PREVALANCE OF PARASITIC AND ENTERIC INFECTION AMONG ASYMPTOMATIC FOOD HANDLERS OF DIFFERENT HOSPITAL CANTEENS OF CHATTOGRAM CITY

Dr. Sumaiya Islam

Roll: 0120/33

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A thesis submitted in the partial fulfillment of the requirements for the degree of MPH (Public Health)

One Health Institute
Chattogram Veterinary and Animal Sciences University
Chattogram -4225, Bangladesh

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Dr. Sumaiya Islam

April, 2023

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This is to certify that we have examined the above Master's thesis and have found that it is complete and satisfactory in all aspects, and that all revisions required by the thesis examination committee have made.

Supervisor

Dr. Rumana Rashid

Assistant Professor, Epidemiology & Community Medicine,
BITID, Chattogram.

Professor Dr. Sharmin Chowdhury

Chairman of the Examination Committee

Director, One Health Institute.

One Health Institute

Chattogram Veterinary and Animal Sciences University

Khulshi, Chattogram-4225, Bangladesh.

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LIST OF CONTENTS

List of Tables

Lists of Figures

List of Abbreviations

Abbreviation	Elaboration
BMI	Body Mass Index
CrI	Credible Interval
CT	Cycle Threshold
EAC	Ethics Approval Committee
HAI	Hospital-Acquired Infections
ICU	Intensive Care Unit
IEDCR	Institute Of Epidemiology, Disease Control and Research
IPIs	Intestinal Parasitic Infections
IQR	Interquartile Range
PCR	Polymerase Chain Reactions
RML	Rodolphe Merieux Laboratory
SD	Standard Deviations
SPSS	Statistical Package for Social Science
TCBS	Thiosulphate Citrate Bile Salt Sucrose
WHO	World Health Organization
XLD	Xylose Lysine Deoxycholate
BITID	Bangladesh Institute of Tropical &Infectious Disease

Operational Definitions

Food handlers

The term food handlers mainly refer to people who directly contact with food as part of theirwork and work in different canteen of health setup.

Asymptomatic food handler

Asymptomatic food handler means who may be carrier for enteric bacteria or parasitic infection shows no symptoms of infection.

Bacterial infection

Bacterial infections is presence of harmful strain maybe found in stool.

Parasitic/worm infection

Parasitic/worm infection means presence of parasite or worm in the host which can be detect by examination of stool.

Age of food handler worker mark for the study analysis as teenage (10-19), young adult (20-29), middle aged adult (30-39), old aged adult (40-49), senior (50-60)

Personal hygiene of food handler the personal hygiene of the food handler marks as standard personal hygiene practice includes hand wash, drinking water, nail trimming, bath, usage of hand gloves, hair and sandal.

Hand wash means habit of washing hand to ensure as a part of the hygiene practice food handler specially before and after serving, before and after food handling, after use toilet and also use soap during handwashing with timing, process of hand wash, how many often wash hand.

Nail trimming weekly at least once, bathing habit, usage of gloves, usage of hair net, wearing sandal habit, having home food

Food hygiene Food hygiene means cook food in proper temperature (at 145° F), storage food in proper temperature, washing raw food in running water for 2 min, store raw food in refreeze separately.

Canteen condition a proper canteen condition means proper kitchen which is well ventilated, kitchen far from toilet, the waste product keep outside it. Wash the kitchen both inside and outside and consumable kitchenitems with disinfectant.

Health condition of food handler

When the food hander had taken anthelmintic in one year, how many times got sick due to typhoid, how many days had antibiotic, any health checkup done.

Summary

Gastrointestinal parasitic infection is one of the important public health problems in the world which causes significant mortality and morbidity. These infections are mostly due to food-borne diseases, which are a cause for concern in both industrialized and underdeveloped nations. Helminth and protozoan infections play major roles in the occurrence of the digestive disorders. These infection may spread rapidly from food prepared and processed by food handlers. On this regard descriptive type of cross-sectional study was conducted among 125 food handlers of different hospital canteens in Chattogram city. The study was conducted from June 2022 to April 2023. A semi-structured and pretested questionnaire used to obtain information on socio demographic characteristics of foodhandler, personal hygiene, food hygiene, condition of canteen, and health condition of foodhandler. The samples were collected in appropriate method and was transported in the same day to the laboratory in a cold box. Analysis had done by using Microsoft Excel and the SPSS version 26 with 95% confidence interval and 5% level of significance. Scoring was performed for personal hygiene related questions and based on the total score personal hygiene was categorized into three ranks- very good, good and poor. Result showed zero prevalence of parasite and enteric infection that indicate asymptomatic food handlers had good health and good hygiene practice. It was also seen that food handler never had food borne illness due to good hygiene practice. Among the food handlers their experience and daily duty hours showed significance relation with the good hygiene practice. Awareness for Covid-19 plays an important role for improvement of hygiene practice. The zero prevalence of intestinal parasites and nil Salmonella, Shigella and Vibrio species in our food handlers indicated good canteens condition and occupation policies. On analyzing variables to identify good hygiene practice among food handler, there was no association with sociodemographic status except gender, as the male were predominant worker become significant ($p < 0.001$). Work experience and eating leftover food showed significance. The hygiene status showed no significant association with the health condition of the food handler like intake of Anthelminthic, sickness in last 1 year, having antibiotic, idea about typhoid fever. The most of the respondents had good (60.8%) personal hygiene whereas, 39.2% had very good personal hygiene. Using this study as a baseline, further evaluation on the prevalence can be done including other hospitals and restaurants of the city.

Chapter-1: Introduction

1.1 Background

Food-borne diseases remains to be a major threat to health around the world. Because it is difficult to provide adequate hygienic food handling standards in developing nations, the situation is severe. The danger of food contamination is mostly determined by the health of the food handlers, their personal hygiene, and their knowledge and practice of food hygiene. Intestinal parasite, Salmonella, and Shigella infections are serious risks to health all around the world, especially in developing countries where there is a shortage of clean water and unclean food handling procedures.

In developing countries, contaminated food is responsible for up to 70% of diarrheal illness cases.(World Health Organigation 2015) As a result, feces-contaminated materials either directly or indirectly influence the spread of intestinal parasites and enteropathogenic bacteria. Food, drink, nails, and fingers are among them, demonstrating the significance of fecal oral human-to-human transfer. More than 70 protozoan and helminthic parasite species are capable of infecting humans via contaminated food and water. Bare hand contact with food was the most frequently reported factor associated with food handler involvement, followed by failure to properly wash hands, inadequate cleaning of processing or preparation equipment or utensils, and cross-contamination of ready-to-eat foods by contaminated raw ingredients (Desta et al. 2014).

Both health and economic damage can be caused by foodborne outbreaks. Every year about 600 million people worldwide become very ill as a result of food contamination, with 420,000 dying according to the World Health Organization (WHO) (Mehlhorn 2016). Food related diseases impact an estimated 48 million USA population every year, causing 128,000 hospitalizations and 3,000 mortality (Scharff 2012; Adane et al. 2018). Intestinal parasitic infections (IPIs) are the common infectious diseases caused by food handlers in worldwide, especially in low economic country. Over two-fourths of worldwide population is believed to be infected with helminths contaminated through soil, whereas over 3 billion are afflicted with IPs but have not showed any clinical symptoms (World Health Organization 2023).

When cleanliness is not followed, food handlers may directly transfer intestinal protozoa and some helminths via the fecal-oral pathway, even except the requirement for intermediate hosts. Helminths and protozoa are common intestinal parasites that

have been associated with a variety of gastrointestinal illnesses. These parasite infections can happen in many different kinds of ways. In the intestinal system of a helminth-infected person, infective stages increase into adult worms that lay eggs (World Health Organization 2023). The infective stages of intestinal protozoa spread easily through the fecal-oral pathway of contaminated food or drink (Alqarni, Wakid and Gattan 2023). According to the WHO, roughly 24% of the world population is infected with one type of intestinal parasite, with Ascaris and Giardia infections being the most common. The popular intestinal parasites were *Ascaris lumbricoides*, *Entamoeba histolytica/dispar*, *Giardia lamblia* and hookworm infestation, among food handlers with a pooled frequency of 7.58%, 6.78%, 3.67%, and 2.70%, respectively, in four selected districts of Ethiopia (Girma and Aemiro 2022). According to a Malaysian study, food handlers are responsible for 10-20% of food-borne epidemics in the community (Khurana et al., 2008). Also, Strongyloides stercoralis infections were widespread with a prevalence of 48%, and Ancylostoma spp. prevalence was higher than that of Necatorameri canus (25% versus 15%), the hookworm species that is often assumed to prevail in East- Africa (Meurs et al. 2017). . Many food- borne parasitic pathogens are known (for example Ascaris, Cryptosporidia and Trichinella) but few of these are effectively monitored in foods, livestock and wildlife and their epidemiology through the food-chain is poorly understood (Newell et al. 2010). In Iran, parasites of intestine prevalence was 42.5% and prevalence of 20.5% Giardia lamblia, 14.6% Entamoeba coli, 13.3% Blastocystis hominis, 2.5% Iodamoeba butschlii, 10.6% Enterobius vermicularis and 0.2% Hymenolepis nana, respectively (Lotfi, Shah and Omidyar 2015). Geographical location, climate, area magnitude, cultural and biological factors all contribute to a favorable environment for parasite activity.

The high prevalence of parasites in some parts of the country is due to regional climate, local habits, and the usage of human and animal composts in agriculture and olericulture. Lack of clean and safe water, high density of population, improper waste disposal, denial with health regulations (social and individual), inadequate vegetable cleaning, and a lack of cooked meat all contribute to a high frequency of intestinal parasites. One of the most obvious areas of risk of IPs infections in the population is the harmful nature of diverse occupations. These settings encourage disease transmission through intimate dealings with infectious sources, which are an inherent element of various vocations, and hence present an opportunity of easy infection. Food

handlers play a crucial role as the final agent of product supplier since they might prepare dangerous and hazardous foods for ingestion. If these persons do not adhere to the guidelines of personal hygiene and food maintenance, they are regarded as primary sources of disease transmission by food and it might readily convey many infectious agents, particularly intestinal parasites, to their receivers. So, on the incidence of parasitic diseases among food industry employees and the number of infection among them could help in a decrease and prevention of these diseases (Balarak et al., 2016).

Major disease burden is observed in the low-income countries of Africa and Southeast Asia, particularly affecting vulnerable populations like children, elderly, sick immunocompromised patients. The clinical spectrum of illness varies widely from acute diarrhea and cancer to chronic malnutrition and disability, thus impeding socioeconomic progress. Most Food borne infection outbreaks are caused by diarrheal disease agents such as bacteria, viruses or parasites, spreading through contaminated food and water or from an infected person. For example, Salmonella species are prevalent in Southeast Asia and account for most food-borne deaths in recent times. Such infectious agents can be prevented by following recommended hygiene measures in food production and the supply chain. The hospital food service department provides nutritious and safe diets to patients. However, FBI outbreaks in healthcare setups can be more devastating due to highly susceptible hospitalized patients and multi-drug-resistant microbial environments. Such outbreaks further burden the healthcare system by raising the incidence of hospital-acquired infections (HAI) (Jothi et al., 2022).

Food handlers play a crucial role in the prevention of foodborne diseases because they are directly involved in the preparation and handling of food. However, if adequate food safety standards are not followed, they can become a source of foodborne illnesses and represent a risk to customers. Personal hygiene behaviors that are neglected, such as not washing hands after using the restroom or touching their faces, might introduce germs into the food preparation process (Desta et al. 2014). Inadequate temperature management during food storage and preparation can encourage the growth of pathogenic germs. Food handlers who work while sick, particularly if they have symptoms such as diarrhea, vomiting, or fever, might contaminate food and transfer germs to customers. Not having adequate food safety training can result in risky behavior and an increase in the incidence of foodborne illness outbreaks(Kumie and Zeru 2007). These are the risk factors of food handlers that might cause the food borne

disease among individuals.

Several studies in different countries have been worked of parasitic infection of food handlers, but not specific in healthcare services or organizations. As medical institutions are supposed to be an example for healthy practices, including food services, it is expected that the food service establishments inside their boundaries, as well as the food handlers who work there, should not be sources of food-borne infections (Khurana et al., 2008). The presence of entero-pathogenic bacteria protozoan and parasites among food handlers working in a hospital's food service department, such as the canteen in Chattogram city, necessitates frequent screening because they may be asymptomatic carriers, particularly in endemic hospitals. On this regard the purpose of this study is to assess the asymptomatic food handlers as carrier and also asses their hygiene knowledge and practice of food handlers in Chattogram city.

1.2 Justification of the study

Food borne illness is one of the major causes of intestinal infections. Food handlers are those who directly work with food during cook, serving, packaging in a food department as part of their work. Food contamination may be done by them. Asymptomatic food handlers are source of infection specially salmonella, shigella vibrio and parasitic infection. The food handler those who do not maintain the food hygiene during handling of food may causes contamination of food. Food handler play essential part during the product of food. The food hygiene practices among food handler which prevent the contamination of food from enteric infection and parasitic infection.

All food-handling personnel should get educated and take training in proper hygiene procedures as an effective method of minimizing the transmission of enteric pathogens and parasite infection from food-handling personnel to customers via food. This study will help us to know the frequency of parasitic and enteric infection among food handlers, those who do not show any symptoms, as they are the provider of food, so they can make the food contaminated easily. Their food hygiene practice among the food handlers prevent the contamination of food from enteric infection and parasitic infection.

This study also provided baseline assessment of food handler in different canteen about the health status and socio-economic condition.

1.2 Research question

What are the prevalence of parasitic and enteric infection among food handlers in different hospital canteens of Chattogram?

1.3 Objectives

1.3.1 General Objectives

To study prevalence of parasitic and enteric infections among Asymptomatic food handlers.

1.3.2 Specific Objectives

1. To determine the hygiene status of food handlers.
2. To study prevalence of the enteric infection in food handler.
3. To study prevalence of the parasitic infection in food handler.
4. To describe the socio demographic status of food handlers.

Chapter-2: Review of Literature

Food borne illness is very common public health problem across the globe. Food borne illness is consume contaminate food that causes illness. Review of literature shows hygiene practice of food handler, food handling practice and knowledge, food hygiene, canteen conditions, prevalence of parasitic infection and enteric infection, health condition of food handler. The main purpose of this chapter is to provide up-to-date scientific information based on past studies and accordingly identify gaps and justify the present MPH thesis research on prevalence of parasitic and enteric infection among asymptomatic food handler in different hospital canteen of Chattogram city. The review findings of relevant published and non-published articleshave been presented under the following headings as below.

2.2 Food borne illness

Foodborne diseases can occur when food is contaminated with pathogens such as bacteria, viruses, and fungi. According to the World Health Organization, one out of every ten persons globally gets a foodborne illness each year(World Health Organigation 2015). However, the annual infection rate in the United States is slightly greater, with an estimated 1 in 6 people contracting a foodborne illness each year(World Health Organigation 2015) Some foodborne infections are less dangerous than others, but if left untreated, they can cause long-term health consequences or death.

Bacteria: Leading causes of hospitalization due to bacterial food borne pathogen were nontyphoidal *Salmonella spp.* (35%), *Campylobacter spp.* (15%), and *Toxoplasma gondii* (8%) and leading causes of death were nontyphoidal *Salmonella spp*. (28%), *T. gondii* (24%), *Listeria monocytogenes* (19%). Also, diarrheagenic pathogen like E. coli, *Salmonella spp*., *Shigella spp*., *Staphylococccus aureus*, *Vibrio spp*. and *Yersinia enterocolitica* are also cause food borne disease. These may be present in raw and undercooked meat, fish, andpoultry; unpasteurized dairy products; contaminated fruits and vegetables; andcontaminated drinking water.

Viruses: Viruses are transmitted to the body through food contaminated by viral particles. Hepatitis A and Noroviruses are most common viruses causing food borne illness.

Parasites: *Cyclospora cayetanensis*, *Toxoplasma gondii* and *Trichinella spiralis* are common parasites seen among patients with food borne disease. Contaminated water and soil can transmit harmful parasites to freshproduce, seafood, meat, poultry, and other foods.

Prions: These infectious proteins are associated with "mad cow disease" andcan come from eating parts of cattle, such as the brain tissue.

2.3 Food-borne bacterial agents

Some bacteria resulting in food-borne illness are mainly related in terms of disease frequency and/or severity. Bacteria of many types (both Gram positive and Gram negative) generate toxins that cause food poisoning, with symptoms ranging from gastrointestinal problems to paralysis and death. Gram-negative bacteria have been reported to be responsible for around 69% of bacterial food-borne illness cases. Despite the fact that 31 pathogens have been identified as responsible for food-borne diseases, bacterial pathogens such as *Staphylococcus aureus* (S. aureus), *Salmonella species*, *Campylobacter species*, *Listeria monocytogenes* (L. monocytogenes), and *Escherichia coli (E. coli)* are the leading causes of food-borne disease and death worldwide (Scallan et al., 2011).

Salmonella (over 2300 types) mostly found in Raw or undercooked eggs, poultry, and meat; unpasteurized milk and juice; cheese and seafood; and contaminated fresh fruits and vegetables. Salmonellosis is a frequent bacterial infection of the gastrointestinal tract. Salmonella germs are commonly found in the intestines of animals and humans and are excreted through feces. Humans are most commonly infected by contaminated water or food.

Campylobacter spp. are frequently found in association with water sources like water troughs and streams and are a natural component of the gut flora of many different healthy domestic and wild animals. Most of campylobacteriosis cases are occurred with eating raw or undercooked poultry meat, unpasteurized milk, contaminated water, or from cross-contamination of other foods by these items. In October 2013, Australian public health authorities were notified of a suspected gastroenteritis outbreak in students and guests following a catered function at a university residential college; a

total of 56 cases of gastroenteritis, including seven laboratory-confirmed cases of *C. jejuni* (Bintsis 2017).

The bacterial genus *E. coli* is enormous and diversified. While the majority of *E. coli* strains are safe for humans to consume, some strains have developed features, such the ability to synthesize toxins, that make them dangerous. Transmission of *E. coli* occurs when food or water that is contaminated with feces of infected humans or animals is consumed (Bintsis 2017). These bacterial pathogens, together constitute the greatest burden of food-borne illness for which etiology is known. Not surprisingly therefore these diseases command the majority of public health interest and policy maker awareness in intestinal infectious diseases. They also provide clear examples of the persistence of bacterial food-borne pathogens despite considerable efforts aimed at prevention and control (Newell et al., 2010)

2.3 Food-borne parasites agents are living things that use other living things - like your body - for food anda place to live. Parasites are organisms which survive on their host while causing it harm. Parasitology studies three types of parasites: parasitic protozoa, helminths, and parasitic arthropods. Parasites can be transmitted through contaminated food or drink, bug bites, sexual contact, or animal contact.

Walking barefoot, inadequate excrement disposal, lack of cleanliness, close contact with someone carrying specific parasites, and eating undercooked meals, unwashed fruits and vegetables, or foods from polluted locations are all ways for people to obtain parasitic diseases.

2.4 Food-borne antimicrobial resistance

Food can be a source of both antimicrobial resistant bacteria and resistance genes. Antimicrobial resistance also found in some food borne illness. It occurs when germs such as bacteria and fungi achieve the ability to resist medications designed to kill them. This means that the germs are not eliminated and can continue to multiply. Antimicrobial-resistant microorganisms may cause more severe sickness and fewer treatment options in people. Although those with severe infections may require medical attention, antibiotics, or hospitalization, persons with moderate symptoms of food poisoning usually do not require antibiotics to recover (CDC Dec 19,2022).

Antibiotic-resistant pathogenic bacteria, such Salmonella spp. or Campylobacter spp., can pose a direct infection risk after consumption or food handling. A bacteria that is

pathogenic for humans can acquire resistance genes either directly or indirectly through commensals like E. coli and Enterococcus species. Through numerous channels, including food, mobile genetic elements carrying resistance determinants can easily be transferred horizontally across bacteria from terrestrial animals, fish, and humans. Furthermore, such transfer can occur in naturally occurring conditions in the kitchen. Although there is growing evidence that diet has a significant role in antibiotic resistance risk in microorganisms of public health concern, it is too complex and ambiguous to estimate. Additionally, direct contact between bacteria and antimicrobial agent residues in food may lead to the development of antimicrobial resistance(Newell et al., 2010).

Microscopic examination

The most common method of diagnosing intestinal parasites is microscopic analysis of stool samples. By combining a tiny sample of feces with physiological sodium chloride solution (0.9%), a direct microscopic inspection is first carried out. Then, to improve sensitivity, different stool concentration techniques based on either sedimentation or flotation with a formalin-ether concentration approach are carried out. There are now many methods available for finding microscopic organisms.

Methylene blue preparation

Put a tiny bit of mucus and a tiny bit of stool on a clean glass slide, add a drop of 0.05% methylene blue solution to it, and look for cellular exudates as follows:

Shigellosis is characterized by clumps of pus cells with > 50 cells per high power field, combined with macrophages and erythrocytes.

Salmonellosis and infections brought on by invasive E. coli have fewer pus cells—about 20 per high power field—than other diseases.

Cholera, EPEC, ETEC, and viral diarrhea all have few leucocytes (5 cells per high power field).

Wet mount

A wet mount is the quickest and most straightforward method of spotting motile bacteria in a bacterial suspension. Use the 10X and 40X objectives to microscopically search for motile organisms after placing a tiny drop of suspension on a slide and

covering it with a coverslip. In order to provide a strong contrast, ensure sure the condenser's iris diaphragm is adequately closed.

Culturing the specimen

MacConkey's Agar

The production of pink colonies in the case of lactose fermenters and colorless colonies in the case of nonlactose fermenters is an added benefit of this handy, non-selective medium for general use. As nonlactose fermenters, Salmonella, Shigella, and Vibro all produce colorless colonies on this medium. Pink colonies are produced by lactose fermenting E. coli.

Xylose lysine deoxycholate (XLD) agar

For the isolation of Shigella and Salmonella in particular from faecal samples, this selective medium has been suggested. Due to its inability to ferment xylose and lactose, Shigella develops pink-red colonies. Due to the generation of hydrogen sulfide, Salmonella also produces colonies that are pink in color with black centers (Geteneh et al. 2023).

Thiosulphate citrate bile salt sucrose (TCBS) agar

The main isolation of V. cholerae can be done using this good, selective medium. It is advised to enrich the sample in alkaline peptone water beforehand unless the sample has a significant amount of Vibrio bacteria that are in the acute stage. Because of the sucrose fermentation, Vibro develops enormous yellow-colored colonies on TCBS.

Sorbitol MacConkey's agar

Instead of lactose, this MacConkey's agar contains sorbitol. On this medium, E. coli 0157 forms colorless colonies because it does not digest sorbitol. The majority of other enterobacteria and E. coli strains digest sorbitol and create pink colonies. This medium is therefore helpful for detecting 0157 E. coli (Abreham et al., 2019).

Slide agglutination test

The slide agglutination test can be used to isolate Salmonella and Vibrio. On a slide, two drops of saline are used to emulsify a loopful of cultured growth. To demonstrate that the strain is not autoagglutinable, one emulsion is used as a control. One drop of bacterial emulsion is placed on the slide, and in the case of Salmonella, the 'o' antiserum is applied. The Salmonella group can be detected when there is an immediate agglutination (Hatch and Scalarone 2013).

Stool examination for parasites

Worms, bile-stained eggs, larvae, protozoan trophozoites, and cysts can all be found using the saline wet mount method. It also has the ability to make RBCs and WBCs visible.

Iodine wet mount is used to stain the cysts' glycogen and nuclei (Khanna et al., 2014). The mobility of the trophozoite is hindered in the iodine preparation, but a cyst is more easily seen in it.

PCR technique for intestinal parasite detection:

For the identification of helminths and intestinal protozoa, real-time and conventional polymerase chain reactions (PCR) have both shown to be sensitive and reliable. These methods have the benefit of increasing sick person identification, detecting low parasite levels, and quantifying treatment outcomes (Sow et al., 2017). Additionally, a worker skilled in PCR might conduct numerous tests to find other pathogen classifications, including viruses, bacteria, and parasites. Real-time PCR is more efficient than conventional PCR because it lowers the possibility of reagent contamination and lowers reagent costs (Verweij and Rune Stensvold 2014). Up to now, a number of real-time PCR tests have been independently created to find typical helminths and intestinal protozoans. However, a small number of species are covered by the majority of research evaluating real-time PCR.

Comparison of microscopic examination of intestinal parasite with PCR:

Comparing the sensitivity of FECT-microscopy to that of PCR, G. intestinalis could only be detected with 38% of the sensitivity (Stensvold and Nielsen 2012). Microscopy unable to find cryptosporidium, but PCR did in 16 samples. Findings from other investigations are supported by the increased sensitivity of PCR. The difference between the median cycle threshold (CT) values for samples that were Giardia positive by PCR and microscopy was 25.28 (interquartile range [IQR], 20.37 to 26.62), compared to 32.02 (IQR, 29.07 to 35.91) for samples that were positive by PCR alone, which may directly explain the relatively low sensitivity of microscopy. Contrary to the wide variety of various parasites that may be discovered using microscopy, the number of distinct pathogens that can be detected using PCR is obviously constrained.

Food factors associated with food borne disease

Foodborne diseases are illnesses caused by consuming contaminated food or beverages.

Several food factors can contribute to the occurrence of foodborne diseases.

Cook Food Safely

The first step in having safe leftovers is cooking the food safely. Use a food thermometer to make sure that the food is cooked to a safe, minimum internal temperature. Cooking all raw beef, pork, lamb and veal steaks, chops, and roasts to a minimum internal temperature of 145° F as measured with a food thermometer before removing meat from the heat source. For safety and quality, allow meat to rest for at least three minutes before carving or consuming. For reasons of personal preference, consumers may choose to cook meat to higher temperatures (Anon, 2020).

Keep Food out of the Danger Zone: Bacteria grow rapidly between the temperaturesof 40° F and 140° F. After food is safely cooked, hot food must be kept hot at 140° For warmer to prevent bacterial growth. Within 2 hours of cooking food or after it is removed from an appliance keeping it warm, leftovers must be refrigerated. Throw away all perishable foods that have been left in room temperature for more than 2 hours (1 hour if the temperature is over 90° F, such as at an outdoor picnic during summer) (Anon, 2020)

Cool Food Rapidly

To prevent bacterial growth, it's important to cool food rapidly so it reaches as fast as possible the safe refrigerator-storage temperature of 40° F or below. To do this, divide large amounts of food into shallow containers. A big pot of soup, for example, will take a long time to cool, inviting bacteria to multiply and increasing the danger of foodborne illness. Instead, divide the pot of soup into smaller containers so it will coolquickly.

Cut large items of food into smaller portions to cool. For whole roasts or hams, sliceor cut them into smaller parts. Cut turkey into smaller pieces and refrigerate. Slice breast meat; legs and wings may be left whole.

Hot food can be placed directly in the refrigerator or be rapidly chilled in an ice orcold-water bath before refrigerating (Anon, 2020)

Thaw Frozen Leftovers Safely

Safe ways to thaw leftovers include the refrigerator, cold water and the microwave oven. Refrigerator thawing takes the longest but the leftovers stay safe the entire time. After thawing, the food should be used within 3 to 4 days or can be refrozen.

Cold water thawing is faster than refrigerator thawing but requires more attention. The frozen leftovers must be in a leak-proof package or plastic bag. If the bag leaks, water

can get into the food and bacteria from the air or surrounding environment could enter it. Foods thawed by the cold-water method should be cooked before refreezing.

Microwave thawing is the fastest method. When thawing leftovers in a microwave, continue to heat it until it reaches 165° F as measured with a food thermometer. Foods thawed in the microwave can be refrozen after heating it to this safe temperature (Anon, 2020)

Reheat Leftovers Safely

When reheating leftovers, be sure they reach 165° F as measured with a food thermometer. Reheat sauces, soups and gravies by bringing them to a rolling boil. Cover leftovers to reheat. This retains moisture and ensures that food will heat all theway through.

When reheating in the microwave, cover and rotate the food for even heating. Arrange food items evenly in a covered microwave safe glass or ceramic dish, and add some liquid if needed. Be sure the covering is microwave safe, and vent the lid or wrap to let the steam escape. The moist heat that is created will help destroy harmful bacteria and will ensure uniform cooking. Also, because microwaves have cold spots, check the temperature of the food in several places with a food thermometer and allow a resting time before checking the internal temperature of the food with a food thermometer. Cooking continues for a longer time in dense foods such as a whole turkey or beef roast than in less dense foods like breads, small vegetables and fruits (Anon,2020).

Refreezing Previously Frozen Leftovers

Sometimes there are leftover "leftovers." It is safe to refreeze any food remainingafter reheating previously frozen leftovers to the safe temperature of 165° F as measured with a food thermometer.

If a large container of leftovers was frozen and only a portion of it is needed, it is safe to thaw the leftovers in the refrigerator, remove the needed portion and refreeze the remainder of the thawed leftovers without reheating it (Anon, 2020).

Contaminated water:

Water used in food preparation or for washing food items must be safe and free from pathogens. Contaminated water can lead to food contamination and cause diseases. Fruits and vegetables may be contaminated with harmful microorganisms, including bacteria, viruses, and parasites. If these items are washed with contaminated water, the pathogens can be transferred from the water to the produce, making them unsafe to eat. The types of pathogens that can contaminate water and cause foodborne illnesses

include bacteria (e.g., Salmonella, E. coli), viruses (e.g., norovirus, hepatitis A), and parasites (e.g., Giardia, Cryptosporidium)(Afzalur Rahman et al., 2018). the availability of clean water, the survival of pathogenic parasites and bacteria in different environmental conditions, and personal and public hygiene habits all play an important role in the transmission of intestinal parasites (Girma and Aemiro 2022). If the drinking water used during food preparation is contaminated, it can directly contaminate the food being made, increasing the risk of foodborne diseases.

Hygiene and food borne illness

Handwash

Handwashing helps prevent spread of infectious diseases. A number of infectious diseases can be spread from one person to another by contaminated hands. These diseases include gastrointestinal infections, such as salmonellosis, and respiratory infections, such as influenza and coronavirus (Rokshana Rabeya et al. 2022).

Washing your hands properly with soap and water can help prevent the spread of the germs (like bacteria and viruses) that cause these diseases (Morens and Fauci 2020).

Some forms of gastrointestinal and respiratory infections can cause serious complications, especially for young children, the elderly, or those with a weakened immune system (Anon,2020).

Food handlers – personal hygiene

To prevent food poisoning using good personal hygiene, follow these tips: wash and dry hands thoroughly before handling food, and wash and dry themagain frequently during work and dry your hands with a clean towel, disposable paper towel or under an air dryer (Rokshana Rabeya et al., 2022). Also, never smoke, chew gum, spit, change a baby's nappy or eat in a food handling orfood storage area. Personal hygiene should be maintained and never cough or sneeze over food, or where food is being prepared or stored. Wearing clean protective clothing, such as an apron is very much necessary during food preparation (Adane et al. 2018). Food handler should keep their spare clothes and other personal items (including mobile phones) away from where food is stored and prepared. Hair mask should be used and tied back or cover long hair. Fingernails should be kept short so they are easy to clean, and don't wear nail polish because itcan chip into the food. At last, one should avoid wearing jewelry, or only wear plain-banded rings and sleeper earrings. If there is any all cuts and wounds, those should be completely covered with a wound strip or brightly coloredwaterproof bandages are

recommended. Disposable gloves can be wore over the top of the wound strip if you have wounds on yourhands and change disposable gloves regularly (Banna et al., 2022). Food handlers need to know how their actions can affect the safety of the food they handle (ACT Government Health 2018).

Food handlers training

Everyone working in a food premises are encouraged to be trained in safe food handling. Do Food Safely, a free online learning program, is a good place to start (ACT Government Health 2018).F

Food handling responsibilities

The food handler must make sure their personal hygiene is up to par and that the working environment is "fit for purpose" before handling any food. He must wash his hands before handling food and before serving it. During food preparation a food handler needs to:

At any level of food manufacturing and service, be watchful to ensure that food is not at risk of contamination.

Items that show signs of contamination or improper food must be reported to the manager or supervisor and removed from the food environment right away. To prevent cross contamination, keep raw and cooked food separate.

Make sure that food is not placed on the ground or contaminated by bugs.

Make sure there is adequate screening when offering food for sale to prevent food from being contaminated (ACT Government Health 2018).

Health Education

People of developing country face poor health condition. Poor health condition due to lack of an improved water source, poor sanitation, malnutrition, underdeveloped public health services, war and conflict, poverty. The lack of safe water and adequate sanitation facilities causes diarrheal diseases. Every year, approximately 4 billion people develop diarrheal disease with 2.2 million deaths(World Health Organization 2016). Since education lowers poverty, fosters economic expansion, raises a nation's GDP, provides employment prospects, and enhances general health, it is considered as a crucial investment. By enhancing their physical, mental, emotional, and social health and changing their attitudes toward taking care of their well-being, communities and individuals are empowered to lead healthier lives. Promote health education and

behavioral changes through appropriate training in classrooms, workplaces, food production facilities, canteens, public places, and online forums.

Current situation of food borne illness:

Foodborne illnesses are a growing public health issue that are responsible for significant global morbidity and mortality. The World Health Organization (WHO) claims that hazardous food that contains harmful bacteria, viruses, parasites, or chemicals is the root cause of more than 200 ailments, ranging from cancer to diarrhea. 33 million healthy life years (DALYs) are lost annually due to the estimated 600 million people who get sick from eating contaminated food each year and the 420,000 deaths that result (World Health Organization: WHO 2022). Food-borne illnesses are more common in developing and impoverished nations. However, they are frequently underestimated since those who are afflicted might not disclose their condition because of difficult reporting processes. Only individuals who visit clinics or hospitals for medical care are reported to the public health authority (Odeyemi et al., 2019). Although there are insufficient investigations and studies on the surveillance of foodborne illnesses in Bangladesh, it is reported that 30 million people are affected annually by foodborne illnesses caused by harmful microorganisms (Afzalur Rahman et al., 2018). Evidence from a report by the Dhaka-based Institute of Epidemiology, Disease Control and Research (IEDCR) showed that acute watery diarrhea is the most prevalent outcome as a result of food poisoning in the country, with around 0.28 million cases in 2015 (Feed the Future 2022). Another two common foodborne ill- nesses, enteric fever and hepatitis, occur in approximately 30,000 and 500 people per year, respectively (Al Banna et al., 2021). It was also estimated that each year 31 major pathogens acquired in the United States caused 9.4 million episodes of foodborne illness (90% credible interval [CrI] 6.6–12.7 million), 55,961 hos- pitalizations (90% CrI 39,534–75,741), and 1,351 deaths (90% CrI 712–2,268) (Scallan et al., 2011).

Prevalence of previous study:

Prevalence of intestinal parasites, Salmonella, and Shigella among food handlers in food service establishments at the main campus and Health Sciences College of Hawassa University, Hawassa, Ethiopia (Desta et al.,2014). Twenty-six percent of the 272 food handlers who were tested for enteric infections from February to April 2010 were positive for various intestinal parasites. Strongyloides stercoralis, Entamoeba

histolytica, and Ascaris lumbricoides were the three parasites with the highest prevalence rates, respectively (9.5%, 2.2%, and 2.2%). One of the food handlers tested positive for Shigella spp. Stool cultures revealed no Salmonella spp. Of the food handlers tested, 22 (8.1%) had positive Widal results. 16 positive samples (9.3%) and 156 positive samples (90.69%) in total were associated with helminths and protozoa, respectively. The majority of parasite infections were caused by Giardia and Entamoeba coli, while H. nana-related infections were the least common. Additionally, there was a strong correlation between educational attainment and the prevalence of parasitic infections (P = 0.0044). Food handlers in a North Indian tertiary care hospital developed intestinal bacterial and parasite illnesses (Khurana et al.,2008).

Due to widespread bad food handling and sanitation methods, foodborne illnesses are frequently observed in poorer nations like Ethiopia. If the strictest hygiene standards are not upheld, food cooked in large quantities is susceptible to contamination and the emergence of foodborne diseases (Kumie and Zeru 2007)

Twenty-two (8.1%) of food handlers were positive for Widal test. In Research Article Prevalence of Intestinal Parasitic Infection among Food Handlers in Northwest Iran in 172 cases (3.73%) of 4612 samples(Balarak et al., 2016). Food handlers contracted enteropathogens in proportions of 8.75%, 16%, 1.4%, 6.75, 2.56, and 6.75 during the years 2001 to 2006. In our study, parasite infections ranged from 1.3 to 7%, whereas enteropathogenic bacteria and Salmonella infections ranged from 0% to 13.3%. Among food handlers in campus canteens (Susanna, Purwanisari and Ratih 2020). 10.4% of food handlers had parasitic organisms in their bodies. Only one infection by H. nana (0.1%) was found in this group, while G. lamblia, E. coli, and B. hominis were the protozoan parasites with the highest species counts. One third (13.2%) of positive cases (n=14/106) showed mixed infections.

It is important to research the food handlers' cleanliness standards since high hygiene can lower the rate of infection transmission, particularly enteric fever. 1160 stool samples in total were processed. The prevalence of salmonella was 0.4%, or 1 out of every 232 food handlers. S. typhi was the recognized serotype. S. typhi was isolated from a 35-year-old male food handler who had completed the 11th standard of education. He was employed as a cook and server in the hostel. He got his fingernails

clipped short, washed his hands with soap and water after using the restroom, and wore gloves while preparing and serving food (Meghna, Vidyalakshmi and Shrikala 2020).

Rangsid University Canteen in central Thailand One stool sample was submitted by each of the 79 food handlers who were included in the study (response rate: 73.2%). The majority of research participants—93.7% of whom were female—were in the 41–50 age range (34.2%). Only Aeromonas spp. were found, and enteropathogenic bacteria were present in stool cultures at a 2.5% prevalence. Giardia intestinalis, a pathogenic protozoa, was isolated in 1.3% of samples, and nonpathogenic protozoa were discovered in 11.4%. No samples included any helminths. Approximately 80% of food handlers had good hygiene habits, such as routine hand washing after using the restroom, routine hand washing before preparing food, using soap while washing hands, donning uniforms or gowns, and utilizing the proper hand washing methods. However, the results showed a lack of personal hygiene training and routine medical care (>50% of samples) (Kitvatanachai et al., 2021).

In this cross-sectional study, 800 stools were chosen at random over the course of six months, from June to November 2015. On direct wet mount, formalin-ether concentration, Ziehl-Neelsen, and Trichrome stained slides, the diagnosis was made. So, a positive test for stool parasites was found in 34.9% of subjects. The workers of bakeries (54.3%), factories (41.1%), fast food (35.7%), supermarkets (33.7%), restaurants (33.9%), offices (29.5%), butchers (27.3%), and coffee shops (26.7%) were the most infected (P0.05). Blastocystis hominis, 8.0%, Entamoeba coli, 6.8%, Giardia lamblia, and 4.3% of people had intestinal parasites, respectively. In this study, only two infections with Hymenolepis nana (0.3%) and one with Enterobius vermicularis (0.1%) were found. Living in the workplace and direct contact with the raw foodstuff affected the prevalence of intestinal parasites ($P<0.05$) (Heydari-Hengami et al., 2018).

Data on sociodemographic information, previous medical conditions, hygiene awareness practices, and occupational prophylaxis taken were collected from 110 food handlers in the hospital kitchen area to determine the prevalence of intestinal parasites, salmonella, and shigella species among food handlers working in a tertiary care hospital in south India. Their stool samples were taken using saline and Lugol's iodine wet mount preparations for microbiological examinations of common intestinal parasites.

For intestinal parasites such as Entamoeba histolytica (1.8%), Ascaris lumbricoides (0.9%), and Giardia lamblia (0.9%), only 4 (3.6%) food handlers tested positive. The incidence of intestinal parasites was unaffected by any Shigella or Salmonella species isolated from stool cultures (P 0.05) (Jothi et al.,2022).

Chapter-3: Materials and Method

3.1 Ethical consideration

Prior to commencement of the study, the research protocol was approved by the Ethics Approval Committee (EAC) of the CVASU, Chattogram, Bangladesh. Organizational approval was taken and detailed information regarding the study was acknowledged. The approval form given in appendix later.

3.2 Study period and area

The study was conducted over the period of one year from June 2022 to April 2023 at different hospital canteen of Chattogram city. In Chattogram city there are many private hospitals and public medical colleges' hospital. In hospitals there are many patients, patient attendants, doctors, nurses and all other health worker who spent long time in the hospital. So, all hospitals have one canteen for the availability of food for the hospital stuff and attendance. In the study 10 different hospital canteens in Chattogram city -Bangladesh Institute of Tropical and Infectious Diseases, Chattogram Veterinary and Animal Sciences University Shuvo canteen, Chattogram Veterinary and Animal Sciences University M A Hannan hall canteen, University of Science and Technology Chattogram canteen, Diabetic Genarel Hospital canteen, Chattogram Medical Canteen Doctors canteen, Chattogram Medical Canteen Student canteen, Chattogram Ma o Shishu Genarel hospital canteen ,CSCR canteen, Southern Medical College hospital canteen and Merine City Medical college hospital canteen were selected.

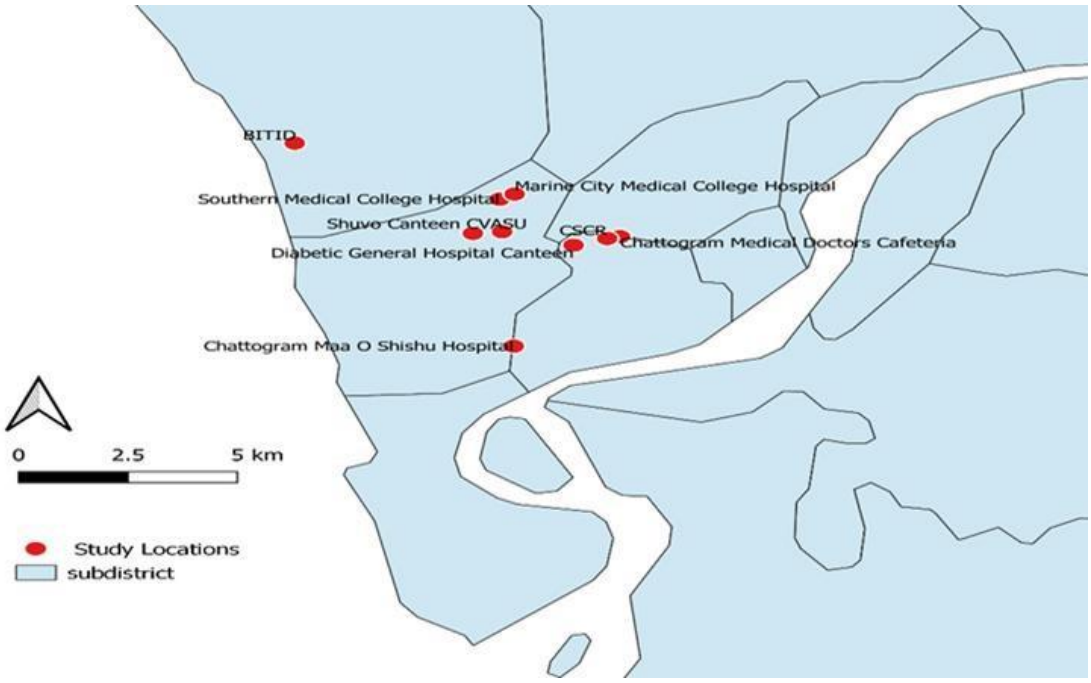

Figure-1: Maps of selected canteens in Chattogram city

3.3 Study design

This is a cross sectional study, where purposive sampling technique was applied to identify the food handlers of canteens. Study population were food handlers of selected canteens. Food handler of canteen include manager, cook, cook helper, waiter, cleaner. Sample size was calculated with the formula of $n = z^2 pq \div d^2$, with 95% confidence interval, z=1.96 and 5% was considered as margin of error. Total sample size was 384, however, due to limitation of time and resources and convenience the sample size of the study limited to 125. Inclusion criteria of the study population were, 1. Food Handlers who are working directly in the selected canteens, 2. Participant those who will give consent to participate. And exclusion criteria were: 1. Food handler who deals with packet food, 2. H/O recent (2 Weeks) Enteric fever or any acute febrile infection, 3. H/o taking Anthelminthics 2 month back. Semi-Structured and pretested questionnaires used to obtain information on Socio demographic characteristics of food handler, personal hygiene, food hygiene, condition of canteen, and health condition of food handlerA consent form was provided both in English and Bangla. Those who cannot read and write the consent form explained and thumb impression taken as consent. Enrollment done by giving explanation on and taking their signature/thumb impression on the consent form. Stool was the specimen of choice for detecting the carrier status of parasite and bacterial infection. The stool sample was collected from food handler on next day and kept sample in a cool box. 1st 100 samples were brought to microbiology lab of Rodolphe Merieux laboratory, BITID, Fouzdarhat Bangladesh and nest 25 samples were tested in the CVASU parasitology laboratory, Chattogram, Bangladesh on the next day.

3.4 Fecal sample collection preservation and investigation:

Participants were clearly instructed regarding the method of collecting the stool specimen individually during face-to-face interview. Stool specimens were obtained from the food handlers in a sterile, dry wide-mouthed container, without admixture with urine. After collection, sample was transported in the next morning to the laboratory in a cold box after which they were stored at -20*C until assayed.

Figure- 2: Food handler in CMC student's cafeteria.

Initially, incubated for 24 hours then next day macroscopic examination of each sample was conducted by observing the consistency, color, presence of blood, mucous, segments or worms. After labeling, the stool samples were sent for the detection of salmonella and parasites and stored at – 200C until they were assayed. Two people were excluded from the study because one on antibiotic course and other had typhoid fever 2 month back.

Naked eye examination to observe blood, mucous, liquid consistency were done macroscopically. Microscopic examination was done by Lugol's iodine + saline method in BITID lab for the 1st 100 samples. Other 25 samples were examined at CVASU laboratory with direct smear, sedimentation and floatation method. Egg, cyst, oocyst was identified up to genus level. Then Stool sample were examined with direct wet mount and concentration techniques. Culture was performed using xylose lysine deoxycholate agar and MacConkey agar. Culture: Selective media-XLD (Xylose Lysine Deoxycholate) agar, TCBS (Thiosulfal biosold agaras) for detection of salmonella and shigella. On day 1 of culture process, specimen (stool) was recieved into Cary Blair tubes arrives at microscopy lab. Then, warm culture plates were required number of TCBS & XLD plates (2 specimen/plate) and those were kept into an incubator at 37^0C for 30 min. The plates were labeled with specimen ID & date of

inoculation and inoculation of the plate were done rightly. Incubation of the inoculated plates were done at 37ºC for next 18-24 hours. Next day examination of the culture plates were done after 18-24 hour: plates for growth of vibrios on TCBS, salmonella or shigella like colonies on XLD. If there was no yellow colonies on TCBS & no pink red colonies on XLD, then no additional testing required. Salmonella or shigella, vibrios, species were not isolated in any sample. Biochemical tests **were** not done as there is no growth.

3.5 Data management and analysis

Questions related to the personal hygiene of the food handlers were scored based on the response of the participants. Among total 20 marks, below 14 mark ranked as poor, 15 mark ranked as good hygiene and above 15 marks was very good hygiene practice. Analysis will be done by using Excel and SPSS version 26 with 95% confidence interval and 5% level of significance. Based on findings, a scientific thesis paper written. Continuous data were expressed as mean and standard deviation and categorical data were expressed as frequency and percentage. To determine the association between categorical variables, chi square test and Fishers Exact test were done, where applicable. Statistical significance was set as 95% confidence level at 5% acceptable error level ($p<0.05$)

Chapter-4: Results

The present study was conducted at Chattogram district and data was collected over a period of seven months (July 2022 to April 2023) from the canteens of hospitalssituated in different location within Chattogram district. A total 125 food handlers from 10 hospital canteens were enlisted. A questionnaire was used to obtain information on socio-demography, personal hygiene, condition of canteen, characteristics of food handler and their stool sample were examined in microbiology lab of Rodolphe Merieux laboratory (RML), BITID.

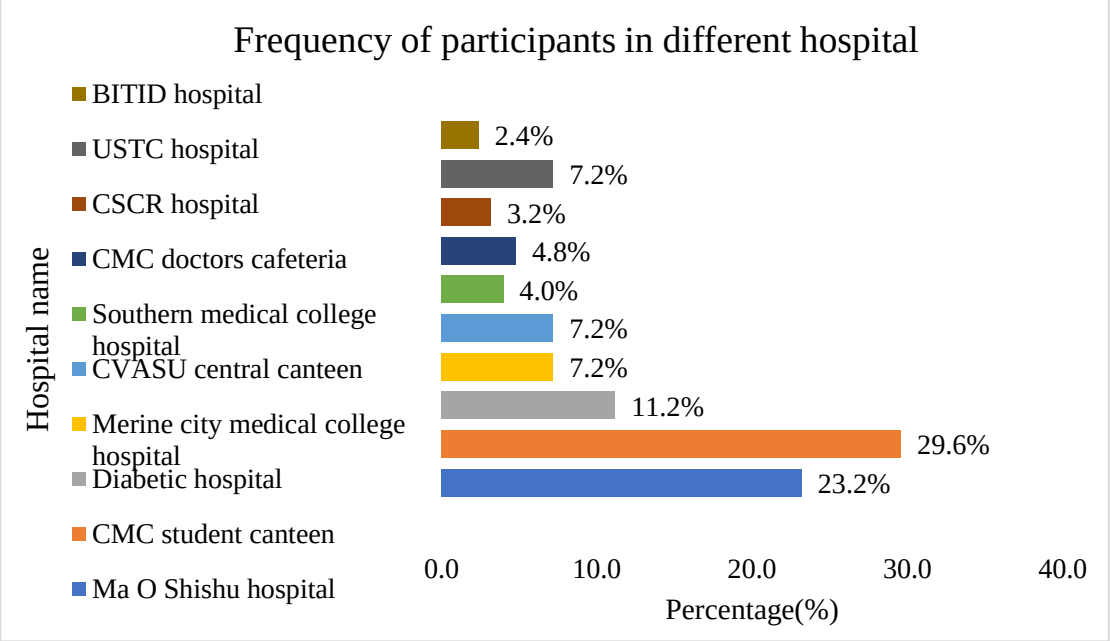

Figure-3: Distribution of participants in different hospital in the study (n=125)

In figure 3 majority of the participants were from CMC student canteen was 37 (29.6%), Chattogram Ma O Shishu Hospital canteen was 29 (23.2%) and Diabetic General Hospital Canteen 14 (11.2%). Other participants were from Merine City Medical College and hospital canteen 9 (7.2%), CVASU central canteen 9(7.2%), USTC canteen was 9 (7.2%), CMC doctor canteen was 6 (4.8%), CSCR canteen was 4 (3.2%), Southern Medical College and hospital canteen was 5 (4%) and BITID canteen 3 (2.4%).

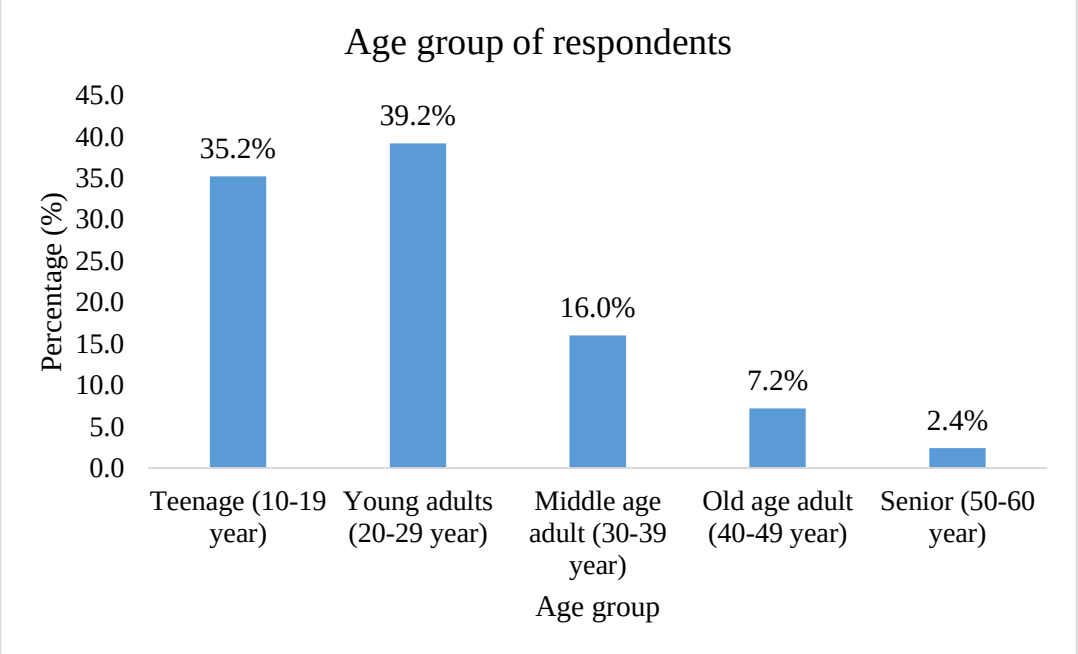

Figure-4: Distribution of Age of food handler of different canteens (n=125)

In figure 4 Among the food handler different age group were observed. The age range were in divide in different age like teenage 10–19-year, young adult 20–29-year, middled aged adult 30–39-year, old aged adult 40-49 year, senior 50- 60 year. The highest percentage of age group seen teenage is 35.2%, young age adult 39.2% and lowestwas senior 2.4%.

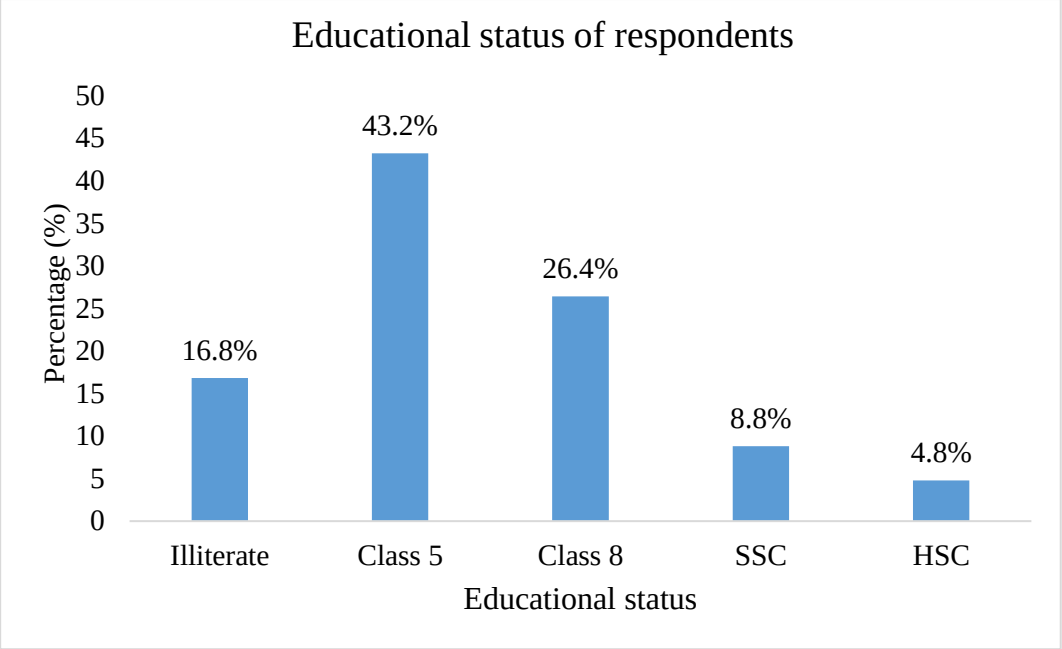

Figure-5: Education status of food handler in different canteens of the study (n=125)

In figure 5, in this study the food handler education status was categorized as illiteracy, class 5, class 8, SSC and HSC. The maximum was completed Class 5 (43.2%) and only 4.8% completed HSC.

Table-I: Distribution of sociodemographic status (n=125)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	116	91
	Female	9	9
Income	>10,000/month	34	27.2
	<10,000/month	91	72.8
Family member	1 to 4 members	42	33.6
	5 to 7 members	70	56
	8-10 members	11	8.8
	>10 members	2	1.6
Living with	Bachelor	105	84
	Family	20	16
Position	Cook	12	9.6
	Cook helper	11	8.8
	Manager	15	12
	Waiter	75	60
	Msl	1	0.8
	Cleaner	11	8.8
Experience	1month to <1 year	62	49.6
	2year -5 year	37	29.6
	6 years to 10 years	18	14.4
	>10 year	8	6.4

In **Table-I**, it shows that among 125 food handlers 91% were male predominant. Food handler monthly income less than 10000 per month their percentage range was 72.8% higher than another category. Food handler family member categories into 4. Here highest 5-7 members have 56%, and lowest >10 members had 1.6%. The food handler mostly 84% live as bachelor. Among the food handler highest range was 60% waiter, lowest was 0.8% MSL. The food handler work experience highest 1 month to <1 year percentage (49.6%) & 2-5-year experience were 29.6%.

Table -II: Table of personal hygiene (n=125)

Variable	Category	Frequency (n)	Percentage (%)
Time of wash	After Every work	125	100
	Only Before meal	0	0
	Only After meal	0	0
	Only After toilet use	0	0
Wash with soap	Every time	125	100
	Intervely	0	0
	Sometimes	0	0
	Never	0	0
Cutting nail	Weekly 1	115	92
	Weekly 2	10	8
	After 2 weeks	0	0
Taking Bath	Everyday 1 time	123	98.4
	Everyday 2 time	2	1.6
	Often	0	0
	Never	0	0
Work with raw materials	Yes	20	16
	No	105	84
Use of Hand gloves	Yes	27	21.6
	No	98	78.4
Use of Hair net	Yes	39	31.2
	No	86	68.8
Use of Sandal	Yes	122	97.6
	No	3	2.4
Taking Home food	Yes	4	3.2
	No	121	96.8

In **Table-II**, all food handler (n=125) washes their hand after every work and also wash with soap every time (100%). 92% food handlers cut their nail weekly 1 time. Bath regularly 98.4% didn't work with raw materials. 78.4% didn't use hand gloves. 68.8% didn't use hair net.97.6% use sandals. 96.8% of food handler had canteen food.

Table-III: Table of food hygiene (n=125)

Variable	Category	Frequency (n)	Percentage (%)
Eating Leftover food	Sometimes some store properly and reuse	5	4
	Never have any	120	96
Cooking with Proper temperaturefood	Sometimes	0	0
	Most of the time	125	100
	Never	0	0
	No idea	0	0
Heating food beforeeat	Yes	84	67.2
	No	41	32.8
Training on food handling (orientation /training receive)	Yes	0	0
	No	125	100
Process of washing raw food (meat /fish/ vegetable)	Running water for 2 min	125	100
	Keep water in a bowl then wash	0	0
Preservation of rawfood (meat /fish)	Separately in deep freeze	125	100
	Together	0	0
Use of Disinfectant	Yes	125	100
	No	0	0
Location of kitchen	Near Toilet	0	0
	Far From Toilet	125	100
Disposal of waste	Keep In Kitchen	0	0
	Throw In Dustbin Or Proper Place	125	100
Ventilation	Yes	125	100
	No	0	0

In **Table-III,** 94% food handlers never had any leftover food.100% of them cook food in proper temperature. 67.2% food handlers heat before eat. However, no one had training on food handling (100%). 100% of them wash raw food (meat /fish/ vegetable) wash in a bowl for 2 minutes in running water and also preserve raw (meat/fish) separately in freezer. In every canteen disinfectant was used (100%) to clean the kitchen. Toilet was far from kitchen in all places (100%). Waste disposal in dustbin situated in out of kitchen (100%). In 100% canteen and all are well ventilated.

Table-IV: Table of health condition(n=125)

Variable	Category	Frequency (n)	Percentage (%)
Taking of anthelminthic	3 Times/Year	4	3.2
	2 Times/Year	7	5.6
	1 Times/Year	100	80
	Never	14	11.2
Any illness in last 1 Year	Yes	22	17.6
	No	103	82.4
For sickness need hospitalization	Yes	0	0
	No	125	100
Typhoid Symptom (Abdominal Pain, Fever, Diarrhea/Constipation)	Yes	0	0
	No	125	100
Use Antibiotic	Yes	2	1.6
	No	123	98.4
Take Antibiotic with DoctorAdvice	Yes	125	100
	No	0	0
Days of taken antibiotic	3 days	1	1.9
	7 days	1	1.9
	10 days	0	0
	14 days	0	0
Yearly health checkup	Never	9	7.2
	When Sick	116	92.8
Site of health checkup	Government	55	44
	Private	54	43.2
	Never	16	12.3
Concept on Typhoid fever	Yes	3	2.4
	No	122	97.6

In **Table -IV,** 80% food handler had anthelminthic yearly 1 time. 82.4% didn't sick in 1-year whose symptom which was not relate to typhoid symptom and all of them no need for hospitalization. They took any antibiotic with doctors' advice (100%). Only 1 respondents had antibiotic course for 3 days and 7 days, both. 92.8% did their health checkup when they were sick and 7.2% never had any checkup. 43.2% had their health checkup in private hospital and 44% had in government hospital. 97.6% didn't had any idea about typhoid fever.

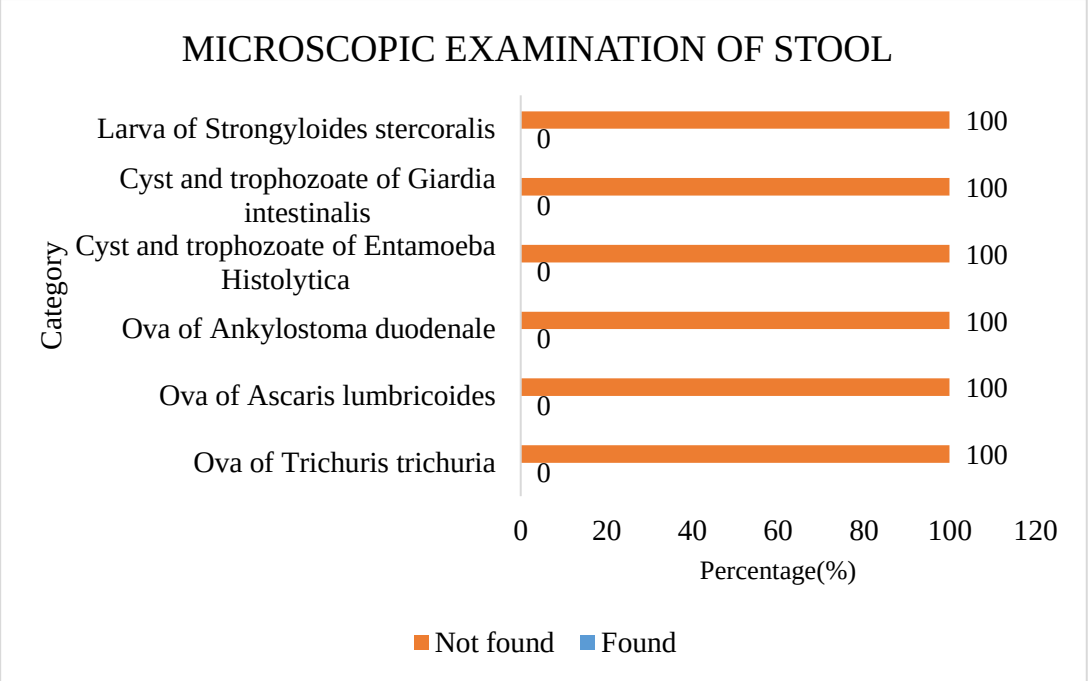

Figure 6: Stool routine examination and culture(n=125)

In **Figure 6,** All the 125 food handlers stool sample were tested. In microscopic examination no parasite was found.

Table-V: Stool routine examination and culture (n=125)

CULTURE OF STOOL	
Growth of normal flora E.coli n(%)	**Pathogen n(%)**
125 (100%)	0 (0%)

In table 4.5, in culture -XLD (XYLOSE LYSINE DEOXYCHOLATE) agar, TCBS (Thiosulfal biosold agaras) no growth were found, all samples showed presence of normal flora (100%).

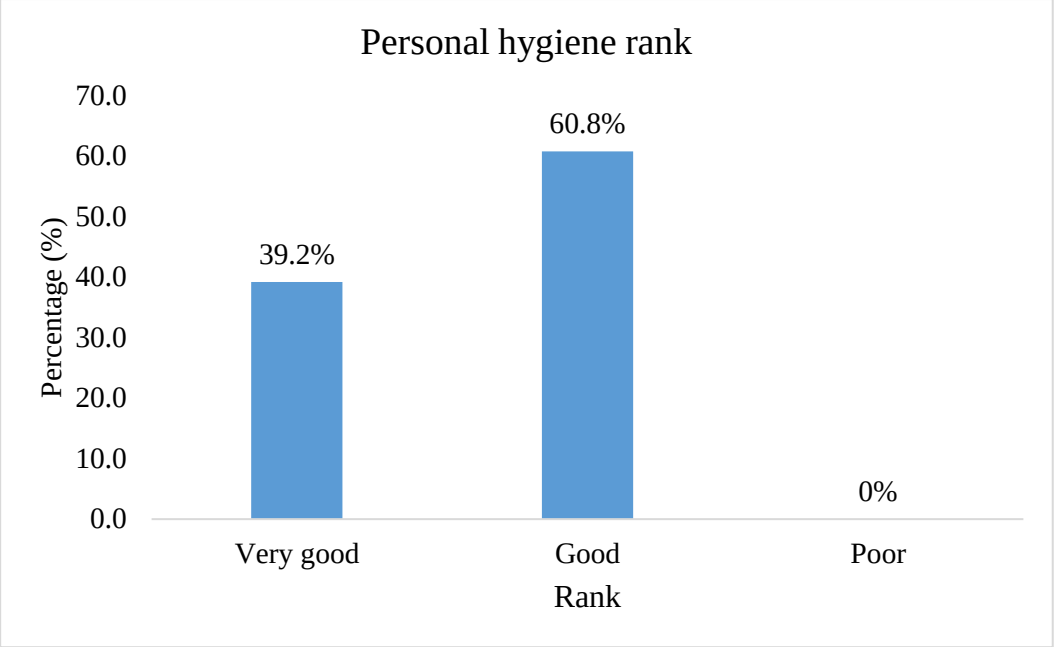

Figure 7: Distribution of personal hygiene rank among respondents (n=125)

In figure 7, majority of the respondents had good (60.8%) personal hygiene and 39.2% had very good personal hygiene. No one had poor personal hygiene.

Table-VI: Association of personal hygiene rank as very good, good and poor with sociodemographic status (n=125)

Variable	Category	V. good	Good	P value
Age	10-19 year	12(24.5)	32(42.1)	0.194*
	20-29 year	21(42.9)	28(36.8)	
	30-39 year	9(18.4)	11(14.5)	
	40-49 year	6(12.2)	3(3.9)	
	50-60 year	1(2)	2(2.6)	
Gender	Male	41(83.7)	75(98.7)	**0.002***
	Female	8(16.3)	1(1.3)	
Education	Illiterate	13(26.5)	8(10.5)	0.200*
	Class 5	18(36.7)	36(47.4)	
	Class 8	11(22.4)	22(28.9)	
	SSC	5(10.2)	6(7.9)	
	HSC	2(4.1)	4(5.3)	
Income per month (tk)	>10000	35(71.4)	20(26.3)	0.782**
	<10000	14(28.6)	56(73.7)	

*Fishers Exact test and **Chi-square test was done. Values were expressed in frequency with percentage in parenthesis over column.

In **Table -4.6**, shows No association with sociodemographic status except gender. As the male were predominant it become significant (p <0.001).

Table -VII: Association of personal hygiene rank as very good, good and poorwith sociodemographic status and food hygiene (n=125)

Variable	Category	Verygood	Good	P value
Experience	1 month to 1 year	28(57.1)	34(44.7)	**0.016***
	2 years to 5 years	8(16.3)	29(38.2)	
	6years to 10 years	7(14.3)	11(14.5)	
	>10 years	6(12.2)	2(2.6)	
Eating leftover food	Never	44(89.8)	76(100)	**0.008***
	Store properly and reuse	5(10.2)	0	
Heating food before eat	Yes	19(38.8)	22(28.9)	0.253
	No	30(61.2)	54(71.1)	

*Fishers Exact test and **Chi-square test was done. Values were expressed in frequency with percentage in parenthesis over column.

In table 4.7, experience and eating leftover food had significant association with personal hygiene rank. Most of the respondents had experience for 1 month to 1 year with 57.1% in very good and 44.7% in good personal hygiene rank. 100% good personal hygiene and 89.8% very good personal hygiene never had leftover food. Besides, heating food before eat had no significant association with personal hygiene rank.

Table-VIII: Association of personal hygiene rank as very good, good and poor with health condition of food handler (n=125)

Variable	Category			
		V. good	Good	P value
Taking of Anti helminthic	Never	6(12.2)	8(10.5)	0.312*
	Yearly 1 time	37(75.5)	63(82.9)	
	Yearly 2 time	5(10.2)	2(2.6)	
	Yearly 3 time	1(2)	3(3.9)	
Sick in 1 year	Yes	9(18.4)	13(17.1)	0.856**
	No	40(81.6)	63(82.9)	
Take antibiotic with doctor advice	Yes	1(2)	1(1.3)	>0.999*
	No	48(98)	75(98.7)	
Site of checkup	Never	3(6.1)	13(17.1)	**<0.01****
	Government hospital	12(24.5)	43(56.6)	
	Private hospital	34(69.4)	20(26.3)	
Concept on typhoid	Yes	2(4.1)	1(1.3)	0.561*
	No	47(95.9)	75(98.7)	

*Fishers Exact test and **Chi-square test was done. Values were expressed in frequency with percentage in parenthesis over column.

Site of checkup had no significant association with personal hygiene rank, as who had very good personal hygiene (69.4%) mostly were in private hospital and who had good personal hygiene (56.6%) were in government hospital. Besides, taking of anti-helminthic, sick in 1 year, take antibiotic with doctor advice and concept on typhoid had no statistical relation with personal hygiene rank.

Chapter-5: Discussion

In the study the Prevalence of parasitic and enteric infection of asymptomatic food handler of different hospital canteen in Chattogram city. My target of the study was to find the health and hygiene condition of the food handler in different hospital. Feco-oral route is main source of food borne illness so, food handlers hygiene practices and health condition are important.

In this study the population was 125 and all the sample were collected from 10 different hospital canteens. In study of south India shows the cross-sectional study was conducted amongfood handlers in the food service department of a tertiary care hospital attached to a medical college in rural South India there 110 food handlers working in the hospital kitchen area from January to March 2019 were included in the study [Jothi et al., 2022]. Another study of Indonesia their population was all food handlers working full time at the canteen of a campus in Depok, consisting of 260 people were not sellers of packaged food, and were working in the canteen at the time of the study (Susanna et al., 2020). Another study showed 4612 samples were collected in Northwest Iran (Balarak et al., 2016). In my study the selected hospital canteens were all small so the food handlers of the hospital canteen are small in number. The highest food handlers' number was 37 (29.6%) in CMC student canteen and 29 (23.2%) in Ma O Shishu hospital because these canteen provided larger amount of food consumers. Some patients, even patients' attendance along with medical students and teachers also took home food from these canteens.

In this study among the food handler different age group were observed. The age range were divided in different age like teenage 10–19-year, young adult 20–29-year, middle aged adult 30–39-year, old aged adult 40-49 year, senior 50- 60 year the percentage of age group seen teenage is 35.2%, young age adult 39.2%, middle aged adult 16%, old aged adult 7.2%, senior is 2.4%. In previous study of Mangalore, India the demographic study showed that majority (60%) of the population were between 21 to 30 years of age. Among 232 food handler the age of the food handlers ranged from 21 to 60 years. Majority (60%) of them were between 21 to 30 years of age. Twenty five percent of food handlers were between the age group [31-40], and 8% constitute the age group [41-50]. The age group [51-60] constitute the least (7%) (Meghna et al., 2020). In another study of central Thailand among 79 food handler the largest food handler age group was 41–50 years (34.2%) (Kitvatanachai et al., 2021). These were similar with my

study. This was caused due to searching of job and financial demand so, to fulfill their basic needs they need earning source. Working in the hospital canteen they got food, money and also living space. So, all age group got more attraction with this job.

In this study the food handler education status shows illiteracy is 16.8%, Class 5 is 43.2%,Class 8 is 26.4%, SSC is 8.8%, HSC is 4.8%. In previous study of Hawassa, Ethiopia among 272 food handler One hundred eighty-one (66.5%) food handlers had education aboveelementary school(Desta et al., 2014). In another study of central Thailand among 79 food handler 65.8% were formally educated, and 26.6% had no education(Kitvatanachai et al. 2021). In another study of India shows among 232 food handler the literacy level of the food handlers was also assessed. Majority (37%) of them had completed their 1st and 2nd PUC. Twenty six percent were literate up-to 10th standard.Twenty two percent were literate up to 5th standard. Whereas only 4% were graduates(B.sc and B.com). Fourteen percent were illiterate(Meghna et al., 2020). In another study of Northwest Iran, the education level of the food handler was observed to be under high school diploma (30.68%), high school diploma to B.S. (58.2%), and over B.S. (11.12%)(Balarak et al., 2016) It didn't show similarity with this study. The food handler found easy source of earning with less educational qualification.

In my study the sociodemographic status shows 91% male, 9% female. In another study of india shows males formed the majority 59% (137) of the population (Meghna et al., 2020). This study shows similarity with my study. This shows in the food handler worker malefood handlers are more in number. In another study of Hawassa, Ethiopia shows the number of female food handlers (68.8%) was almost twice compared to the male foodhandlers (31.2%)(Desta et al., 2014). A total of 79 food handlers (74 females (93.7%) and five males (6.3%)) out of 108 potential participants (73.2%) responded(Kitvatanachai et al., 2021). But these last 2 study didn't show similarity. Here femalewas more predominant as food handler. In Bangladesh perspective still female were not allowed to work outside because of inadequate working environment, social believes, women facility and women safety.

In this study the food handler 33.6% have 1–4-member, 56% have 5-7 members, 8.8% have 8-10 members, 1.6% have >10 members. The food handler 16% live with family and 84% live as bachelor.

In this study Among 100 food handler 9.6% was cook, 8.8% cook helper, 12% manager, 60% waiter, 0.8% MSL, 8.8% cleaner. In another study of India among 232 food handler Eighteen percentage of the food handlers were work as only cooking, 30% were

only serving, 16% were both cooking and serving, 11% were cleaning tables/utensils and 26% were involved in sweeping and mopping (Meghna et al., 2020)Its seen serving/ waiter percentage was more which is similar with the study.

In this study food handler 27.2% had more than 10,000/month and 72.8% had less than 10,000/month. Experience of the food handler showed 49.6% 1 month to 1 year, 29.6% showed 2 years to 5 years' experience, 6 year to 10 year showed 14.4%, 6.4% showed more than 10 years' experience. In another study of Central Thailand participants had 1–5 years of work experience, and more than half were middle income, earning 9,001–16,000 Baht(USS 300-533)/month (Kitvatanachai et al., 2021). In this study 67% had less than 10,000/month as they had less experience and less work load. The food handler got more than 10000salary/month who had more education, experience and more work load like cook, manager of hospital canteen which is similar to the study.

In this study personal hygiene of the food handler working in the selected canteen 100% wash their hand every time after work. Every time means before serving food, after serving food,before having meal after having meal, after using toilet. Food handler 100% wash with soap when handle dirty things and raw materials. 92 % food handler cut their nails weekly 1 time and 8% weekly 2 times. 98.4% Food handler bath every day, 1.6% bath everyday 2 times. 16% food handler work with raw materials. 21.6% food handler use hands gloves during handling food. 31.2% use hair net during duty time.97.6% use sandal during working hour. 96.8% have canteen food and 3.2% have homefood. From this study it was found that all the percentage indicate food handler had good hygienic practice. Similarly, in the study of central Thailand Personal Hygiene among Food Handlers. Of the total respondents, 64 (81.0%) used the correct handwashing method, 77 (97.5%) reported that they regularly washed their hands when preparing food, 76 (96.2%) used soap during handwashing, all regularly washed their hands aftervisiting the toilet, 63 (79.8%) had fingernail trimming (Kitvatanachai et al., 2021). In another study of India the overall hygiene of the food handlers was good (Ninety-eightpercent of the food handlers washed their hands with soap and water after defecation 94% had their finger nail cut short and 96% wore gloves while cooking and handling food (Meghna et al., 2020).

In this study 96% food handler never had any leftover food and 4% sometimes had leftover with store in proper temperature and reuse. 100 % food cook in a proper temperature food .67.2% heat food before eat and 32.8% do not heat before eat. All the selected canteens food handler did not have any training receive or any orientation, but

the food handler had knowledge about proper hygiene technique its Maybe from the family or from educational institute.

In this study 100% raw food wash in a running water for 2 min. 100% separate raw food like meat and fish separately in a deep freeze. In kitchen hygiene 100 % use disinfectant for cleaning floor, table, utensils and table cleaning cloth. All the selected canteens kitchen location far from toilet (100%). Selected canteens waste disposal method wassame, like waste were thrown in dustbin or proper place (100%). All the waste throw in dustbin which was situated out of kitchen and empty the dustbin every day. All the selected canteens had proper ventilation (100%). In these selected hospital canteens, their monitoring done by the hospital authority, this monitoring help them keep clean and proper hygiene maintenance of the kitchen.

In this study it showed 80% had anthelminthic once in last one year, 5.6% had 2 times in one year and 3.2% had 3 times in one year. All the percentage indicated food handlers' alertness of parasitic infection. These self-deworming made food handler safe for himself and others too.

In this study, 17.6% food handler sick in last 1 year due to other cause.100% of food handler didn't have typhoid symptoms like fever, abdominal pain, diarrhea. 98.4% didn'thad any antibiotic in last 1 year, 2% had antibiotic in last one year. 100 % of the handler had antibiotics as per doctor advice as accessibility of doctor advice easy for them. 1.9% had 3-day course antibiotic and 1.9% had 7 days course antibiotic, which was not related to typhoid antibiotic course. All the 100-food handler didn't have any stool examination in past year. Food handler 92.8% had health checkup when they got sick. All that indicated the health wellbeing knowledge was riches in all aspects specially food handlers.

As food handlers of hospital canteens had more knowledge about healthy behavior as they work with health worker. So, health knowledge was easily assessable to them.

Among them 44% in government hospital, 43.2% in private hospital and 12.3% never had any checkup. In these studies, the food handler who work in government get checkup in the government hospital and those who work in private hospital get checkup in that.The handler who are young aged they didn't need for any checkup.

In this study 97.6% food handler had no idea about typhoid fever as they didn't see any sufferings or any knowledge about these or any media spread.

In this study, the result showed that the prevalence of enteric infection (salmonella, shigella) of food handler of selected canteens of Chattogram city are 0%. Stool routine

examination shows growth of Escherichia coli which was normal flora of intestine. In microscopic examination parasite not found and in culture -XLD (Xylose Lysine Deoxycholate) agar, TCBS (Thiosulfal biosold agaras) no growth found. Nil parasite and no growth in the culture indicate the hygiene cautiousness of the food handler. These findings were probably due to recent covid pandemic scenario people develop use of sanitizer after every contact or hand washing behavior and also rational use of ivermectin as people had myth that ivermectin prevent Covid. Usually, salmonella grow in leftover food and cooking in improper temperature, in raw material if not cook properly or wash properly. But in my study, it was seen all the food handler do not eat leftover food, they had fresh food daily, wash raw materials with proper technique and store raw materials properly. So, no food borne carrier found. In study of south India none had Salmonella or Shigella species isolated in their stool culture analyses (Jothi et al., 2022). This was nearly similar with my study. Out of 272 food handlers that were evaluated for the Ethiopian study, just one Shigella isolate was found in stool cultures. None of the stool samples collected from food handlers contained any Salmonella species. The results of the Widal test revealed that 22 (8.1%) food handlers had positive results for the Salmonella typhi O or/and H antigens (Desta et al., 2014). This is partially similar with my study. In another study of Indonesia, it shows the laboratory results of the Salmonella IgM and IgG examination of the handlers showed that two people (4.1%) indicated positive for Salmonella IgM in their blood tests, which shows the existence of Salmonella typhi infection in the food handlers (Susanna et al., 2020). This study shows dissimilarity with my study. In the study of Mangalore, India total of 1160 stool samples were processed. The salmonella carriage rate was 0.4% (1 out of 232 food handlers) (Meghna et al., 2020). This shows partially similarity with my study.this study population 9.28 times higher than my study. However, PCR test for parasite could not be done during this study period, as per microscopic examination and culture all respondents had intestinal normal flora (Escherichia coli) in this study. In contrast to the wide variety of various parasites that may be discovered using microscopy, the specificity of PCR clearly limits the number of distinct infections that can be detected. In addition, none of the 889 samples contained any helminth ova or larvae in another study, supporting the findings of our study(Stensvold and Nielsen 2012).

In this study the prevalence rate of parasite showed zero due to yearly deworming habit and good personal hygiene practice. Good personal hygiene practice means regular hand wash after every contact, wash hand with soap after handling every raw thing or

sneezing or coughing or any serving or after toileting, wearing sandals. In previous study of Philippines, the absence of helminthic infections may be considered not unusual. Although helminths such as Ascaris, Trichiuris and hookworm were considered to be the most common helminths especially in developing countries. It's possible that some of the study participants may have undergone treatment with an anthelminthic drug before submission of stool specimens for assessment. It's also possible that the obtained parasite rates were underestimated since prior intake of deworming drugs was not considered (Esparar, Med and Belizario 2004). This was similar with my study. However, in 2018, Central Thailand study in school children in the same area also showed no helminthic infections similar to our study. This may be the suburbanization effect on people to have better hygiene, to use toilet, to eat cooked food, to wear shoes for work,and also less number of people working in agriculture (Kitvatanachai et al., 2021)

In this study, majority of the respondents had good (60.8%) personal hygiene and 39.2% had very good personal hygiene. No one had poor personal hygiene. In this study Sociodemographic status shows no Association with personal hygiene andgender shows highly significance, working time per day, living shows significance and working position shows highly significance. Eating leftover food and food heat before eating shows significance. Anthelminthic, food handler sickness in 1 year, having antibiotic, site of the idea about typhoid fever shows no significance. In another study, the frequency of parasite infection was not statistically significantly correlate with age, sex, service year, or washing hands before handling food. Similar results were found in Khartoum, Sudan, where it was revealed that there was no statistically significant correlation between parasite infection and age, sex, or service year. The current investigation revealed that parasite infection was equally distributed among food handlers of all ages, both sexes, and service years (Desta et al., 2014). This finding was dissimilar with my study. In another study of Indonesia found no significant relationship between the characteristics of the handlers (age, sex, education, health training, and immunization status) and Salmonella infection based on Fisher's exact test (p-values> 0.05). Regarding the behavior and personal hygiene of the respondents, those who were infected by Salmonella also showed poor behavior (Susanna et al., 2020). Experience and eating leftover food had significant association with personal hygiene rank. Most of the respondents had experience for 1 month to 1 year with 57.1% in very good and 44.7% in good personal hygiene rank. 100% good personal hygiene and 89.8% very

good personal hygiene never had leftover food. Besides, heating food before eat had no significant association with personal hygiene rank. Site of checkup had no significant association with personal hygiene rank, as who had very good personal hygiene (69.4%) mostly were in private hospital and who had good personal hygiene (56.6%) were in government hospital. Besides, taking of anti-helminthic, sick in 1 year, take antibiotic with doctor advice and concept on typhoid had no statistical relation with personal hygiene rank.

Chapter-6: Conclusion

This study presented zero prevalence of intestinal parasites among food handler in different canteens of Chattogram city. Microscopic examination found no ova. Salmonella, Shigella and vibrio species in stool culture in asymptomatic food handlers and no intestinal pathogen was detected via culture examination. This indicated personal hygiene rank showed very good and good rank among most of the respondents and good hygiene and occupation practice in the hospital canteen. Parasites found in stool examination dependon study sample, age distribution and geographical area. Hygiene awareness for Covid-19 plays a big role as improvement of hygiene practice.

Chapter-7: Recommendations

Further study is recommended with large sample size centers.

Nationwide surveillance should be done to uncover the total scenario of hospital canteen worker on concern issue.

This type of study can be done in different setup like restaurants and canteens in different part of the country.

Food handlers are one of the important sources of Parasitic and Enteric infection. So proper training and health education program should be done.

Hospital Canteens need to be monitored for maintenance of good hygiene.

PCR can be done for further evaluation of the presence of parasite DNA.

Every food handler is required to obtain a Health Care Card and undergo test for parasites.

Further research on Hospital canteens Food microbiology along with Health Hygiene of Food Handler with collaboration of Food Science need to do.

Limitations

Due to resources limitation, the study population was small. As the study population was relatively small so the results of this study may not reflect the exact picture of the whole country, as the samples were collected from urban hospital canteens, where hygiene preparation was strictly maintained. Stool sample collection was not possible on the same day. Prevalence of antimicrobial-resistant participants couldn’t be included in my study. The dish swab test and nail scrapping of food handlers wasn’t done. Rural hospital could not be included. This may give the little scenario about food handler health hygiene but food used in hospital canteen need to be tested to rule out total hygiene condition of hospital canteen.

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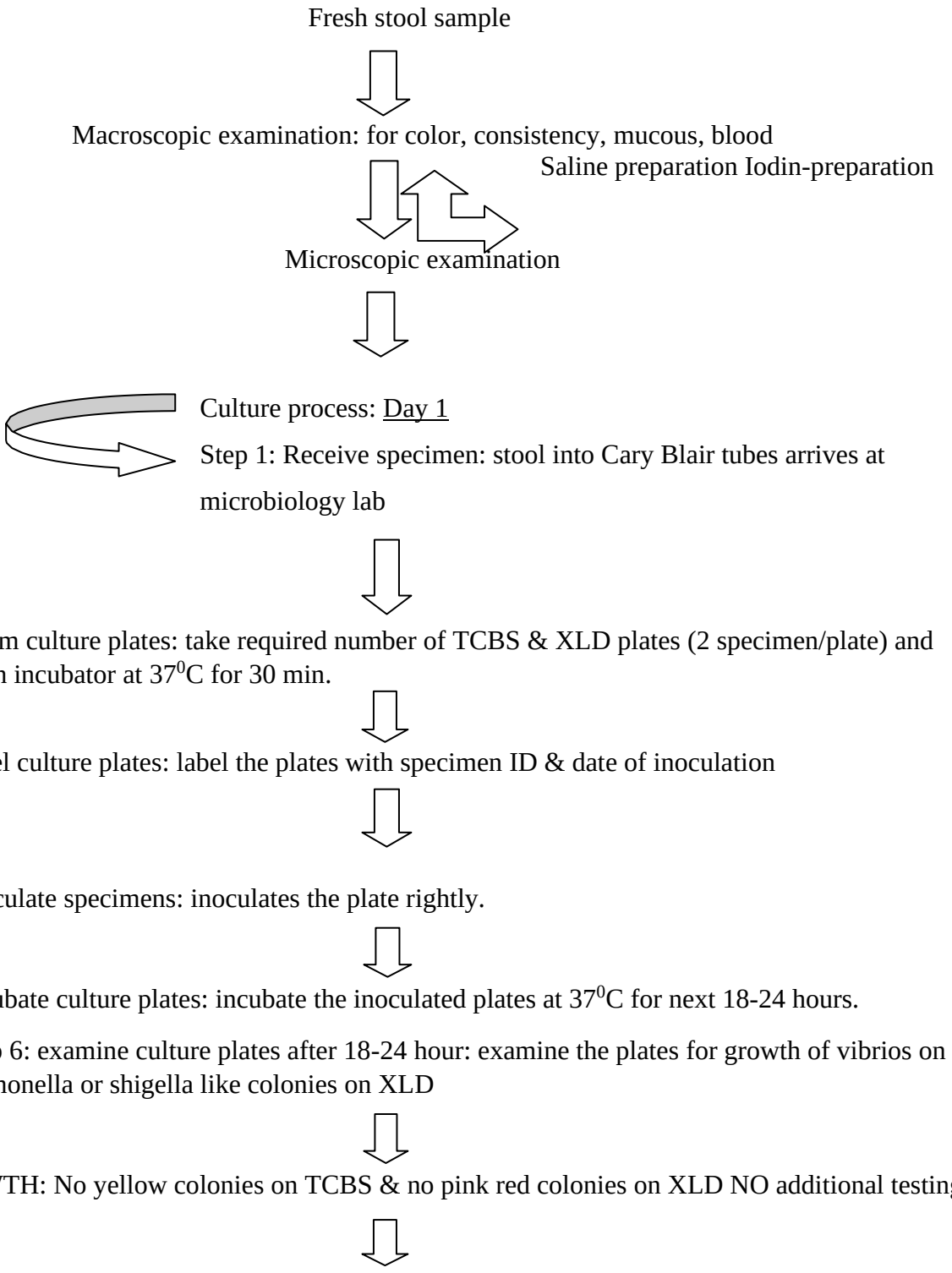
Appendix-A: Study Flow Chart

Process: Stool examination process



Appendix-B: Questionnaire

Prevalence of Parasitic and Enteric Infection Among the Food Handlers in Different Canteens of Chittagong City

ID NO: DATE:

Part 01: Socio-Demographic Status

1. Name of the canteen .....
2. Address of the canteen: ……
3. Participant name: ....
4. Position of the participant in the canteen: Manager, Cooker, Assistance Waiter, Cleaner
5. 5Age: .....
6. Gender: M F
7. Education Level: Illiterate, Complete Class 5(PSC), JSC, SSC, HSC
8. Monthly Income? Below 10000 BDT Above10000
9. No of family member: .....
10. Home Address: .....
11. Living Style With Family Single/Bachelor
12. Work Nature: Full Time Par-Time?
13. Duration of service (In Year, Total Including This Canteen and Others If Previous): .....

Part 02: Personal Hygiene

1. How many times you wash hand in a day?.....
2. When you wash your hand?
3. Before preparing/cooking food * after handling raw food items* before serving food
4. After serving food After using toilet
5. How frequently you use soap to wash hand? Always Frequently Rarely Never
6. Source of your drinking water? mineral *tap water *boiling water Filter water
7. Do you cut your nail regularly? Weekly once twice in a week 2-weekinterval
8. How frequent do you take bath? always frequently rarely never
9. Are you involving in handling (washing /preparing) raw foods (vegetable/meat etc.)
   Yes No
10. If yes, do you use gloves during handling (washing /preparing) raw food (vegetables meat)?

a. yes no

Part 03: Food Hygiene

1. Do you cook food with proper heating?
2. *Sometimes *Most of the time *never * no idea about heating
3. Do you eat reheated food? Often * most of the time Never
4. Do you eat leftover food? Often Most of the time Never

5. How you wash raw foods
    a. *Wash with running tap water for 2 min *Wash with bowl of water instantly
6. How do you preserve raw vegetable and meat fish and cook food?
7. *Separately in deep freeze *together
8. Do you get training on food hygiene practice? *YES *NO

Part 04: Condition of canteen

1. kitchen location- *near toilet * far from toilet
2. Do you use disinfectant in floor of kitchen? *Yes *No
3. Waste disposal? Keep in the kitchen Throw in Dust bin or proper place
4. Presence of enough air and light? Yes No
5. Do you wear Sandal/shoe? Yes No

Part 05: Health condition

1. How many times (in a year) you have taken antihelminth drug?

    *3time *2time *1time *never
2. Any sickness within1year? *yes *no
3. If yes, what were the symptoms at that time?

    *fever *body ache *Abdominal cramp, Fever associated with diarrhea, Vomiting

4 H/O of ANTIBIOTIC taken Yes No

    If yes, Duration of taking antibiotics? *7days *10days *14 days

5 Did you complete the full course of Antibiotic? Yes No

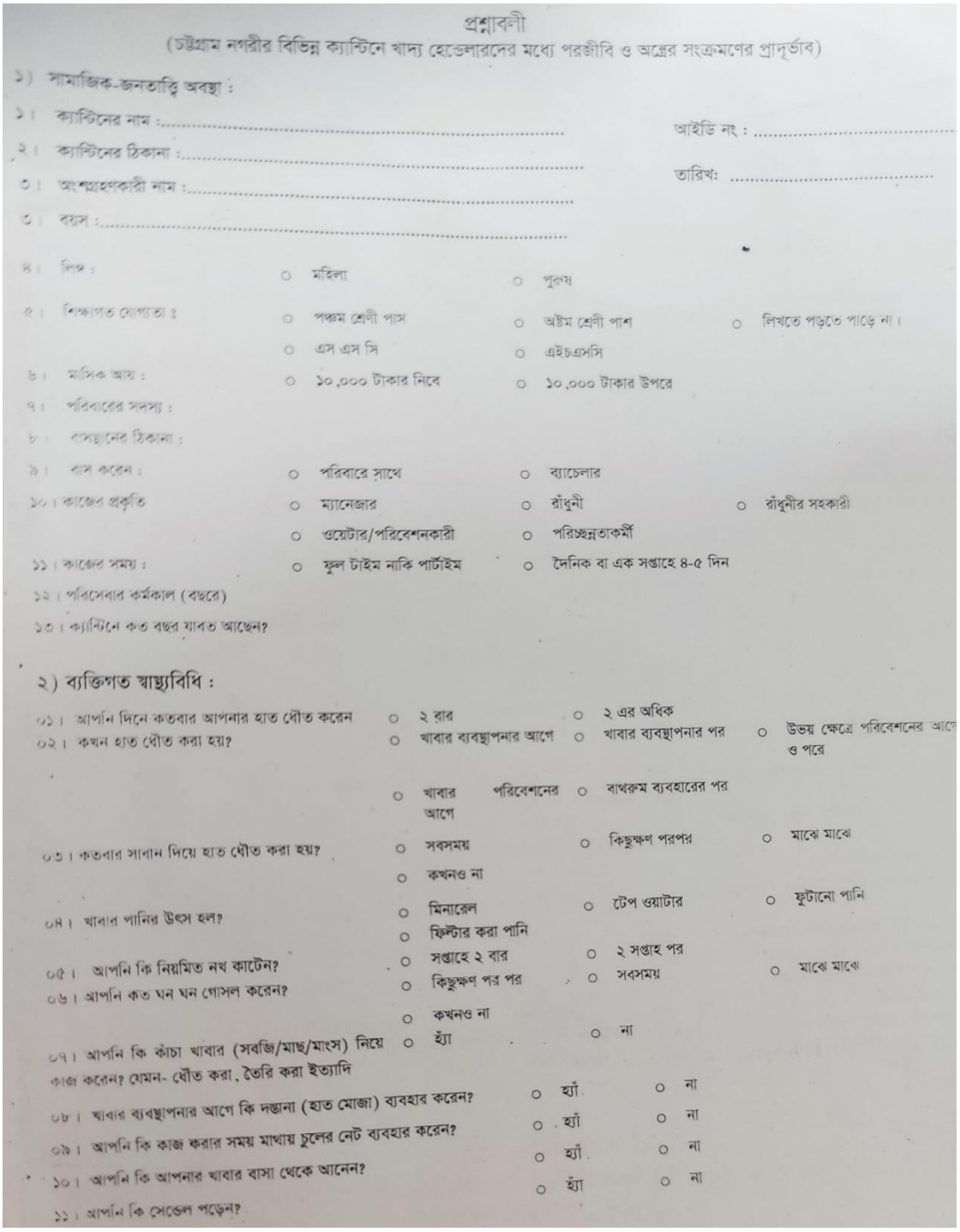
6. Do you ever do any stool test? Yes No
7. Do you have gone for yearly health checkup? Yes No
8. If yes, where you gone for checkup? Hospital Private Clinic never
9. If yes, how many times per year? * 1 time *2time * when sick

LAB FINDINGS:

Microscopy: .....

Stool culture: .....

Questionnaire (Bangla)



প্রশ্নাবলী

(চট্টগ্রাম নগরীর বিভিন্ন ক্যান্টিনে খাদ্য হেন্ডেলারদের মধ্যে পরজীবি ও অন্ত্রের সংক্রমণের প্রাদূর্ভাব)

১) সামাজিক-জনতাত্ত্বি অবস্থা :

১। ক্যান্টিনের নাম :..... আইডি নং : .....

২। ক্যান্টিনের ঠিকানা :..... তারিখ: .....

৩। অংশগ্রহণকারী নাম :.....

৩। বয়স :.....

৪। লিঙ্গ : ○ মহিলা ○ পুরুষ

৫। শিক্ষাগত যোগ্যতা ঃ ○ পঞ্চম শ্রেণী পাস ○ অষ্টম শ্রেণী পাশ ○ লিখতে পড়তে পারে না।
○ এস এস সি ○ এইচএসসি

৬। মাসিক আয় : ○ ১০,০০০ টাকার নিচে ○ ১০,০০০ টাকার উপরে

৭। পরিবারের সদস্য :

৮। বসবাসের ঠিকানা :

৯। বাস করেন : ○ পরিবারে সাথে ○ ব্যাচেলার

১০। কাজের প্রকৃতি ○ ম্যানেজার ○ রাঁধুনী ○ রাঁধুনীর সহকারী
○ ওয়েটার/পরিবেশনকারী ○ পরিচ্ছন্নতাকর্মী

১১। কাজের সময় : ○ ফুল টাইম নাকি পার্টাইম ○ দৈনিক বা এক সপ্তাহে ৪-৫ দিন

১২। পরিসেবার কর্মকাল (বছরে)

১৩। ক্যান্টিনে কত বছর যাবত আছেন?

২) ব্যক্তিগত স্বাস্থ্যবিধি :

০১। আপনি দিনে কতবার আপনার হাত ধৌত করেন ○ ২ বার ○ ২ এর অধিক

০২। কখন হাত ধৌত করা হয়? ○ খাবার ব্যবস্থাপনার আগে ○ খাবার ব্যবস্থাপনার পর ○ উভয় ক্ষেত্রে পরিবেশনের আগে ও পরে
○ খাবার পরিবেশনের আগে ○ বাথরুম ব্যবহারের পর

০৩। কতবার সাবান দিয়ে হাত ধৌত করা হয়? ○ সবসময় ○ কিছুক্ষণ পরপর ○ মাঝে মাঝে
○ কখনও না

০৪। খাবার পানির উৎস হল? ○ মিনারেল ○ টেপ ওয়াটার ○ ফুটানো পানি
○ ফিল্টার করা পানি

০৫। আপনি কি নিয়মিত নখ কাটেন? ○ সপ্তাহে ২ বার ○ ২ সপ্তাহ পর

০৬। আপনি কত ঘন ঘন গোসল করেন? ○ কিছুক্ষণ পর পর ○ সবসময় ○ মাঝে মাঝে
○ কখনও না

০৭। আপনি কি কাঁচা খাবার (সবজি/মাছ/মাংস) নিয়ে কাজ করেন? যেমন- ধৌত করা, তৈরি করা ইত্যাদি ○ হ্যাঁ ○ না

০৮। খাবার ব্যবস্থাপনার আগে কি দস্তানা (হাত মোজা) ব্যবহার করেন? ○ হ্যাঁ ○ না

০৯। আপনি কি কাজ করার সময় মাথায় চুলের নেট ব্যবহার করেন? ○ হ্যাঁ ○ না

১০। আপনি কি আপনার খাবার বাসা থেকে আনেন? ○ হ্যাঁ ○ না

১১। আপনি কি সেন্ডেল পড়েন?

) খাদ্য স্বাস্থ্যবিধি :

০১। রান্নাঘর/পাকের ঘরের অবস্থান কোথায়? ○ টয়লেটের পাশে ○ টয়লেট থেকে দূরে

০২। আপনি কি খাবার যথাযথ তাপমাত্রায় গরম করেন? ○ মাঝে মাঝে ○ বেশীরভাগ সময়
○ কখনও না ○ এর সম্পর্কে কোন ধারণা নেই

০৩। আপনি কি অবশিষ্ট খাবার/ উদ্বৃত্ত খাবার খেয়ে থাকেন? ○ মাঝে মাঝে ○ বেশীরভাগ সময় ○ কখনও না

০৪। খাবার গ্রহণ করার পূর্বে কি পুনরায় গরম করা খাবার খাওয়া হয়? ○ হ্যাঁ ○ না

০৫। কাঁচা সবজি এবং মাছ-মাংস কিভাবে ধৌত করা হয়? ○ প্রবাহমান ট্যাপের পানিতে ক্রমগত ২ মিনিট ধুই
○ নির্দিষ্ট পানিতে বোল এর মধ্যে তাৎক্ষনিক ধুই

০৬। কাঁচা সবজি এবং মাছ-মাংস ফ্রিজে কিভাবে রাখা হয়? ○ আলাদাভাবে ডিপ ফ্রিজে
○ একসাথে

০৭। খাদ্য স্বাস্থ্যবিধি নিয়ে কোন প্রশিক্ষণ আছে কি? ○ হ্যাঁ ○ না

৪) ক্যান্টিনের অবস্থা :-

০১। রান্নাঘর/পাকের ঘরের অবস্থান কোথায়? ○ টয়লেটের পাশে ○ টয়লেট থেকে দূরে

০২। মেঝেতে সংক্রামক শক্তিনাশক (ডিসইনফেক্টন) ব্যবহার করা হয়? ○ হ্যাঁ ○ না

০৩। আর্বজনা কোথায় ফেলা হয়? ○ রান্না ঘরে রাখা হয় ○ ময়লা বক্স অথবা উপযুক্ত স্থানে ফেলা হয়।

০৪। উপযুক্ত আলো বাতাস আছে কি না? ○ হ্যাঁ ○ না

৫) স্বাস্থ্য ব্যবস্থা :-

০১। গত কতবার কৃমির ঔষধ খান? ○ ৩ বার ○ ২ বার
○ ১ বার ○ কখনও না

০২। গত ১ বছরের কোন অসুস্থতা হয়েছি? ○ হ্যাঁ ○ না

০৩। হ্যাঁ হলে,

ক) সে সময় উপসর্গ কি ছিল ○ জ্বর ○ শরীল ব্যাথা ○ পেটে ব্যাথা
○ জ্বরের সাথে পাতলা পায়খানা

খ) হাসপাতলে ভর্তির প্রয়োজন হয়েছিল? ○ হ্যাঁ ○ না

০৪। এন্টিবায়োটিক খেতে হয়েছিল কি? ○ হ্যাঁ ○ না

০৫। ডাক্তারের পরামর্শ মত এন্টিবায়োটিক খেয়েছেন কিনা? ○ হ্যাঁ ○ না

০৬। যদি হ্যাঁ হয় কতদিন এন্টিবায়োটিক খেয়েছিলেন? ○ ৭দিন ○ ১০ দিন ○ ১৪ দিন

০৭। আপনি কি কখনও পায়খানা পরীক্ষা করেছেন? ○ হ্যাঁ ○ না

০৮। বাৎসরিক স্বাস্থ্য পরীক্ষার জন্য গিয়েছিলেন? ○ হ্যাঁ ○ না

০৯। হ্যাঁ হলে, বছরে কতবার? ○ ১ বার ○ ২ বার ○ যখন অসুস্থ হই তখন

১০। স্বাস্থ্য পরীক্ষার জন্য কোথায় গিয়েছিলেন? ○ সরকারি হাসপাতাল ○ প্রাইভেট হাসপাতাল

১১। টাইফয়েড জ্বরের সম্পর্কে কি কোন ধারণা আছে? ○ হ্যাঁ ○ না ○

৬) ল্যাব আবিষ্কার :-

০১। অনুবিক্ষণ যন্ত্রে আবিষ্কার

০২। মল কালচার

Appendix-C: Consent Form

CONSENT FORM (BENGALI)

চট্টগ্রাম ভেটেরিনারী এবং এনিমেল সায়েন্স বিশ্ববিদ্যালয়

তারিখ : ...../...../.....

কোড.....

উত্তর দাতার নাম ঃ

আসসালামুআলাইকুম। আমি ডা. সুমাইয়া ইসলাম বিশ্ববিদ্যালয়ের ইএমপি এইচ প্রোগ্রামের ছাত্রী। আমি একটি গবেষণা কর্ম করছি যার শিরোনাম হল "চট্টগ্রাম নগরীর বিভিন্ন ক্যান্টিনে খাদ্য হ্যান্ডলারদের মধ্যে পরজীবী ও অন্ত্রের সংক্রমণের প্রাদুর্ভাব।" আমি আপনাকে এই গবেষণায় অংশগ্রহণের আমন্ত্রণ জানাচ্ছি। আপনার কাছে থেকে কিছু তথ্য জানতে চাই। আপনাকে উক্ত গবেষণা কর্মে কিছু প্রশ্নের উত্তর দিতে হবে যা এই ফর্মে উল্লেখ আছে।

আমি আপনাকে জানাতে চাই যে এটি একটি সর্ম্পূরূপে একাডেমিক গবেষণাকর্ম এবং আপনার প্রদত্ত তথ্য সমূহ অন্য কোন উদ্দেশ্যে ব্যবহৃত হবে না। আপনার নাম প্রকাশনায় গোপন থাকবে।

এই গবেষণা কর্মে আপনার অংশগ্রহণ ঐচ্ছিক এবং গবেষণাকর্মের যে কোন সময় এতে অংশ নেয়া থেকে বিরত থাকতে পারবেন। ইন্টারভিউ চলাকালীন কোন নির্দিষ্ট প্রশ্নের উত্তর না দিতে চাইলে, প্রশ্নের উত্তর না দেওয়া অধিকার আপনি সংরক্ষণ করেন।

আমি আপনার সহযোগিতায় কৃতজ্ঞ হব। আপনি যদি গবেষণায় যোগ দিতে সম্মত হন তবে নির্দিষ্ট স্থানে স্বাক্ষর করুন।

তথ্য গ্রহণকারীর স্বাক্ষর

তারিখ ঃ.....

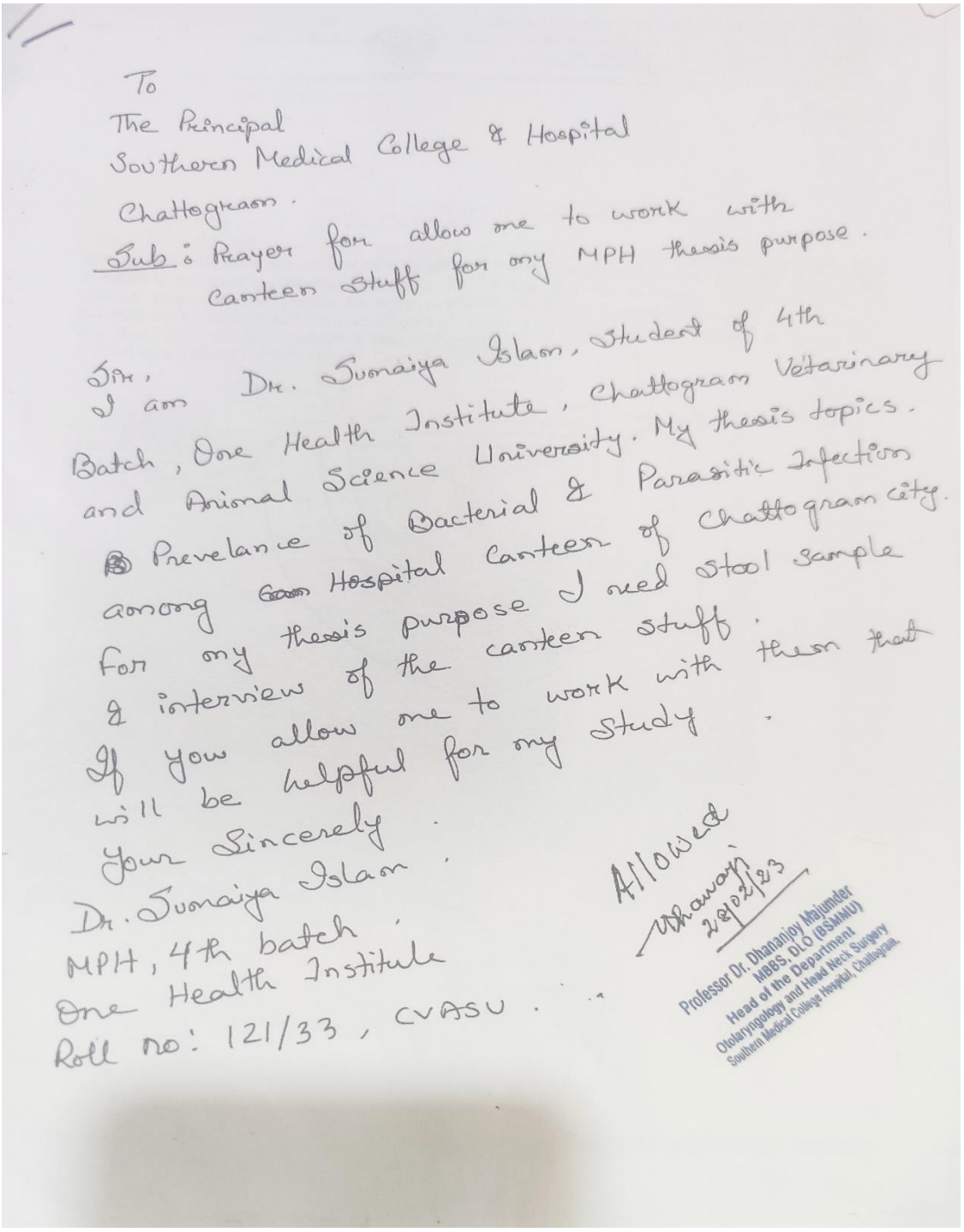
গবেষণায় অংশগ্রহণকারীর স্বাক্ষর

তারিখ ঃ .....

গবেষকের স্বাক্ষর

তারিখ .....

Appendix-D: Written Application Form



To
The Principal
Southern Medical College & Hospital
Chattogram.

Sub: Prayer for allow me to work with canteen stuff for my MPH thesis purpose.

Sir,
I am Dr. Sunaiya Islam, student of 4th Batch, One Health Institute, Chattogram Vetarinary and Anional Science University. My thesis topics. Prevelance of Bacterial & Parasitic Infection among Hospital canteen of chattogram city. For my thesis purpose I ned stool sample & interview of the canteen stuff. If you allow one to work with them that will be helpful for my study.

Your Sincerely.
Dr. Sunaiya Islam.
MPH, 4th batch.
One Health Institute
Roll no: 121/33, CVASU.

Allowed
Dhanonjoy
28/12/23
Professor Dr. Dhananjoy Majumder
MBBS, DLO (BSMMU)
Head of the Department
Otolaryngology and Head Neck Surgery
Southern Medical College Hospital, Chattogram.

To
Director
PRTC
Chattagram Vetarinary and Animal Scieces University
Chattagram

Subject: Prayer for allow me to work with canteen stuff for my MPH thesis purpose.

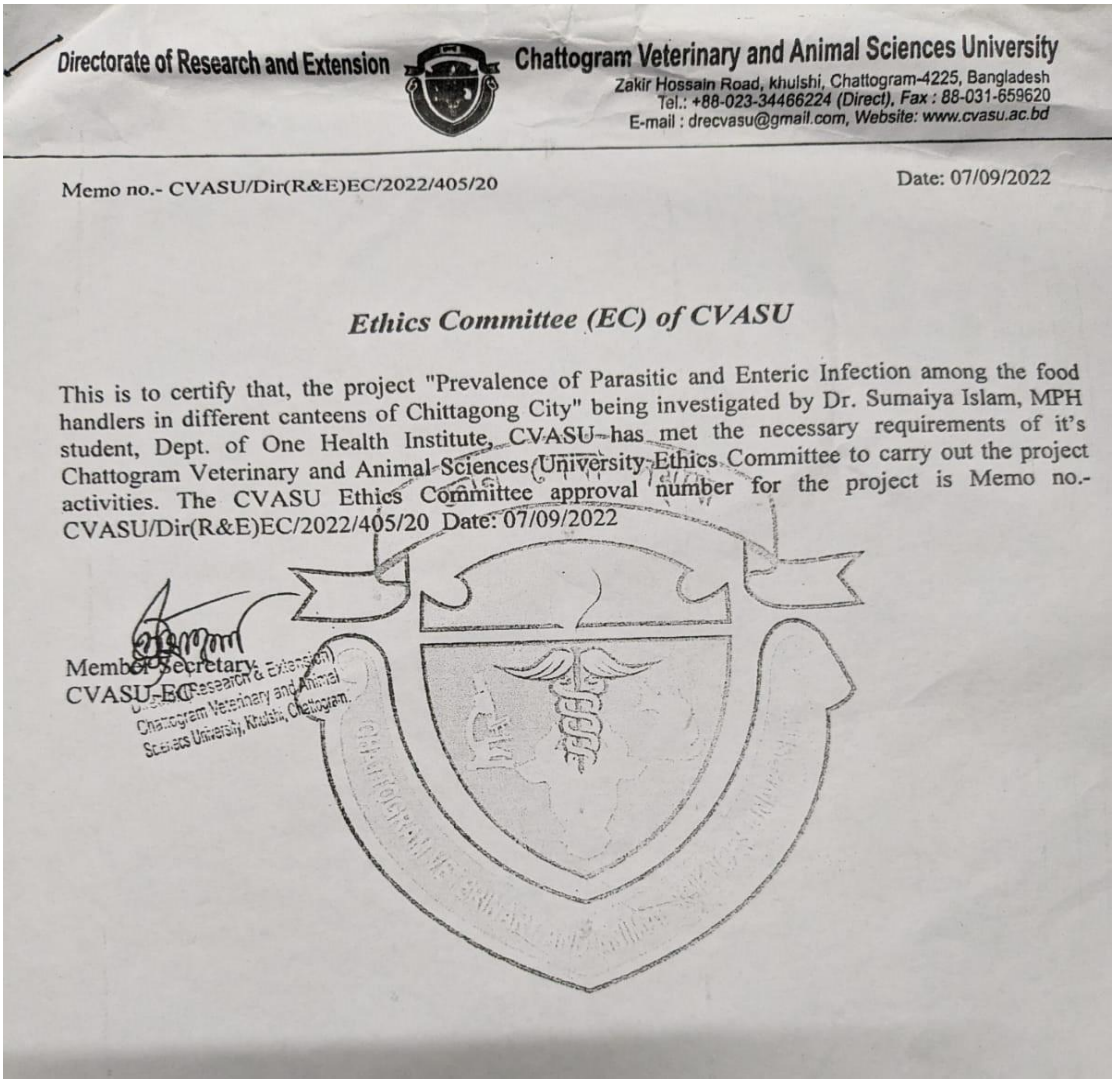
Sir,

I am Dr. Sumaiya Islam, student of 4th batch One Health Institute, Chattagram Vetarinary and Animal Science University. My thesis topics: Bacterial and Parasitic Infection among canteen of Chattagram City. For my thesis purpose I need stool sample and interview of the canteen stuff of PRTC.

If you allow me to work with them that will be helpful for my study.

Your Sincerely
Dr. Sumaiya Islam
MPH 4th Batch, One Health
Roll - 121/33, CVASU.

Recommended
22/11/2022
Professor Dr. Sharmin Chowdhury
Director
One Health Institute
Chattagram Veterinary Animal Sciences University
Khulshi, Chattagram-4225



Directorate of Research and Extension

Chattogram Veterinary and Animal Sciences University

Zakir Hossain Road, khulshi, Chattogram-4225, Bangladesh
Tel.: +88-023-34466224 (Direct), Fax : 88-031-659620
E-mail : drecvasu@gmail.com, Website: www.cvasu.ac.bd

Memo no.- CVASU/Dir(R&E)EC/2022/405/20

Date: 07/09/2022

Ethics Committee (EC) of CVASU

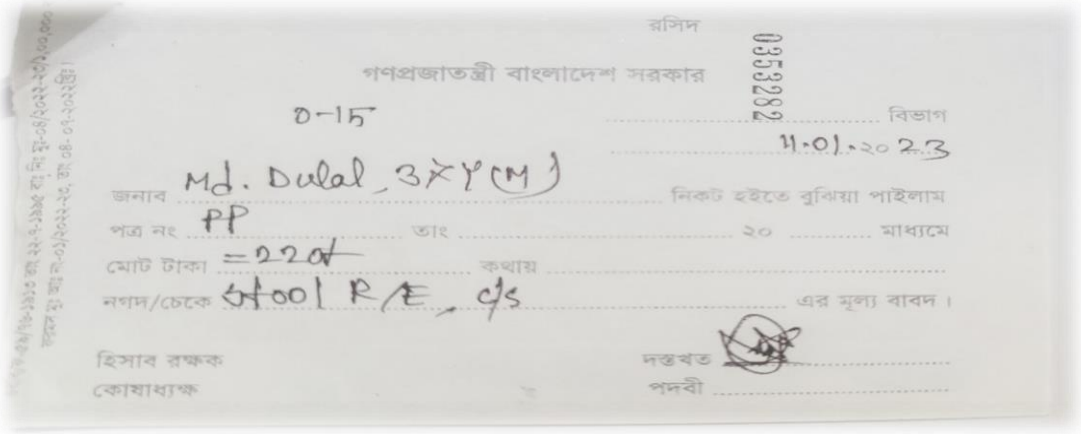
This is to certify that, the project "Prevalence of Parasitic and Enteric Infection among the food handlers in different canteens of Chittagong City" being investigated by Dr. Sumaiya Islam, MPH student, Dept. of One Health Institute, CVASU has met the necessary requirements of it's Chattogram Veterinary and Animal Sciences University Ethics Committee to carry out the project activities. The CVASU Ethics Committee approval number for the project is Memo no.- CVASU/Dir(R&E)EC/2022/405/20 Date: 07/09/2022

Member Secretary
CVASU-EC

Director (Research & Extension)
Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram.

Ethical review

Appendix-E: Laboratorial activities



রসিদ

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

0353282

D-15 ..... বিভাগ

11.01.2023

জনাব Md. Dulal, 37Y (M) ..... নিকট হইতে বুঝিয়া পাইলাম

পত্র নং PP ..... তাং ..... ২০ ..... মাধ্যমে

মোট টাকা =220/- ..... কথায় .....

নগদ/চেকে Stool R/E, C/S ..... এর মূল্য বাবদ।

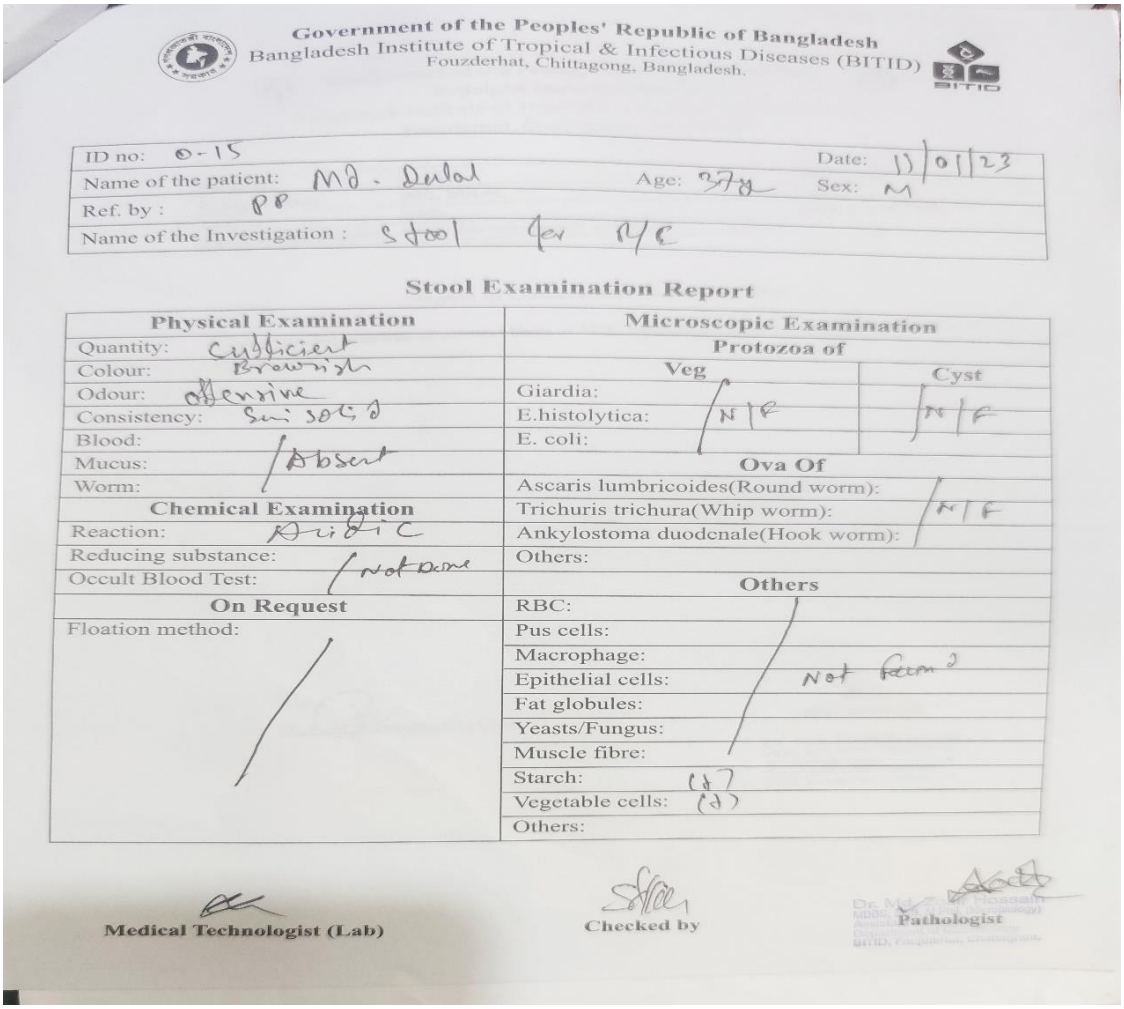
হিসাব রক্ষক

কোষাধ্যক্ষ

দস্তখত .....

পদবী .....

Lab receipt



Government of the Peoples' Republic of Bangladesh
Bangladesh Institute of Tropical & Infectious Diseases (BITID)
Fouzderhat, Chittagong, Bangladesh.

ID no: D-15 Date: 11/01/23
Name of the patient: Md. Dulal Age: 37y Sex: M
Ref. by : PP
Name of the Investigation : Stool for R/E

Stool Examination Report

Physical Examination	
Quantity:	Sufficient
Colour:	Brownish
Odour:	Offensive
Consistency:	Semi solid
Blood:	Absent
Mucus:	
Worm:	
Chemical Examination	
Reaction:	Acidic
Reducing substance:	Not Done
Occult Blood Test:	
On Request	
Floation method:	

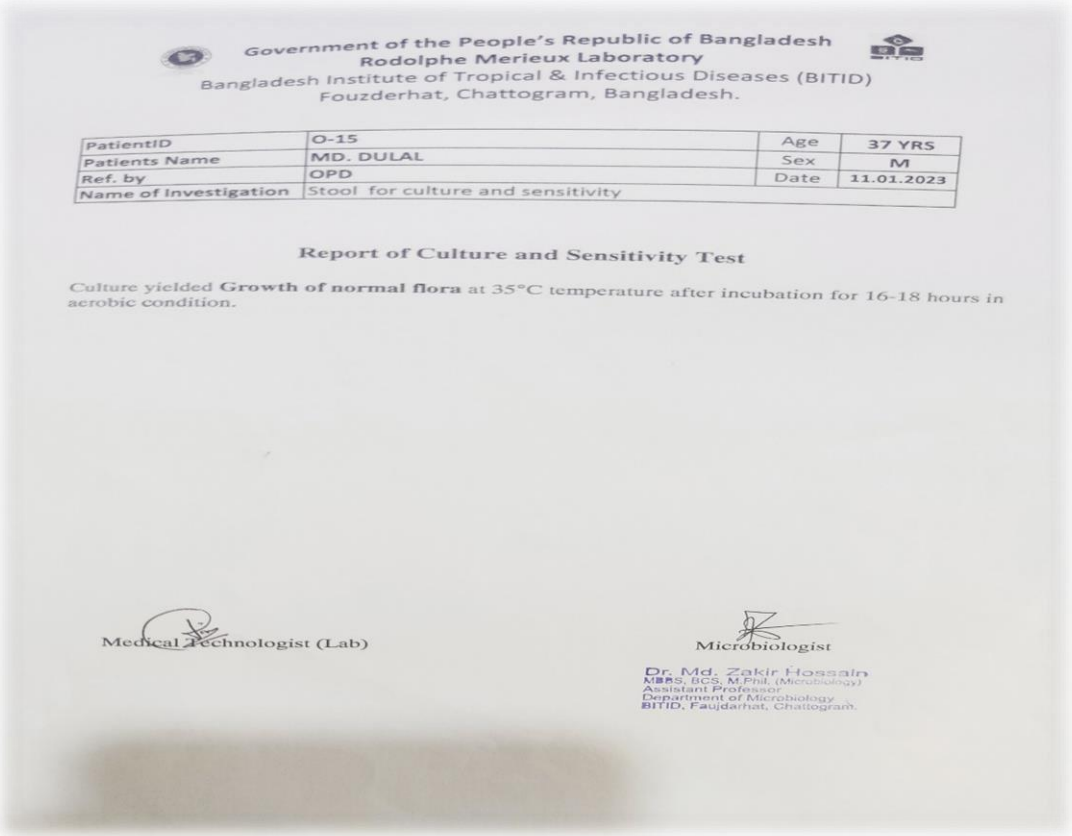
Microscopic Examination		
Protozoa of		
	Veg	Cyst
Giardia:	N/F	N/F
E.histolytica:		
E. coli:		
Ova Of		
Ascaris lumbricoides(Round worm):		N/F
Trichuris trichura(Whip worm):		
Ankylostoma duodenale(Hook worm):		
Others:		
Others		
RBC:		
Pus cells:		
Macrophage:		
Epithelial cells:	Not found	
Fat globules:		
Yeasts/Fungus:		
Muscle fibre:		
Starch:	(+)	
Vegetable cells:	(+)	
Others:		

Medical Technologist (Lab)

Checked by

Pathologist

Stool routine examination report



Government of the People's Republic of Bangladesh
Rodolphe Merieux Laboratory
Bangladesh Institute of Tropical & Infectious Diseases (BITID)
Fouzderhat, Chattogram, Bangladesh.

PatientID	O-15	Age	37 YRS
Patients Name	MD. DULAL	Sex	M
Ref. by	OPD	Date	11.01.2023
Name of Investigation	Stool for culture and sensitivity		

Report of Culture and Sensitivity Test

Culture yielded **Growth of normal flora** at 35°C temperature after incubation for 16-18 hours in aerobic condition.

Medical Technologist (Lab)

Microbiologist
Dr. Md. Zakir Hossain
MBBS, BCS, M.Phil. (Microbiology)
Assistant Professor
Department of Microbiology
BITID, Faujdarhat, Chattogram.

Stool Culture and Sensitivity report

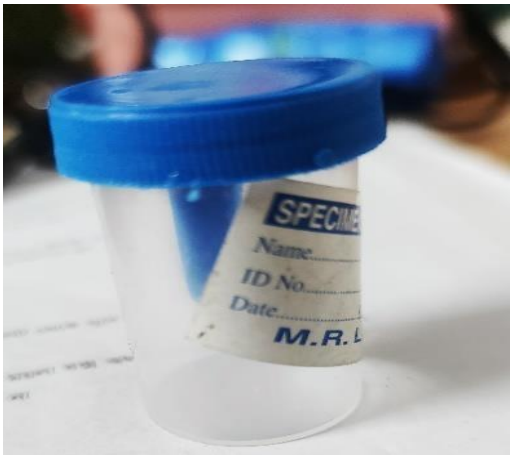
Normal XLD

normal flora in XLD

Normal TCBS

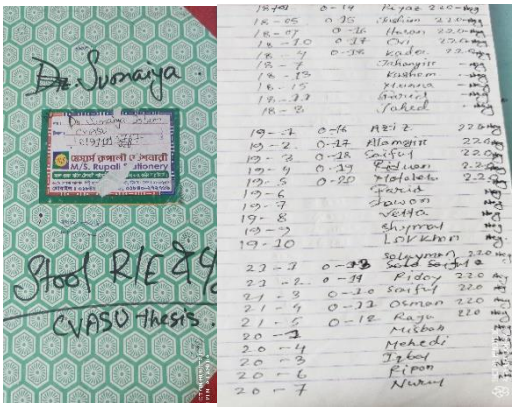
Normal flora in TCBS

Culture slide of this study



Fill up Questionnaire give sterile container to collect stool sample fromfood handler of selected canteen

After collection of samples in a cool box send it in RML (BITID) and maintain a separate registered note and label the container withpermanent marker.



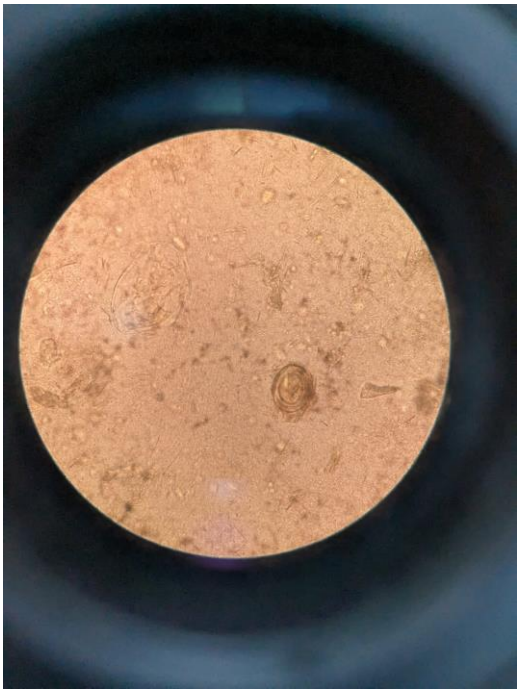


FIG: 25 SAMPLE TEST IN CVASU PARASITOLOGY LAB

Brief Biography of the Author

Dr Sumaiya Islam passed the Secondary School Certificate Examination in 2007 followed by Higher Secondary Certificate Examination in 2009. She obtained her MBBS in 2015 from University of Science and Technology (USTC), Bangladesh. Now, she is a Candidate for the degree of Masters in Public Health (One Health) under the One Health Institute, CVASU. She has immense interest to continue research through One Health approach.