዘብ የሥራ ሁኔታ የሥራ ሁኔታ የተለየ ክፍል አለን?	1. አዎ 2. የለም	/___/
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7. የምግብ ዝገጅትና መልካም እቃዎች ሁኔታ ማህበራዊ ገንዘብ

701	ለምግብ ማህበራዊ ገንዘብ መቆጣጠር የሥራ ሁኔታ ምን ዓይነት ነው?	1. አዎ 2. የለም	/___/
702	ካለ ዓይነት	1. ቋሚ/የማይንቀሳቀስ ለሰራተኛ አካል ያለው 2. ቋሚ/የማይንቀሳቀስ ሽኩራና በሞንቡዎ የተገለጸ 3. ተንቀሳቃሽ ገንዘብ 22.	/___/

		ሌላ _____	
703	የሚከበሩ ገንዘብና አካባቢው ንጽህና	1. ንጽህናው የተጠበቀ ነው 2. ንጽህናው ያልተጠበቀ ነው	/___/
704	መግለጫ ቁሳቁሶችን የሚያጸዳበት/የሚያሳዝበት መንገድ	1. መቅና ቀዝቃዛ ወይ ከሚቻል ጋር 2. ቀዝቃዛ ወይ ከሚቻል ጋር 3. ቀዝቃዛና መቅ ወይ ብቻ 4. ቀዝቃዛ ወይ ብቻ 5. ቀዝቃዛ ወይና ተራ ሳሳቶ ብቻ	/___/
705	የመግለጫ ቁሳቁሶች ከታጠቡ በሁሉም በከፍተኛ ለምሳሌ በበረከት ይነካሉ/ይዘገቡ/ሌላ?	1. አዎ 2. የለም	/___/
706	ለታጠቡ የመግለጫ ቁሳቁሶች የሚደረግ/ሚሰጠው (ራስ) አለ?	1. አዎ 2. የለም	/___/
707	የታጠቡ ቁሳቁሶች ማስቀመጫ(ሽልፍ) ሁኔታ ብክለትን ለመቀነስ የሚያስችል ነው?	1. አዎ 2. የለም	/___/

8. የቆሻሻ አያያዥና አወጋገድ

8.1. የደረቅ ቆሻሻ አያያዥና አወጋገድ

801	የደረቅ ቆሻሻ ማጠራቀሚያ ቅርጾች ትክክለኛ ቦታቸውን ይዘዋል?	1. አዎ 2. የለም	/___/
802	ትክክለኛ ቦታቸውን ከይዙ (ካሉ) ለረዥም ጊዜ ሊያገለግሉ የሚችሉ ናቸው?	1. አዎ 2. የለም	/___/
803	የደረቅ ቆሻሻ ማጠራቀሚያዎ በአግባቡ የሚሰጥ ክፍን ያላቸው ናቸው?	1. አዎ 2. የለም	/___/
804	የደረቅ ቆሻሻ ማጠራቀሚያዎ ዝንቦች እንዲረቡና እንዲዘመቱ የሚያስችሉና የተጠቃሩ ናቸው?	1. አዎ 2. የለም	/___/
805	የሚገለጹ ቆሻሻ የሚጓዙበት ከአቅም በላይ ከመላኩ በፊት ነው?	1. አዎ 2. የለም	/___/
806	ደረቅ ቆሻሻው በመጨረሻ የሚገለጹ የት ነው?	1. ለአስወጋጅ አካላት/በመንግስት ይገለጻል 2. በግቢው ክፍት ቦታ ይቃጠላል 3. መንገድ ላይ ይጠራል 22. ሌላ _____	/___/

8.2. የፍሳሽ ቆሻሻ ማጠራቀሚያና አወጋገድ

807	የፍሳሽ ቆሻሻ ማጠራቀሚያ ማጠቃለያ ተፋሰስ ተዘርግቷል?	1. አዎ 2. የለም	/___/
808	የሚጠቃለል ተፋሰስ ከተዘረጋ ምን ዓይነት ነው?	1. የሚጠቃለል ፍሳሽ ቆሻሻ በሙሉ መያዝ የሚችልና ዝግ ነው 2. ክፍትና የሚጠቃለል ፍሳሽ በከፊል መሸከም የሚችል 22. ሌላ _____	/___/
809	በመጨረሻ ፍሳሽ ቆሻሻው ወደ የት ይወጣል?	1. ማጠቃለያ ይደፋል 2. ወደ ማጠቃለያ ገንዘብ ወስጥ ይገባል 3. ወደ መጽዳቻ በት ይለቀቃል 4. ወደ ወንዝ ይቀላቀላል 22. ሌላ _____	/___/
810	የመጠኑን የንጽህና ሁኔታ የሚያሳይና በግደግለሽ አያያዥ ወይም በፍሳሽ መደረጃው መሰረት ምክንያት ለዝንቦች መቆጣጠር ምን ዓይነት ሁኔታ አለ?	1. የለም 2. አዎ	/___/

ምርመራ/ተጨማሪ አስተያየት \_\_\_\_\_

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አመሰግናለሁ!