FOOD SAFETY PRACTICES BY RESIDENTIAL PEOPLE LIVE IN SHER-E-BANGLA AGRICULTURAL UNIVERSITY (SAU) CAMPUS AND BACTERIAL COUNT IN MILK FOUND IN SAU MARKET: A FOOD SAFETY ISSUE

A Thesis

By

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DHAKA-1207, BANGLADESH

JUNE, 2020

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A Thesis

Submitted to the Faculty of Animal science & veterinary medicine
Sher-e-Bangla Agricultural University, Dhaka,
In partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

IN

ANIMAL NUTRITION

SEMESTER: JANUARY- JUNE, 2020

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এনিম্যাল সাইন্স এন্ড ভেটেরিনারি মেডিসিন অনুষদ
সাবেক বিভাগীয় চেয়ারম্যান
এনিম্যাল নিউট্রিশন, জেনেটিক্স এন্ড ব্রিডিং বিভাগ
প্রাক্তন প্রক্টর
শেরেবাংলা কৃষি বিশ্ববিদ্যালয়, ঢাকা-১২০৭

CERTIFICATE

This is to certify that the thesis entitled, "FOOD SAFETY PRACTICES BY RESIDENTIAL PEOPLE LIVE IN SHER-E-BANGLA AGRICULTURAL UNIVERSITY (SAU) CAMPUS AND BACTERIAL COUNT IN MILK FOUND IN SAU MARKET: A FOOD SAFETY ISSUE" Submitted to the Department of Animal Nutrition, Genetics and Breeding, Faculty of Animal science and veterinary medicine, Sher-E-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE (MS) in Animal Nutrition embodies the result of a piece of bonafide research work carried out by Md. Sazzadul Islam Riday Reg. No. 13-05555 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by him.

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Dedicated To
My Beloved Parents

ACKNOWLEDGEMENTS

*Alhamdulillah, all praises are due to the almighty **Allah Rabbul Al-Amin** for His gracious kindness and infinite mercy in all the endeavors the author to let her successfully complete the research work and the thesis leading to the degree Master of Science.*

*With immense pleasure, the author wishes to express his heartfelt respect and gratitude to his beloved father **Md. TAZUL ISLAM** and mother **SELINA AKTER** whose everlasting love, unfading faith, incessant inspiration, moral and blessings kept him enthusiastic throughout his life and molded him to the present position and without which this work could not be completed.*

*The author humbly takes this opportunity to place his profound debt of gratitude to his Supervisor **Prof. Dr. Md. Mufazzal Hossain**, Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University, Dhaka, for his valuable suggestions, encouragement, affection, personal guidance, keen interest, immeasurable help and constructive criticism given throughout his work and making it possible to bring out this thesis.*

*The author equally and deeply indebted to his Co-supervisor **Ashikur Rahman,** Department of Dairy Science, Sher-e-Bangla Agricultural University, Dhaka, for her cordial suggestions, constructive criticisms and valuable advice to complete the thesis.*

*The author is especially grateful to **Md. Mahfuj Ullah Patoary**, Lecturer, Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University, Dhaka-1207 for his advice and sincere co-operation in the completion of the study.*

*The author is especially grateful to **Lita Biswas**, Lecturer, Department of Dairy Science, Sher-e-Bangla Agricultural University, Dhaka- 1207 for his advice and sincere co-operation in the completion of the study.*

The author expresses his sincere gratitude to all of the respected teachers of the Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University, Dhaka, for their valuable counsel, note-worthy guidance, and cordial co-operation during the course of the investigation.

The author acknowledges Sher-e-Bangla Agricultural University for providing excellent milieu and facilities in the completion of his post-graduation.

Not forgetting the kindness, punctuality of the staff of Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University, Dhaka, who had helped him during the period of study working in his experimental field.

The author acknowledges Department of Dairy Science for providing facilities his to conduct the study.

The author sincerely acknowledges the financial aid from ***Ministry of science and technology as NST fellowship*** *that enable him to complete the research work more smoothly.*

The author is really indebted to Md.Jaber Ali, Md. Ramjan Ali, Rubel Hasan, Sajib Sarkar, Md. Abubakar Siddique and his beloved friends Md. Shafiqur Rahman Milon, Md. Minhazul Islam, Harun-or-Rashid, Abu Naser, Sheuli Bala for their great support, help and encouragement and also special thanks to all other friends for their support and encouragement to complete this study.

The author is deeply indebted to his brothers, sisters and other relative's for their moral support, encouragement and love with cordial understanding.

It is needless to say, omissions and errors are entirely to the author.

June, 2020 ***The author***

SAU, Dhaka

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LIST OF ACRONYMS AND ABBREVIATION

ABBREVIATION		FULL MEANING
ADB	=	Asian Development Bank
BSTI	=	Bangladesh Standards and Testing Institution
CDC	=	Center for Disease Control and Prevention
CSPI	=	Center for Science in the Public Interest
CONT'D	=	Continued
DDT	=	Dichloro Diphenyl Trichloroethane
DGHS	=	Directorate General of Health Services
e.g.	=	For example
et al.	=	And others/associates
FAO	=	Food and Agricultural Organization
FBD	=	Food Borne Disease
EU	=	European union
FBD	=	Food Borne Disease
GoB	=	Government of Bangladesh
HACCP	=	Hazard Analysis Critical Control Point
i.e	=	That is
MOHFW	=	Ministry of Health and Family Welfare
NTFS	=	National Taskforce on Food Adulteration
RTE	=	Ready to eat

LIST OF ACRONYMS AND ABBREVIATION (CONT'D)

ABBREVIATION		FULL MEANING
SAU	=	Sher-e-Bangla Agricultural University
TCC	=	Total Coliform Count
TFTC	=	Too Few To Count
TMTC	=	Too Many To Count
TVBC	=	Total Viable Bacterial Count
UNICEF	=	United Nations International Children Emergency Fund
USPHS	=	United States Public Health Service
Viz	=	Such as
WB	=	World Bank
WHO	=	World Health Organization

LIST OF SYMBOLS

SYMBOLS		FULL MEANING
*	=	5% level of significance
&	=	And
@	=	At the rate of
^{0}C	=	Degree celcius
^{0}F	=	Degree fahrenheit
$	=	Dollar
>	=	Greater than
<	=	Less than
/	=	Per
%	=	Percentage
±	=	Plus-minus
:	=	Ratio

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ABSTRACT

The study was performed at Sher-e-Bangla Agricultural University (SAU) Campus during March 2020 to May 2020 to take ideas about food safety issues. It was accomplished by survey and lab test on microbiological analysis of milk. Among the 471 respondents, 50 number interviewed were teachers, officers and staff at different residential building. Respondents were interviewed to determine their idea about food safety related authority and acts, hand washing, source of buying egg & raw milk and transportation practices, raw milk storage, their food hygiene practices and cleaning of kitchen surfaces were investigated. Survey exposed that only 34% respondents have idea about food safety authority and 66% have no idea. After completing the survey, laboratory test was started to find out pathogen present in milk. Different milk samples were collected from dairy farm of SAU Campus and SAU market and analyzed for total viable bacterial count (TVBC) and total coliform count (TCC) in milk. TVBC aids to enumerate only viable microbes and to determine the contamination and unhygienic conditions of milk handling. On the other hand, TCC support to know the presence of coliform bacteria in milk. During TVBC count it was noticed that all raw milk samples were present at the range of standard value but have significant difference ($P<0.05$) among them. Pasteurized milk (sample 5 and sample 6) were also remained between the range of standard value but have no significant difference ($P>0.05$). The results of TCC for sample 1, sample 3, sample 4 were more than the standard value but sample 2 remained between the range of standard value and there was a significant difference ($P<0.05$) among the samples. The results of TCC for two brands of pasteurized milk (sample 5 and sample 6) were nil (absence of coliform bacteria) also resembled with the standard value. Therefore, these pasteurized milk can be suggested for human consumption as it remain between the standard value. Finally it can be concluded that authority should focuses more on publicity about the safe food and hygiene practices among the people to ensure good health and proper sanitation that is an important issue of sustainable development goals (SDGs).

CHAPTER I

INTRODUCTION

1.1 Background of the study

Bangladesh has long been facing problems related with microbiological contamination of various foods due to the lack of awareness on hygiene followed by the defective legislative action. Manifestation of microbial prevalence in different foods bring about important information on food safety as well as may encounter on the further intoxication caused by the prevailing microorganisms. Although a few extent of food inspection is apparently in some of the governmental regulatory bodies. However, the mass population is still suffering from a group of food borne illness. Present review partially focused on the microbiological regulation of the foods in Bangladesh and discussed the possible remedies for the issue of food safety.

Unsafe food can be a significant reason of numerous acute and chronic diseases. This problem persists at every level of the food chain from preparation to consumption. In Bangladesh, literacy about safe food among people is poor, and level of awareness is very low. As a result, producers, traders and consumers are equally being affected by unsafe foods. Thus, it is severe to maintain a safe food chain for ensuring health, and subsequently a healthy nation.

1.2 State of the problem

The safety of dairy products with food-borne diseases is of great concern around the world including Bangladesh. This is especially true in developing countries where production of milk and various dairy products takes place under unhygienic conditions and poor production practices. Foodborne illness comprises a significant burden both socially and economically on the society and their health systems and food safety is therefore becoming increasingly important. There is also a appreciation that food borne disease is a minor inconvenience and that it is largely unavoidable. However, research and practice shows that food safety pretends a considerable health burden, yet is amenable to solutions. Several developed countries have developed systems that allow assessment of the health burden FBD. These studies found that FBD was common (affecting around one in 3 to one in 6 people a year) and resulted in a high burden of disease (Gkogka *et al.,* 2011; Kirk *et al.,* 2014; Mangen *et al.,*

2015; Scallan *et al.,* 2011; Tam *et al.,* 2014; Thomas *et al.,* 2013). Moreover, the well-known gastrointestinal symptoms of FBD (vomiting and diarrhoea) were responsible for only about half the total health burden. An equally high, but less visible burden came from rare but serious effects such as septicemia, paralysis, stillbirth, and meningitis.

Foodborne illnesses are usually infectious or toxic in nature and caused by bacteria, viruses, parasite or chemical substance entering the body through contaminated food or water pathogens. Chemical contamination can lead to acute poisoning or long-term diseases, such as cancer. Food borne diseases may lead to long-lasting disability and death. Examples of unsafe food include uncooked foods of animal origin, fruits and vegetables contaminated with faeces, and raw shellfish containing marine biotoxins. Salmonella, Campylobacter, and Enterohaemorrhagic *Escherichia coli* are among the most common food borne pathogens that affect millions of people annually – sometimes with severe and fatal outcomes. Foodborne cases with Campylobacter are mainly caused by raw milk, raw or undercooked poultry and drinking water. Enterohaemorrhagic *Escherichia coli* is associated with unpasteurized milk, undercooked meat and fresh fruits and vegetables.

1.3 Justification of the study

The burden of foodborne diseases to public health and welfare to economies has often been underestimated due to under reporting and difficulty to establish causal relationships between food contamination and resulting illness or death. Foodborne diseases are of global public health concerns. While in the poor countries where hygiene maintenance is the principal reason of dissemination of diseases, surprisingly in the developed countries like United States, the impact of food borne diseases may also result in significant morbidity and mortality. However, certain regulatory bodies like the Center for Science in the Public Interest (CSPI), Centers for Disease Control and Prevention (CDC), Foodnet, etc., working with the food safety are actively engaged to control and monitor the food associated problems in the developed countries, whereas in the developing countries like in Bangladesh, such regulation is not that prominent to ensure the local health safety.

The 2015 WHO report on the estimates of the global burden of foodborne diseases presented the first everestimates of disease burden caused by 31 foodborne agents (bacteria, viruses, parasites, toxins and chemicals) at global and regional level.

The 2018 World Bank report on the economic burden of the food borne diseases indicated that the total productivity loss associated with food borne disease in low and middle-income countries was estimated to cost US$ 95.2 billion per year, and the annual cost of treating food borne illnesses is estimated at US$15 billion.

Unsafe food poses global health threats, endangering everyone. Infants, young children, pregnant women, the elderly and those with an underlying illness are particularly vulnerable. Every year 220 million children contract diarrhoeal diseases and 96,000 die. Unsafe food creates a vicious cycle of diarrhea and malnutrition, threatening the nutritional status of the most vulnerable.

The International Conference on Food Safety held in Addis Ababa in February 2019, and the International Forum on Food Safety and Trade held in Geneva in 2019, reiterated the importance of food safety in achieving the Sustainable Development Goals. Governments should make food safety a public health priority, as they play a central role in developing policies and regulatory frameworks, and establishing and implementing effective food safety systems.

Several surveys have detected foodborne pathogens in bulk tank milk (Davidson, 1989; Doyle and Roman, 1982; Farber *et al.,* 1988; Fedio and Jackson, 1990; Hassan *et al.,* 2000; Jayarao and Henning , 2001; Liewen and Plautz, 1988; Lovett *et al.,* 1983, 1987; McEwen *et al.,* 1988; McManus and Lanier, 1987; Muraoka *et al.,* 2003; Murinda *et al.,* 2002a,b, 2004a,b; Rohrbach *et al.,* 1992; Slade *et al.,* 1988; Steele *et al.,* 1997; Van Kessel *et al.,* 2004; Waak *et al.,* 2002). Results of those studies have shown clearly that the prevalence of foodborne pathogens, including *C.jejuni*, *L.monocytogenes*, and *Salmonella* spp. in milk varies considerably. The prevalence of foodborne pathogens in milk is influenced by numerous factors such as farm size, number of animals on the farm, hygiene, farm management practices, variation in sampling and types of samples evaluated, differences in detection methodologies used, geographical location, and season. However, in spite of the variation, all of these surveys demonstrated quite clearly that milk can be a major source of foodborne pathogens of human health significance. Rohrbach *et al*. (1992) reported that the

frequency of isolation of foodborne pathogens from 292 bulk tank milk samples from dairies in east Tennessee and southwest Virginia was 12.3% for *C. jejuni*, 8.9% for *Salmonella* species, 4.1% for *L. monocytogenes*, and 15.1% for *Yersinia enterocolitica*. One or more foodborne pathogens were isolated from 32.5% of bulk tank milk samples evaluated. One of the four foodborne pathogens was isolated from 73 of 95 positive samples, and 22 samples contained two or more foodborne pathogens. Grade classification of the dairy, milking facilities, barn type, milking hygiene, reported incidence of clinical mastitis among cows, or the number of cows per farm were not significantly associated with the isolation of foodborne pathogens in bulk tank milk.

1.4 Objectives

In view of above situation, the present study was undertaken with the following objectives:

- To assess the extent of food safety knowledge among the respondents.
- To enumerate the total viable bacterial counts and presence of coliform bacteria in milk.

CHAPTER II

REVIEW OF LITERATURE

It is very important to review the past research works which are related to the proposed study before conducting any type of survey or experiment. Literature on the present status of food safety practices in Bangladesh & worldwide. A total about 62 literature were reviewed to identify the background, drawbacks and prospects of research, understand previous findings and to answer the research status of this field. To undertake the present study, the following literatures were reviewed which were performed elsewhere in the world and relevant to the present research work.

2.1 Scenario of causes & result of foodborne diseases

Chang *et al.* (2009) found that while *E. coli* O157:H7 infections were not associated with percent African American, Hispanic or urban population, number of food handlers in the population was positively associated with *E.coli* O157:H7 infection. *E. coli* O157:H7 infection was also positively associated with percent population male, percent population living on a farm as well Midwest region and West region.

Avita A. Usfer *et al.,* (2010) in their study indicated that unsafe drinking water and improper food handling practices lead to diarrhoea which is the second leading cause of child mortality worldwide. Each year more than 1.5 million children under the age of 5 die of acute diarrhoea, which translates in 2000-2003 to 18% of deaths of children under the age of 5.

Schlundt *et al.,* (2004) pointed out that food borne diseases are increasing in both developed and developing countries. Diarrhoeal diseases are mostly caused by food borne microbial pathogens, which are a leading cause of illness and deaths in the developing countries, killing an estimated 1.9 million people annually at the global level.

2.2 Scenerio of knowledge about food safety & foodborne diseases

Centres for Disease Control and Prevention (2006) reported that one in four Americans suffered from food borne illness each year, and 1 in 1000 people is hospitalized for these illnesses. Improper food handling practices in the home are believed to be responsible for approximately one fifth of food borne illnesses in United States.

Clayton *et al.,* (2002) conducted a study about the food handlers safety practices at home and found that majority of the food handlers do not follow safe food handling practices and they lack of knowledge about food safety and food borne illnesses. The study concluded that food safety education and training programmes are needed for food handlers.

Curtis and Cairncross (2003) in their study explained that hand washing is considered to be the primary control measure for diseases transmission during food preparation and as one of the most effective ways to reduce the risk of diarrhoea.

Gettings and Kiernan (2001) identified that people in Pennysivania have lack of proper food handling practices and are not aware of the food borne illnesses which impact family health. In their study they concluded that food safety education, awareness programmes, such as videotapes, television, newspaper, radio and written pieces would create food safety awareness among the people.

Knight *et al.,* (2003) conducted house interviews on 110 randomly selected house holders which indicated the householders were concerned about the food they purchase for preparation at home and they displayed strong concerns about sanitation of food handling establishments, food handling practices and the quality of food purchased. It also stated that majority of the householders contacted the local health department or the ministry of health regarding food safety concerns.

Medeiros *et al.,* (2001) stated that food can be mishandled at any number of places during food preparation, handling and storage. Studies show that consumers have inadequate knowledge about measures needed to prevent food borne illnesses in the home.

Trepka *et al.,* (2007) identified that pregnant women and infants are the two groups at the highest risk of severe effects of food borne illnesses. In general, food safety practices were most problematic among the people of Florida. Thus, they concluded that food safety education and programmes should be conducted among the people to make them aware of food handling practices.

2.3 Scenerio of major foodborne illnesses & causes

Dasgupta (2005) in his study revealed that many food borne diseases and pathogenic microorganisms are spread by contaminated hands. If pathogens from human faeces enter a person's mouth, it will cause diarrhoea. School-going children are exposed to

greater risks of diarrhoeal disease by possibly consuming contaminated water and food.

Gauci and Gauci (2005) in their study stated that food borne illnesses cause a significant burden of disease globally. Majority of the confirmed cases of food borne illness in Malta are caused by salmonellosis. Investigation by the disease surveillance unit revealed that most of the notified cases of infectious intestinal diseases are most likely to be due to poor food safety practices at home.

Haapala and Probert (2004) stated that the changing demographics and lifestyle as well as emergence of resistant and exceptionally hazardous strains of food borne micro 16 organisms create a situation that could lead to major outbreaks of life threatening food borne illnesses.

Harrison *et al.,* (2001) in their study, identified that 20% - 40% of food borne illness is associated with the consumption of contaminated food. Catering establishments are found to be the most frequently cited sources of sporadic outbreak of food borne infection.

Kaferstein (2003) in their study explained that there are several studies which discussed the main causes of microbial contamination typically occurring in food service establishments. They are contaminated supplies, dirty food contact surfaces, poor personnel hygiene practices, inappropriate storage temperatures and insufficient cooking.

McCabe – Sellers and Beattie (2004) in their study indicated that most of the reported food borne illness outbreaks are due to inappropriate consumer food handling and unhygienic preparation practices in the home.

Patil *et al.,* (2004) in their study indicated that the epidemiological surveillance summaries of food borne diseases clearly stated that consumer behaviours such as ingestion of raw/undercooked foods and poor hygienic practices are important contributors to outbreaks of food borne diseases.

Redmond and Griffith (2003) pointed out that children and adults are usually unaware of basic methods of food handling and preparation, although a substantial proportion of food borne illnesses can be attributed to improper preparation of food at home.

Santosh *et al.,* (2008) in their study stated that in recent years changing lifestyle, breakdown of the joint family system and increase in the number of working women have led to consumption of ready-to-eat foods. Individuals satisfy their taste and nutrition needs, but pay little attention to hygiene and food safety.

UNICEF (2009) reported that diarrhoea is the second leading killer of children under five and it is an alarming reminder of the exceptional vulnerability of children in developing countries. The main reasons of children mortality were improper sanitation, unsafe drinking water and improper food handling practices.

2.4 Scenerio of importance of hand washing to prevent foodborne diseases

Davila (2009) in his study he pointed out the reasons for diarrhoeal illness among mothers, infants and children and found that there is a lack of awareness about food safety practices like washing hands before preparing meals and infant formula, washing hands after changing diaper for children and washing hands after handling raw and cooked food. In general, mothers reported less frequent in hand washing and had lower food safety practices.

Ehiri *et al.,* (2001) stated that purchasing food from outside the home might pose considerable health risks, not only because of the lack of facilities for food protection, but also from unwashed hands of vendors and materials used for wrapping.

Jay *et al.,* (1998) in their study revealed that most of the consumers did not know the importance of washing their hands before preparing food and were not aware of washing their hands to an optimum extent before preparing food.

Lin *et al.,* (2003) stated that the Centres for Disease Control and Prevention (CDC) reported that hand washing is one of the most important hygienic procedures in preventing the transmission of infectious disease. It is the first line of defence for infectious diseases, including respiratory infection and gastrointestinal disorders among others.

Lindberg *et al.,* (2004) in their study stated that diseases transmitted by contaminated food or drink, person-to person contact, or by contaminated hands lead to food borne illnesses. Human hands usually contain micro organisms, both as part of person's normal microbial flora as well as transient microbes acquired from the environment.

Michael *et al.,* (2001) in their study revealed that bacteria from unwashed raw foods, leaking packages, dirty hands and surface when introduced to domestic refrigerators may directly contaminate other stored foods.

Mitakakis *et al.,* (2004) in their study stated that 70.3% of the respondents handle food preparation surfaces poorly, 46.6% did not wash their hands appropriately or in a timely manner, 41.7% mishandle raw food and 70.1% mishandle cooked food. Thus they concluded that preparing food at home increased the risk of diseases due to poor food handling practices.

Osagbemi *et al.,* (2010) in their study revealed that the number of reported cases of food poisoning has been increasing in recent years and many of the outbreaks can be traced to contamination caused by poor food hygiene among people.

Todd *et al.,* (2010) in his study pointed that washing and drying of hands reduce microbial contamination. During various daily activities at home and work, hands quickly become contaminated. Some activities increase the risk of finger contamination by pathogens more than others, such as the use of toilet paper to clean up following a diarrhoeal episode, change of the diaper of a sick infant, blowing a nose, or touching raw food materials. Many food borne outbreaks investigation reports identified the hands of food workers as the chief source of pathogens in the implicated food.

2.5 Scenerio of importance of safe hygiene practices

Stenberg *et al.,* (2008) conducted a study to find out how effective good domestic kitchen hygiene is at reducing diarrhoeal disease. They found that normally food should be prepared at correct temperature by combining the traditional and scientific methods of food safety. Improper and unsafe handling of food leads to various food borne diseases and diarrhoeal deaths. Mothers and food handlers play a vital role in the preparation of food. Hence, they are the final line of defense against food borne disease. There is a need for the development and implementation of food safety education strategies to improve specific food safety behaviours.

WHO (2004) reported that inappropriate temperature, inadequate refrigeration, improper cooking and reheating were involved in most of the households. Improper food handling, insufficient hygiene, cross contamination and reusing leftover food were also reported among food handlers.

WHO (2011) reported that the population in developing countries is more prone to suffer from food borne illnesses because of multiple reasons, including lack of access to clean water for food preparation; inappropriate transportation and storage of foods, and lack of awareness regarding safe and hygienic food practices.

WHO (2011) reported that food borne illness outbreaks are reported frequently at national as well as international levels, underscoring the importance of food safety. It also reported that the health of people in many countries is affected by consuming contaminated food products.

Food and Agriculture Organisation and World Health Organisation (2008) reported that food safety is an essential public health issue for all countries. Food borne diseases due to microbial pathogens, bio toxins and chemical contaminants in food represent serious threats to the health of thousands of millions of people.

Zain and Naing (2002) in their study stated that an important way to prevent food contamination is to maintain a high standard of personal hygiene and cleanliness. Mishandling of food and disregard of hygienic measures on the part of food handlers may enable pathogens to come into contact with food and in some cases, to survive and multiply in sufficient numbers to cause illnesses in the consumers.

2.6 Scenario of food safety condition in Bangladesh

Food safety is an imperative issue in Bangladesh as there has been a long history of the countries to be victimized due to severe adulteration in foods resulting in fatality.

A recent estimation has revealed that approximately 30 million people in Bangladesh suffer from foodborne illnesses each year. Besides, the National Taskforce on Food Adulteration (NTFS) made by the GoB found that adulterated foodstuffs each year causes various food borne enteric illnesses, malnutrition and other diseases leading to morbidity and mortality especially to the children.

Consumption of unsafe food is a serious threat to public health in Bangladesh for last couple of decades. A survey conducted by the Institute of Nutrition and Food Science, Dhaka University, in early 1980s had revealed that inadequate diets and intake of adulterated foods are responsible for the malnutrition of 60 per cent of the people of Bangladesh.

A recent official statistics published by the Ministry of Health and Family Welfare (MOHFW) of the of the Government of Bangladesh (GoB) reveals that nearly half of the food samples have been found adulterated tested by the IPH from 2001 to 2009.This GoB statistics indirectly demonstrates that the situation of the prevailing food adulteration concerns in Bangladesh has not improved over the past 10 years.

Government of Bangladesh (GoB) unraveled the case of adulteration of approximately half of the food samples tested by the laboratory of the Institute of Public Health (IPH) within the time frame of 2001 to 2009. According to the report of the Directorate General of Health Services (DGHS), the enormity of the diarrhoeal diseases is caused principally by the unsafe foodstuffs. The report revealed around 18,000,000 people to suffer from diarrhoea from 2003 to 2009. Unhygienic state of food as well as malnutrition largely account for this situation.

World Health Organisation (WHO) has expressed its anxiety about the impact of food safety upon public health in Bangladesh in its website. It reveals that unsafe food can be a significant reason of many chronic and non-chronic diseases including but not limited to diarrhoea, cancer, heart diseases, various kidney diseases and birth defects.

The report of the Directorate General of Health Services (DGHS) mirrors the magnitude of the diarrhoeal diseases and confirms that this health problem is caused by mainly unsafe foodstuffs. The DGHS report suggests, from 2003 to 2009 17,999,284 people were attacked by diarrhoea and among them 4,674 people died, 16 which signifies that in average at least 3,850 people die for diarrhoea each year.

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted to find out the food safety practices by residential people live in SAU Campus and Microbiological analysis of milk to find out pathogen present in milk.

3.1 Description of the experiment

A survey was done about food safety issue concerning raw milk purchase, domestic food handling practices, and foodborne illness knowledge was performed between March, 2020 to April, 2020. Lab test of the milk sample were done during the period of April 2020 to May 2020. There are two assessment system were followed during the experimental period. These are:

1. To conduct an experiment to find out food safety practices by residential people live in SAU campus
2. Assessment of microbiological analysis of milk and bacterial count in milk by lab test

3.1.1 Experimental location

The experiment was conducted at residential people of SAU Campus.

3.1.2 Sample

Interviews were conducted of people over 18 years of age who mostly purchased and prepared food in the home. A total of 50 people (randomly selected) was surveyed, by residential people live in Sher-e-Bangla Agricultural University (SAU) campus.

3.1.3 Questionnaire

The questionnaire was designed by research supervisor. Respondents were interviewed to determine their raw milk buying and transportation practices, their food hygiene practices, and their knowledge of food safety. Food handling practices such as raw milk storage, hand washing, and cleaning of kitchen surfaces were investigated.

3.1.4 Sampling unit

The sampling unit or respondent was a consumer living in the SAU residential area.

3.1.5 Sample size

The required sample size was determined based on the confidence level and the precision rate to be followed. The advantage of this approach is that the statistical validity of a sample does not depend on its size relative to the population being investigated. Rather what matters is the required level of probability (confidence level), required degree of precision and the variability of the population. The following formula (S.K. Lwanga,1991) was used to estimate the required sample size:

$$n = \frac{Z^2 P(1-P)N}{E^2(N-1)+Z^2 P(1-P)}$$

n= Required number of sample size =50

Z= Confidence level 95% = 1.96

P= 0.5

E= Design effect (0.131)

N= Number of household in sampled area = 471

3.1.6 Sample distribution

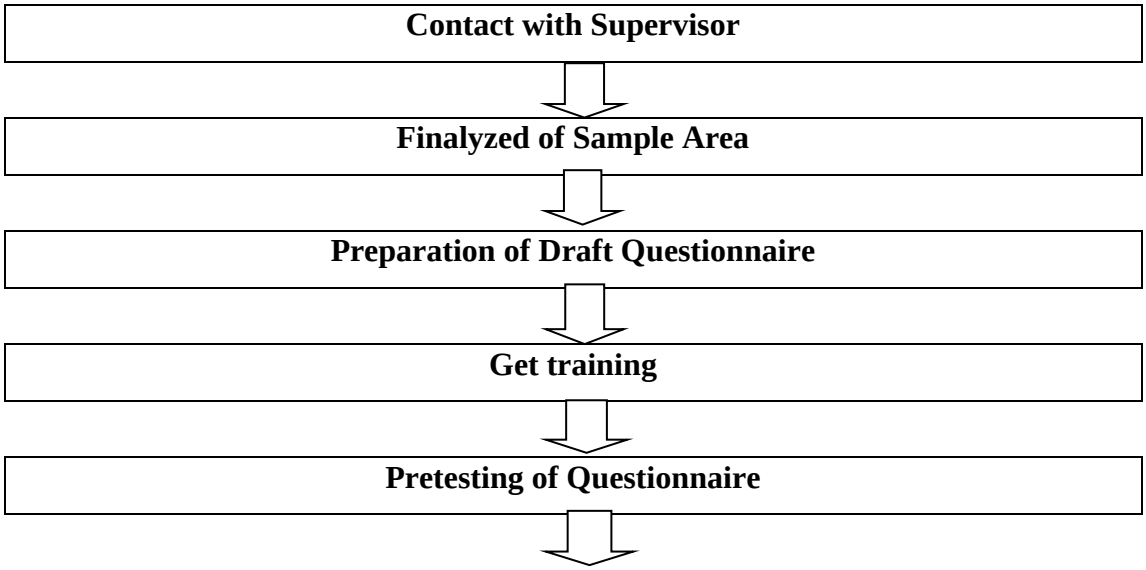
The study covered randomly selected residential people SAU Campus.

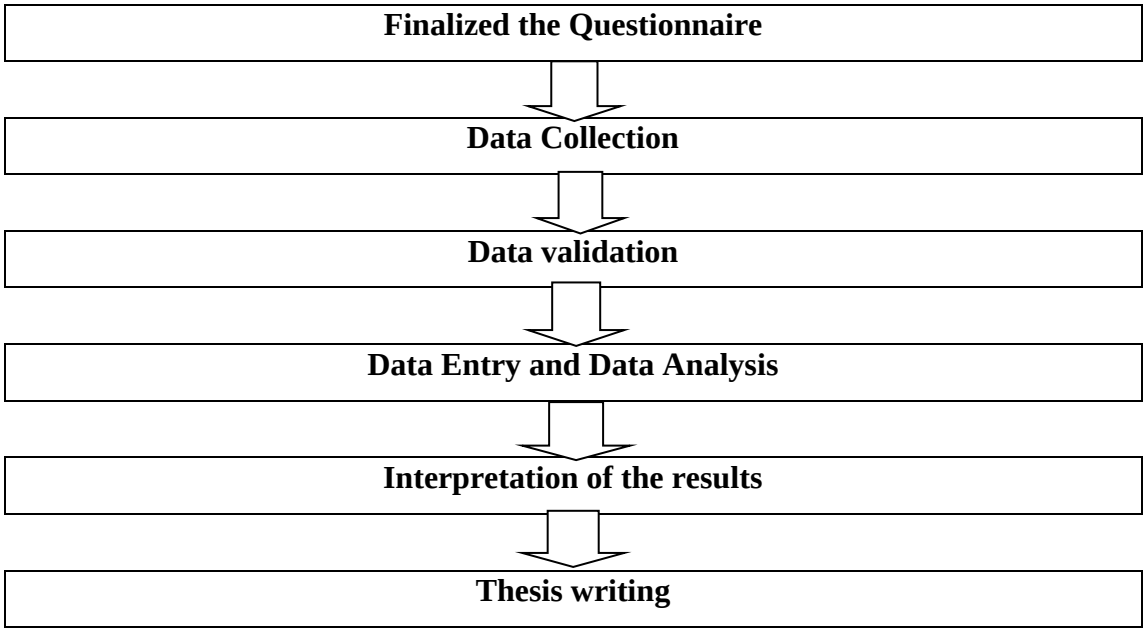
3.1.7 Survey instrument

The instrument of the survey was questionnaire.

- Questionnaire for respondents (Attached in appendix)

3.1.8 Survey Implementation





Data collection

- General information of respondents
- Socio-economic condition of respondents
- Respondents knowledge on food safety authority and acts
- Respondents confidence on practice of hygiene
- Respondents awareness on source of milk, storage and processing of food

Verification and Supervision

Every filled in questionnaire was thoroughly checked and supervised by Supervisor.

Data entry

Data entry was conducted by with the supervision of research Supervisor.

3.1.9 Quality control

In order to ensure the highest level of quality of data, the following measures were adopted:

a) Training on use of the interview techniques and use of tools appropriately including field exercise.

b) Field visit by field survey supervisor

c) Supervision over phone calls

d) Close supervision by Supervisor

e) Day to day checking of collected data by supervisors in order to ensure proper filling and recording of data

f) Preserving contact mobile number of the respondents to recheck if necessary.

Giving gift at the end of questionnaire

After completing the questionnaire, a small gift was given

3.1.10 Data Processing and Presentation

A Microsoft Access and Microsoft Excel program was developed for data entry. Different types of statistical tools like number, mean and percent were used. A Simple tabular technique was presented in the study to classify the data into meaningful categories.

3.2 Microbiological analysis of milk

3.2.1 Sample collection

Different milk samples were collected from dairy farm of SAU campus and SAU market and analyzed for total viable bacterial count (TVBC) and total coliform count (TCC). Samples were chosen from different dairy farm of SAU Campus and SAU Market. Raw samples were collected in small bottles and packed milk samples were purchased as sealed pack by checking the valid expiry dates. Samples were transferred to the laboratory for quality testing within 30 minutes it was collected.

3.2.2 Sample analysis

The microbiological analysis of milk was carried out in the Animal Nutrition laboratory and Dairy Science laboratory in the Faculty of Animal Science and Veterinary Medicine, at Sher-e-Bangla Agricultural University, Dhaka, 1207. The laboratories had available facilities for the determination of microbiological analysis of milk sample.

3.2.2.1 Total viable bacterial count (TVBC) test

The appropriate dilutions of the milk sample are mixed with a sterile nutrient medium that can support the growth of the micro-organisms, when incubated at a suitable

temperature. Each bacterial colony that develops on the plate is presumed to have grown from one bacterium or clump of bacteria in the inoculums. The total number of colonies counted on the plates multiplied by the dilution factor to represent the number of viable micro-organisms present in the sample tested. The test was performed for Enumeration of total viable microbes and to determine the contamination and unhygienic conditions of milk handling.

Procedure

- **Sampling**

The sample is drawn aseptically using standard procedures.

Equipments and materials

In this experiment Nutrient agar (Oxoid^{TM}), phosphate buffer solution (PBS) autoclave machine, laminar air flow, refrigerator, balance, colony counter, dilution bottle, incubator, microwave oven, test tube, test tube rack, petridishes, micropipette, spirit lamp, distilled water and waterbath etc. were used.

Composition of Nutrient Agar (g/l)

Lab-Lemco powder	1.0 g
Yeast extract	2.0 g
Peptone	5.0 g
Sodium chloride	5.0 g
Agar	15 g

Preparation of agar media:

28 gm of Lab-Lemco powder, Yeast extract, Peptone, Sodium chloride, Agar was suspended in 1000 ml distilled water and was mixed thoroughly. The media was dissolved completely in water by heating up to boiling temperature. Then the dissolved media was placed in a conical flask and was sterilized at 121^{o}C for 30 minutes and was kept that temperature to prevent solidification into a water bath.

Sample preparation

- Process the samples as soon as possible, but if necessary store the samples at 0 to 4.4^{o} C until tested.

- Samples must be tested within 36 hours after the initial collection, and the time of plating must be recorded. Fluid milk samples that have been frozen should not be tested microbiologically, because freezing causes a significant change in the viable bacterial count in milk and hence, may give enormous results.
- Mark each plate with sample number, dilution, and other desired information before making dilutions.

Dilution of the sample

1. Label the bottom of six petri plates 1-6. label six tubes of saline 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6}.
2. Using aseptic technique, the initial dilution is made by transferring 1 ml of sample to a 9 ml sterile saline blank (figure below. This is a 1/100 or 10^{-2} dilution.
3. Immediately after the 10^{-1} dilution has been shaken, uncap it and aseptically transfer 1ml to a second 9 ml saline blank. Since this is a 10^{-1} dilution, this second blank represents a 10^{-2} dilution of the original sample.

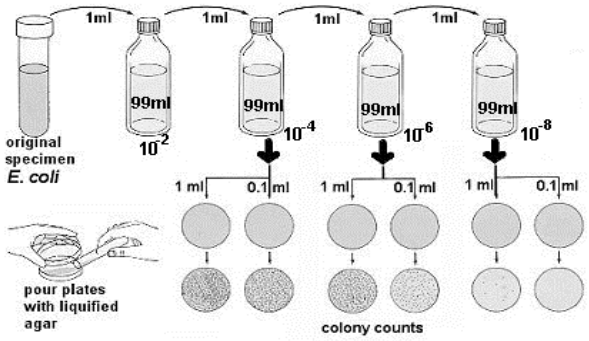


Fig: Dilution of sample

4. Shake the 10^{-2} dilution vigorously and transfer 1ml to the third 9 ml blank. This third dilution represents a 10^{-3} dilution of the original sample.
5. Repeat the process to produce 10^{-4}, 10^{-5} and 10^{-6} dilutions
6. Shake the 10^{-2} dilution again and aseptically transfer 1.0 ml to one petri plate and 0.1 ml to another petri plate. Do the same for the 10^{-3} and 10^{-4} dilutions.
7. Use a separate sterile pipette for transfers from each different dilution.
8. Incubate plates at 37°C for 48 h for SPC. Plates must reach the temperature of incubation within 2 h.
9. Count the plates after the desired incubation period. Record the dilutions used and number of colonies counted on each plate. If it is impossible to count at

once, after the required incubation store the plates at 0 to 4.4 ^{o}C for not more than 24 h.

10. At the end of the incubation period, select all of the petri plates containing between 30 and 300 colonies. Plates with more than 300 colonies cannot be counted and are designated too many to count (TMTC). Plates with fewer than 30 colonies are designated too few to count (TFTC). Count the colonies on each plate. A colony counter should be used.
11. Calculate the number of bacteria (CFU) per milliliter or gram of sample by dividing the number of colonies by the dilution factor multiplied by the amount of specimen added to the agar media.

Calculation

CFU/mL = no. of colonies/ (volume of culture plate × dilution factor)

3.2.2.2 Total coliform count (TCC) test

Coliform is a group of bacteria such as *Escherichia coli*, *Aerobacteraerogenes* etc, found in the feces manure, soil etc. McConkey Agar is a selective medium used to detect and enumerate lactose-fermenting coliform microorganisms. The medium is recommended for use in the microbiological analysis of milk and other dairy products, and for use in the examination of water. The medium contains bile salts and crystal violet which serve as inhibitory agents toward some gram-positive microorganisms, especially staphylococci. Neutral red is employed as the pH indicator. Lactose-fermenting microorganisms produce pink to red colonies that are generally surrounded by a reddish zone of precipitated bile. Non-lactose-fermenting microorganisms result in colorless colonies. If coliform bacteria present in pasteurized milk indicates post pasteurized contamination.

Apparatus and reagents

In this experiment McConkey Agar media (Merck^{TM}), phosphate buffer solution (PBS), autoclave, laminar air flow, refrigerator, balance, colony counter, dilution bottle, incubator, microwave oven, test tube, test tube rack, petridishes, micropipette, spirit lamp, distilled water and waterbath etc. were used.

Preparation of Agar media

- Composition of McConkey agar media:

Peptic digest of Animal tissue	1.5 g
Casein enzymatic hydrolysate	1.5 g
Pancreatic digest of gelatin	17 g
Bile salts	1.5 g
Lactose Monohydrate	10 g
Common salt	5 g
Neutral red	0.03 g
Crystal violet	0.001 g
Agar-agar	15 g

Above components were dissolved into 1 litre of distilled water. The mixture was heated until boiling to dissolve the ingredients. Then this agar media was distributed into different screw cap bottle and was autoclaved at 121^0c for 30 minutes. After sterilization, agar media was cooled down to 40^0c and was kept that temperature until.

Sample preparation

- Process the samples as soon as possible, but if necessary store the samples at 0 to 4.4^o C until tested.
- Samples must be tested within 36 hours after the initial collection, and the time of plating must be recorded. Fluid milk samples that have been frozen should not be tested microbiologically, because freezing causes a significant change in the viable bacterial count in milk and hence, may give enormous results.
- Mark each plate with sample number, dilution, and other desired information before making dilutions.

Dilution of the sample

1. Label the bottom of six petri plates 1 to 6. Label six tubes of saline 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6}.
2. Using aseptic technique, the initial dilution is made by transferring 1 ml of sample to a 9 ml sterile saline blank (figure below. This is a 1/100 or 10^{-2} dilution.)
3. Immediately after the 10^{-1} dilution has been shaken, uncap it and aseptically transfer 1ml to a second 9 ml saline blank. Since this is a 10^{-1} dilution, this second blank represents a 10^{-2} dilution of the original sample.

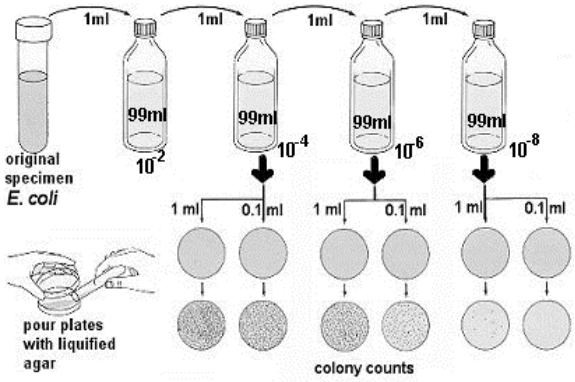


Fig: Dilution of sample

4. Shake the 10^{-2} dilution vigorously and transfer 1ml to the third 9 ml blank. This third dilution represents a 10^{-3} dilution of the original sample.
5. Repeat the process to produce 10^{-4} , 10^{-5} and 10^{-6} dilutions
6. Use a separate sterile pipette for transfers from each different dilution.
7. Aseptically inoculate agar surface with 0.1ml of well mixed diluted sample.
8. Spread the dilution evenly over the surface of the medium.
9. Using a sterile spreader device, distribute the inoculum evenly over the agar surface.
10. Incubate plates aerobically for 48 +/- 2.0 hours at 37ºC.
11. At the end of the incubation period, select all of the petri plates containing between 30 and 300 colonies. Plates with more than 300 colonies cannot be counted and are designated too many to count (TMTC). Plates with fewer than 30 colonies are designated too few to count (TFTC). Count the colonies on each plate. A colony counter should be used.
12. Calculate the number of bacteria (CFU) per milliliter or gram of sample by dividing the number of colonies by the dilution factor multiplied by the amount of specimen added to the agar media.

Counting of bacteria:

After incubation completed, a plate was selected and was counted with the help of colony counter. The bacteria having minimum size of 0.5 mm and these colonies would be darkened colour.

Interpretation of the results

- ✓ Lactose-fermenting microorganisms, including coliforms, produce pink to red colonies that are generally surrounded by a reddish zone of precipitated bile.
- ✓ Surface colonies of *Escherichia coli* appear as entire-edged colonies, while deep colonies appear lens-shaped.
- ✓ Colonies of *Enterobacteraerogenes* often appear mucoid and pinkish in color.
- ✓ *Enterococcus* spp. may grow, and if so, usually appear pinpoint in size and rose colored.
- ✓ Non-lactose-fermenting microorganisms produce colorless colonies.

Coliform standard:

1. Raw milk to be pasteurized = Not more than 1000/ml of milk
2. Raw milk after pasteurization = Not more than 10/ml
3. Certified raw milk to be pasteurized= Not more than 10/ml.
4. Certified raw milk after pasteurization = Nil
5. Ice-cream, Butter, Ghee, Dahi= Not more than 10/ml.
6. Dry milk/milk powder=Not more than 90/g

3.3 Statistical Analysis

Total data were complied, tabulated and analyzed in accordance with the objectives of the study. The collected data was subjected to statistical analysis by applying one way ANOVA using Statistical Package for Social Sciences (SPSS version 16.0). Differences between means were tested using Duncan's multiple comparison test and significance was set at $P<0.05$.

Picture Gallery

Plate 1: Agar media preparation

Plate 2: Autoclaving at 121^{o}C by Autoclave machine

Plate 3: Incubation of media at 37^{0}c in Incubator

Plate 4: Monitoring of research activities by the supervisor

Plate 5: Diluted sample were spreaded by glass spreader

Plate 6 : Colony counting

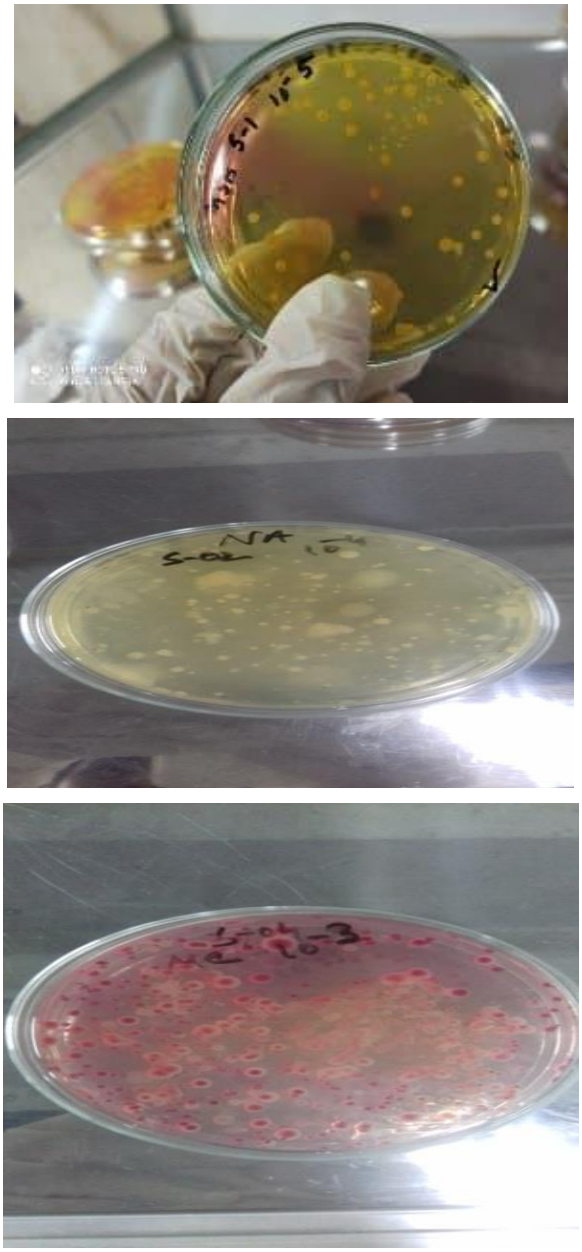


Plate 7: Bacterial colony in agar media

CHAPTER IV

RESULTS AND DISCUSSION

The study was conducted in different residential building of Sher-e-Bangla Agricultural University (SAU) Campus to find out the food safety practices by the residential people and bacterial count in milk. The result have been presented and discussed with the help of table and graphs. During the study the following results are obtained.

4.1 Assessment of socio-economic condition

A Survey consists of 50 samples (Respondents). Among them 18 (36%) were male respondents and 32 (64%) were female respondents (Fig 4.1.1).

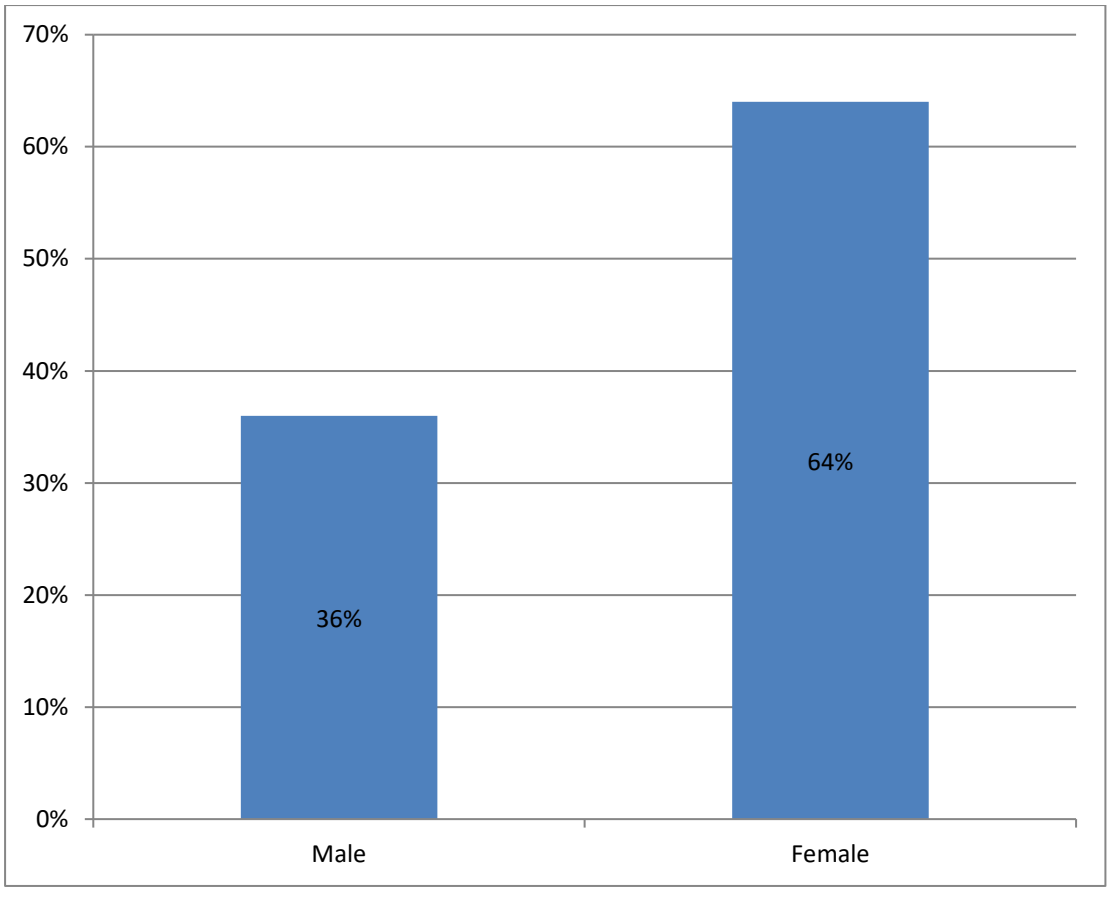


Fig 4.1.1: Distribution of respondents by gender

Survey findings revealed that among the interviewed in the sampled area 14% had completed class 8 or less, 12% had completed SSC, 12% had completed HSC, 6%

had completed only Honors and 56% had completed Masters (Fig 4.1.2).The result showed that more than 60% respondents were highly educated (graduate).

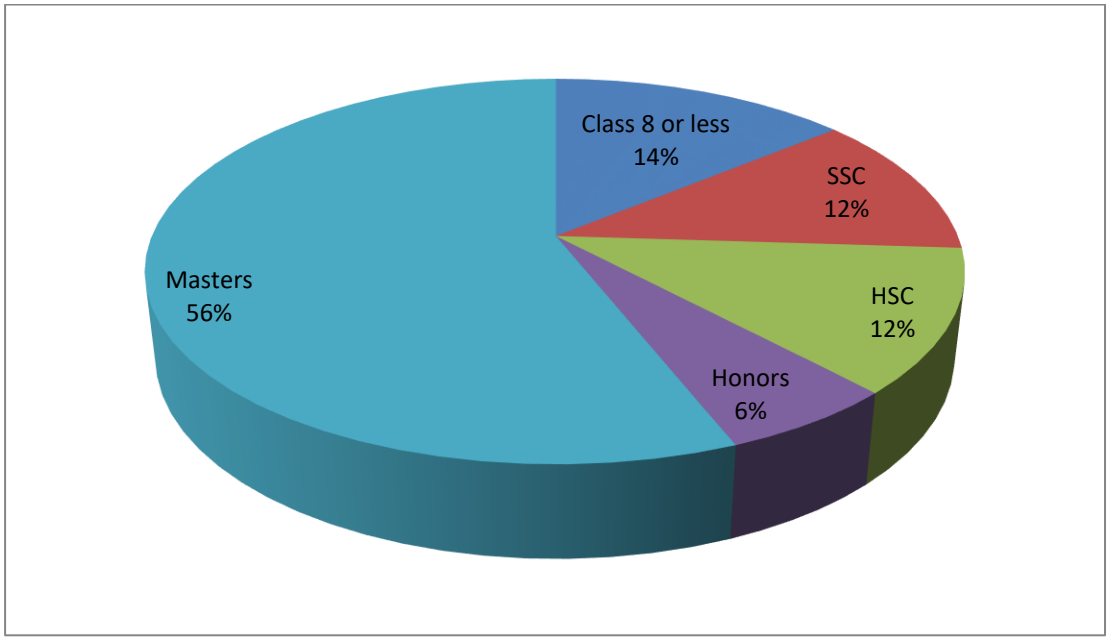


Fig 4.1.2: Education level of respondents

The interviewers consisted of number of family member were 14% less than 4 family members, 82% contains 4-6 family members and 4% contains 7-8 family members (Fig 4.1.3). This result notified that most of the families were nuclear family. A family may be nuclear, consisting of parents and their children, or extended, when a large group of relatives live together or in close contact with each other (Source: Banglapedia).

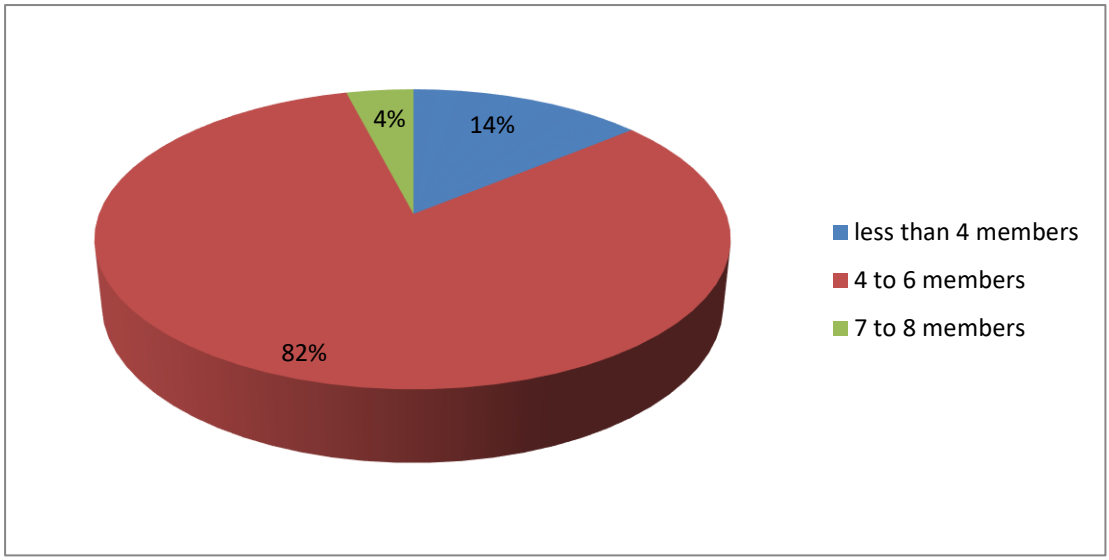


Fig 4.1.3: Distribution of respondents by family members

Survey findings also revealed that 40% respondents have approximate food expenditure of a family (per month) 10,000 to 20,000 taka, 44% respondents 21,000 to 30,000 taka, 8% respondents 31,000 to 40,000 taka, 6% respondents 41,000 to 50,000 taka and only 2% respondents have approximate food expenditure of a family (per month) 51,000 to 60,000 taka (Fig 4.1.4). That means most of the family lead a moderate life and this type of family can be called middle class family. Middle class family have income ranging between $2 to $20 per capita per day (Source: ADB).

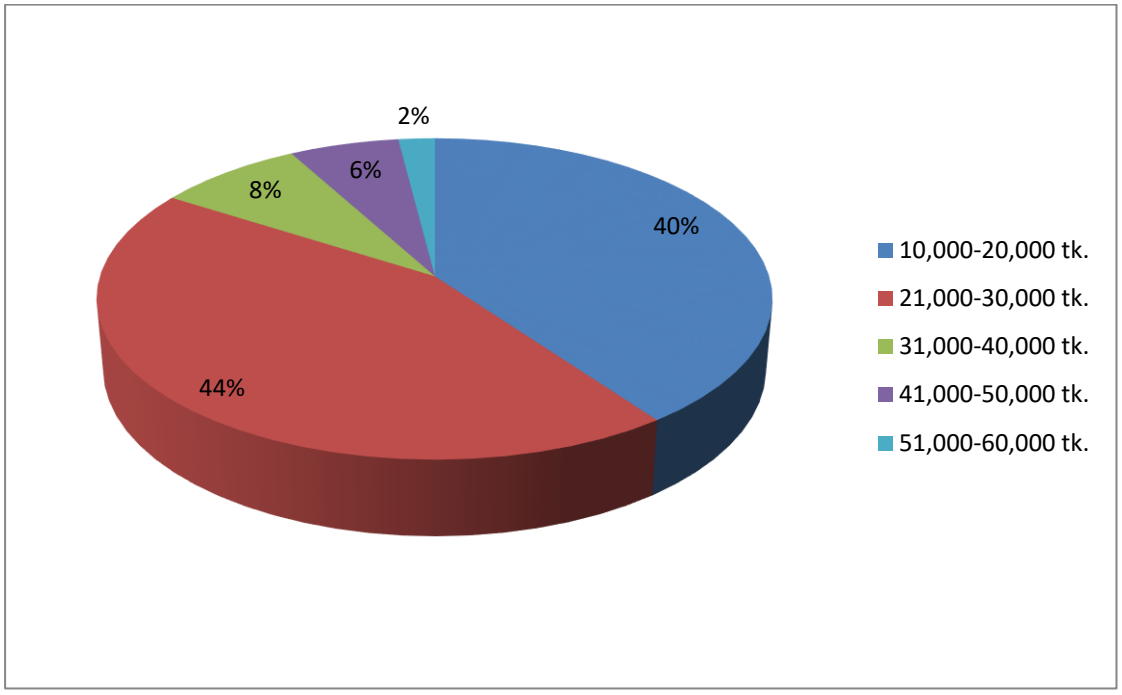


Fig 4.1.4: Distribution of respondents by approximate food expenditure of a family (per month)

4.2 Assessment of concern about food safety acts and regulation

4.2.1 Idea about food safety authority and acts 2013

The survey discovered that 28% respondents have idea about food safety act 2013 and 72% respondents have no idea (Fig 4.2.1.1). It also revealed that 34% respondents have idea about food safety authority and 66% respondents have no idea (Fig 4.2.1.2).

Above this survey analyzing it can be said that most of the respondents have lack of knowledge about food safety authority and act 2013.This could be a reason for lacking of publicity of food safety authorities or respondents have lack of awareness on food safety issues.

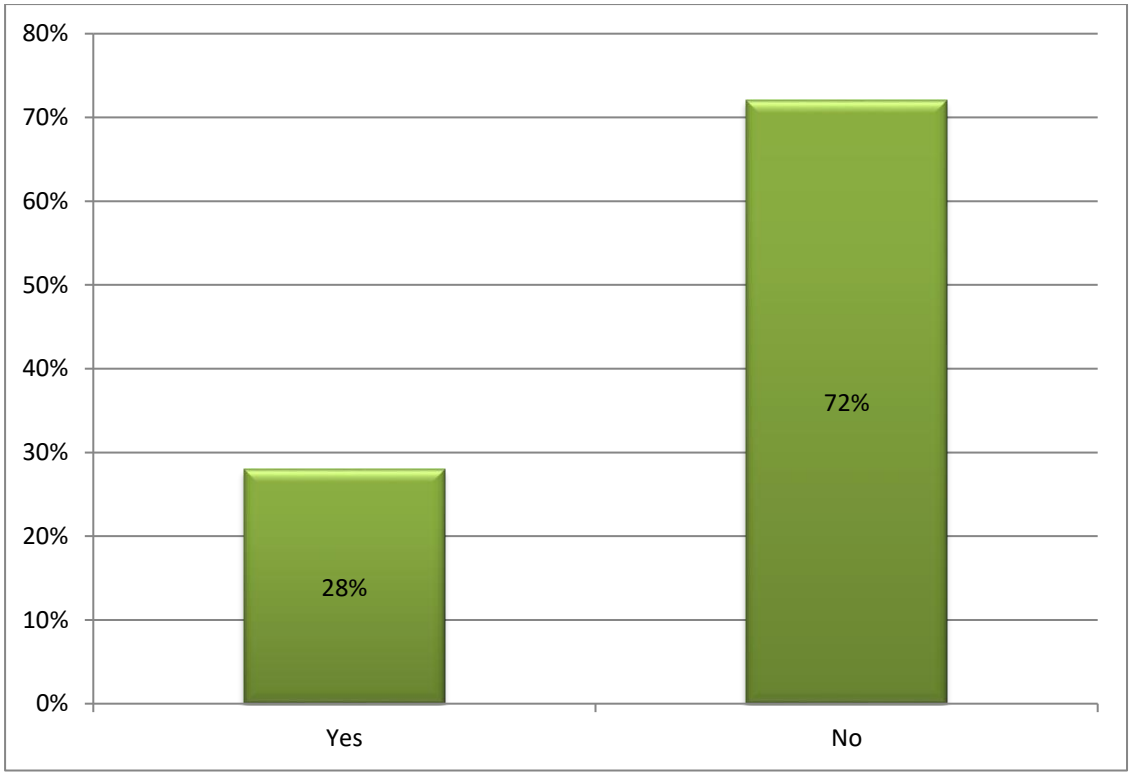


Fig 4.2.1.1: Idea about food safety act 2013

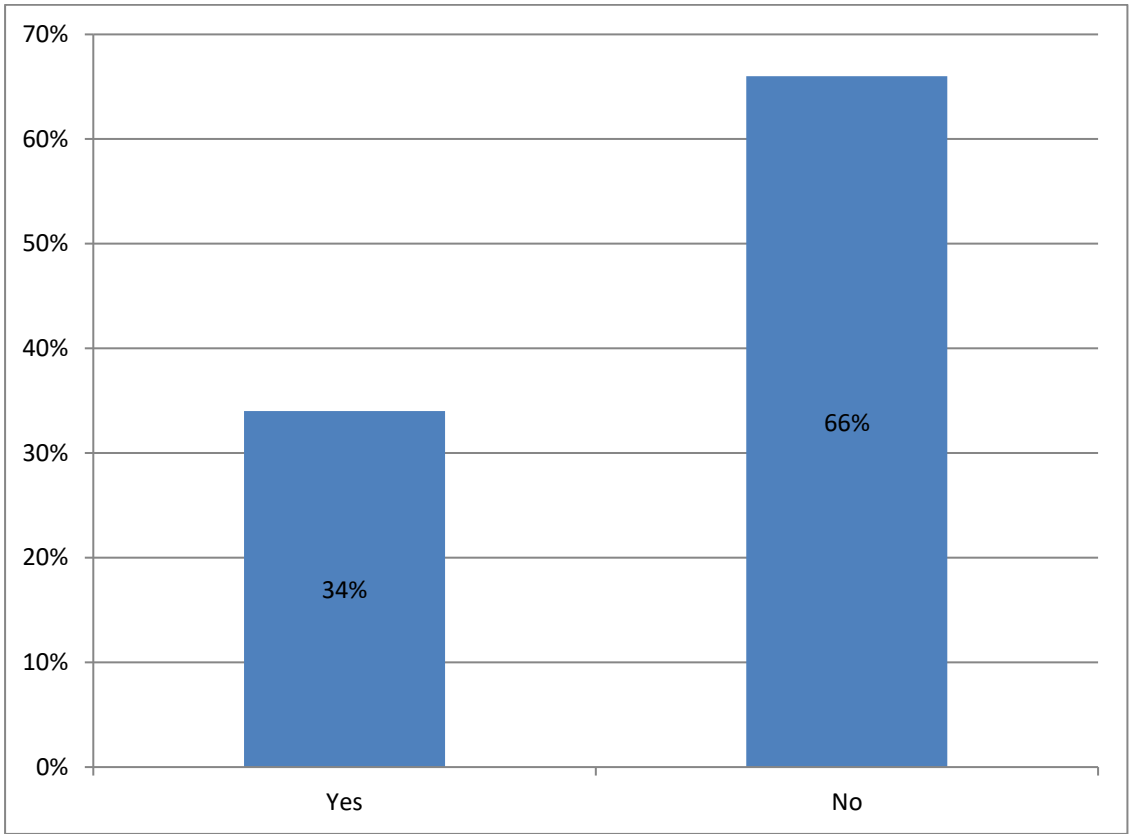


Fig 4.2.1.2: Idea about Bangladesh food safety authority

4.2.2 Idea about directorate of national consumer rights protection & acts 2009

The Survey exposed that 44% respondents have idea about directorate of national consumer rights protection and 56% have no idea (Fig 4.2.2.1). Even only 24% respondents have idea about consumer rights protection act 2009 and 76% respondents have no idea (Fig 4.2.2.2). Survey also revealed that only 2% respondents have complained in the directorate of national consumer rights protection and 98% respondents made no complain (Fig 4.2.2.3).

This result showed that most of the respondents were apathetic about their rights. This can be a cause of lack of knowledge about consumer rights and acts. Also directorate of national consumer rights protection should take initial steps to make conscious about consumer rights and acts. It directs that the directorate will supervise the anti-consumer rights practices listed in the act, however the act does not provide any provision how this is going to be conducted. No power is vested upon the directorate to direct specific agencies of the state to take action as it is necessary. The office of the directorate also lacks appropriate institutional capacity to build a force to supervise the markets and act as the watch-dog for consumer protection rights in Bangladesh. As a result the directorate of national consumer rights protection in Bangladesh is yet to show any visible achievement for protecting the interests of the consumers in this country.

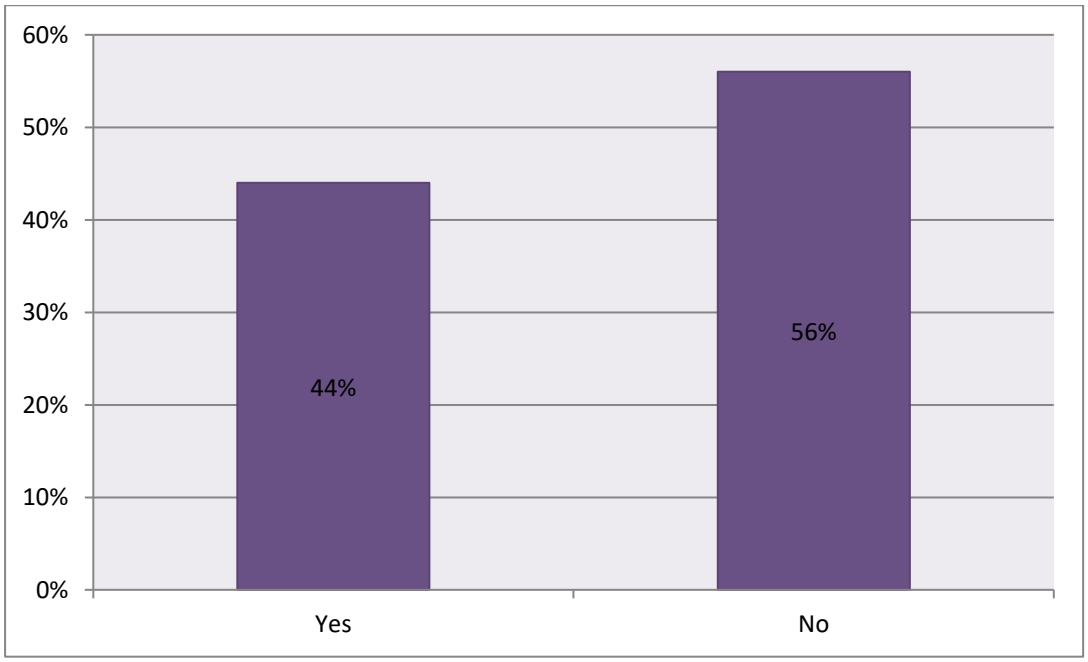


Fig 4.2.2.1: Idea about directorate of national consumer rights protection

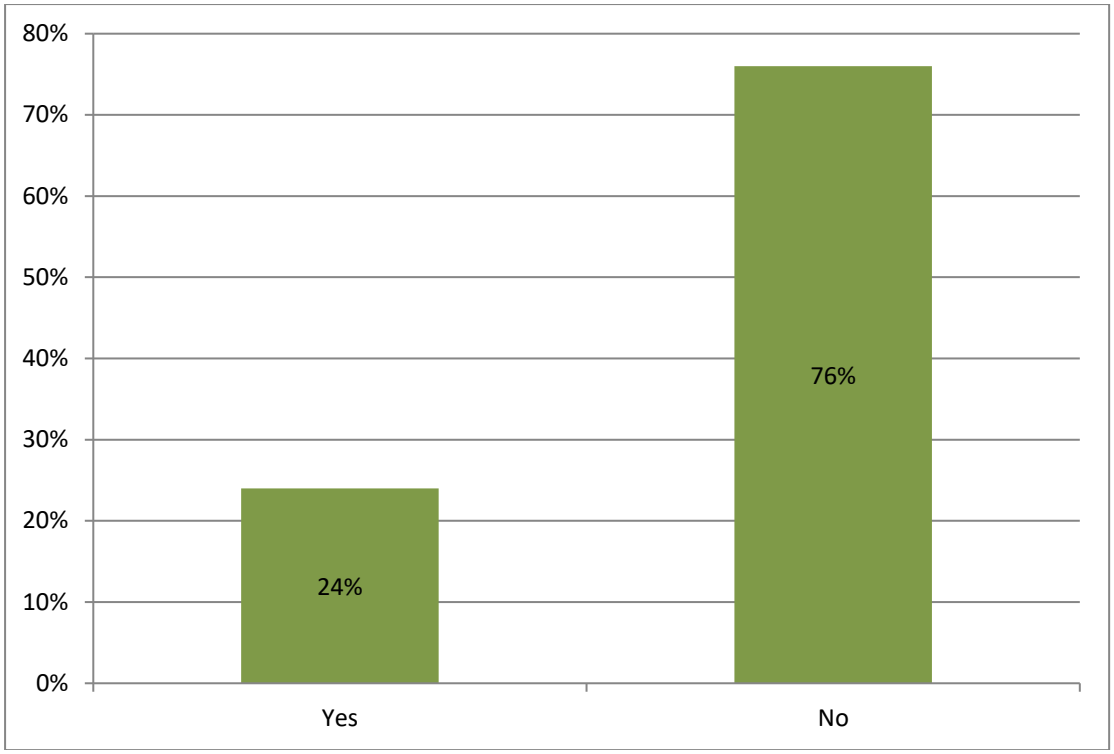


Fig 4.2.2.2: Idea about consumer rights protection act 2009

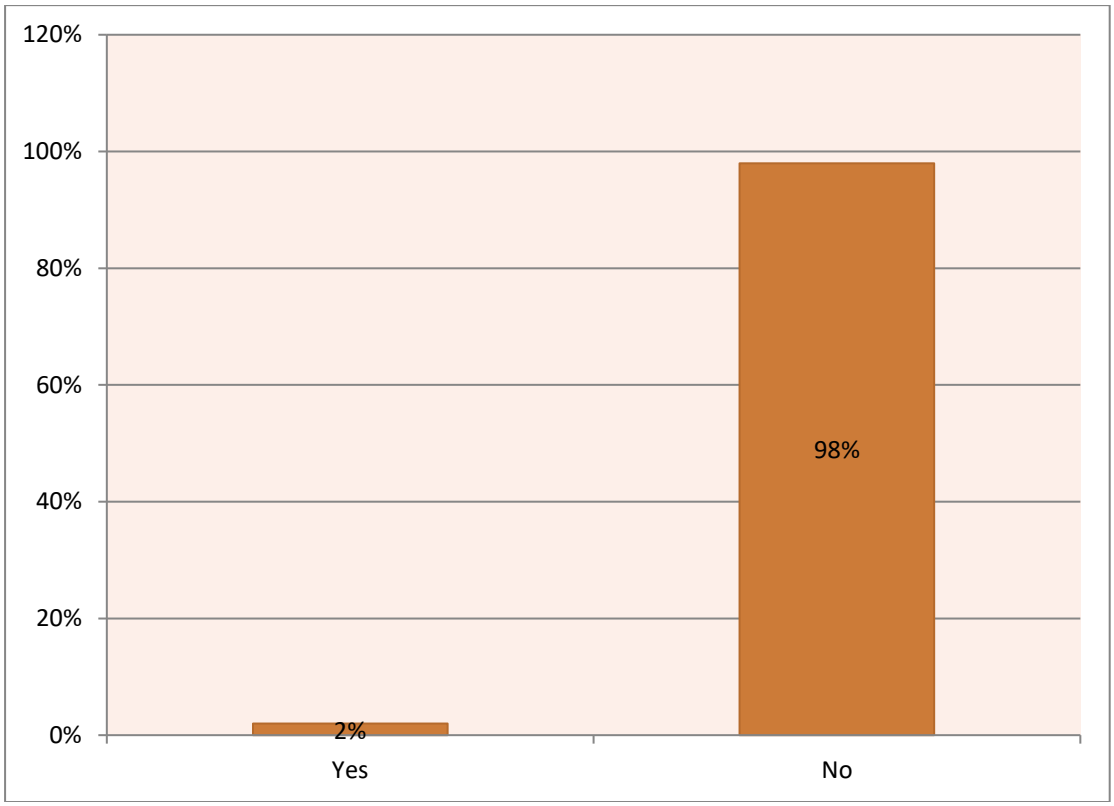


Fig 4.2.2.3: Distribution of respondents by report any complain in the directorate of national consumer rights protection

4.3 Assessment of hygiene practices by children and housekeeper

The survey showed that 86% of children of the family of respondents always wash their hands with soap before eating and 14% of the children of the family of respondents sometimes wash their hands with soap before eating (Fig 4.3.1). Another survey revealed that 86% of children of the family of respondents wash their hands with soap after eating and 14% of the children of the family of respondents sometimes wash their hands with soap after eating (Fig 4.3.2). It also visualized that 44% housekeeper (workman) always wash his hands with soap after using the toilet, 2% sometimes wash his hands with soap after using the toilet , 6% respondents do not know either wash his hands with soap after using the toilet or not and 48% respondents have no housemaid at home (Fig 4.3.3).

In the context of above result it can be said that almost all families are conscious about their children and housekeeper are they washing their hand with soap before or after taking meal and after using the toilet. So, proper hygienic management practiced by children and housekeeper of residential people. These results are in agreement with those of previous researcher Lin *et al.*, (2003) stated that the Centres for Disease Control and Prevention (CDC) reported that hand washing is one of the most important hygienic procedures in preventing the transmission of infectious disease. It is the first line of defence for infectious diseases, including respiratory infection and gastrointestinal disorders among others. Dasgupta (2005) in his study revealed that many food borne diseases and pathogenic microorganisms are spread by contaminated hands. If pathogens from human faeces enter a person's mouth, it will cause diarrhoea.

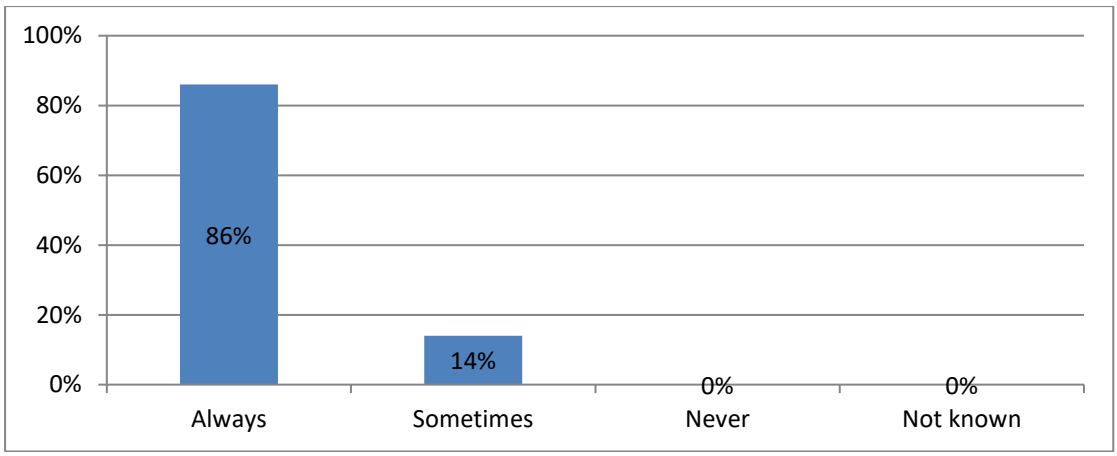


Fig 4.3.1: Children of the family wash their hands with soap before eating

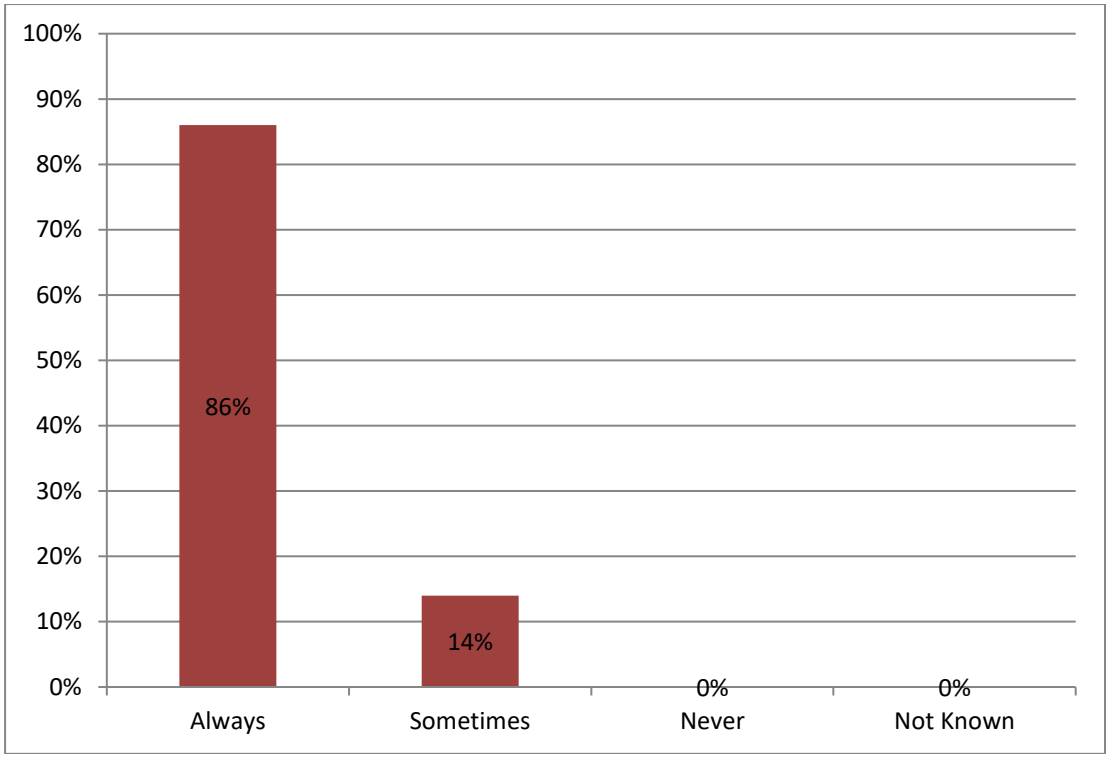


Fig 4.3.2: Children of the family wash their hands with soap after eating

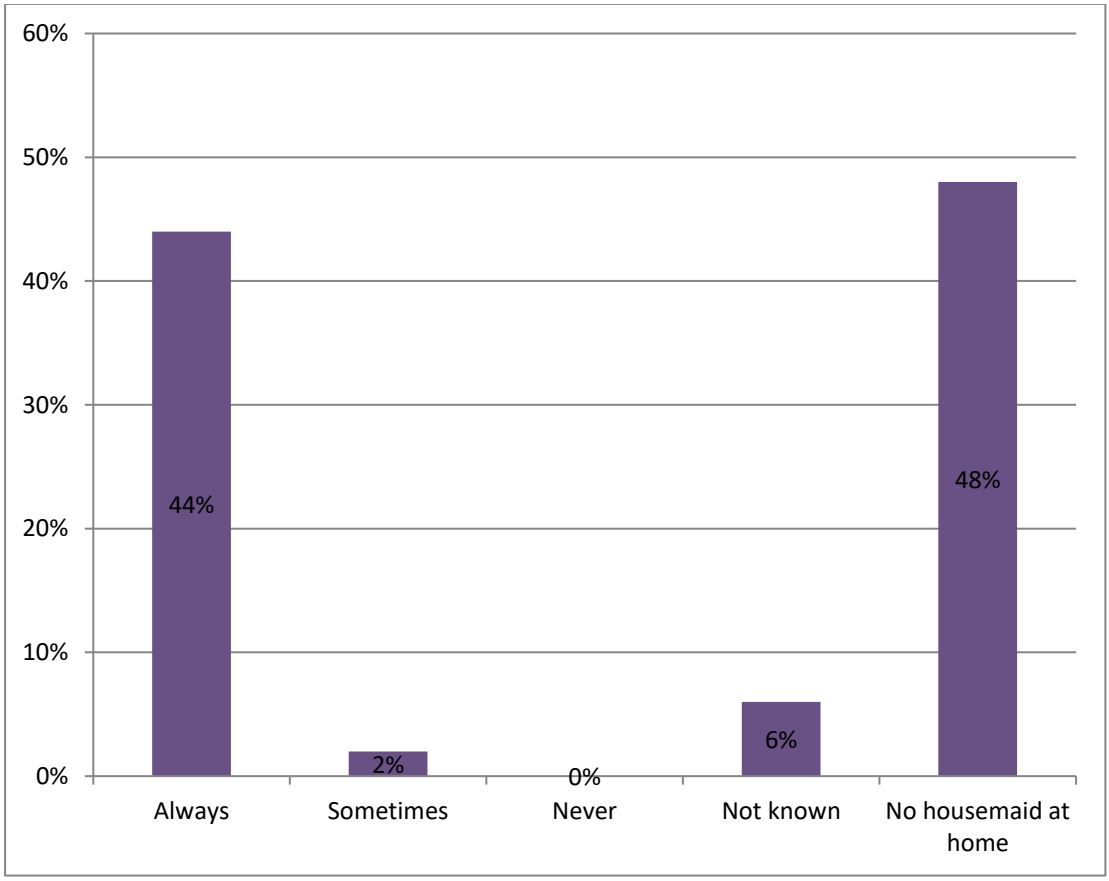


Fig 4.3.3: Housekeeper (workman) wash his hands with soap after using toilet

4.4 Assessment of food safety practices by residential people

The survey revealed that 78% respondents always store eggs in the freeze, 14% sometimes and 8% never store in the fridge (Fig 4.4.1). Another Survey showed that 68% respondents always wash the eggs and keep them in the fridge, 22% respondents sometimes and 10% respondents never wash the eggs and keep them in the fridge (Fig 4.4.2). It also exposed that 14% respondents buy eggs from grocery stores, 82% from egg shop in the Market, 2% from supershop and 2% from egg hawker (Fig 4.4.3).

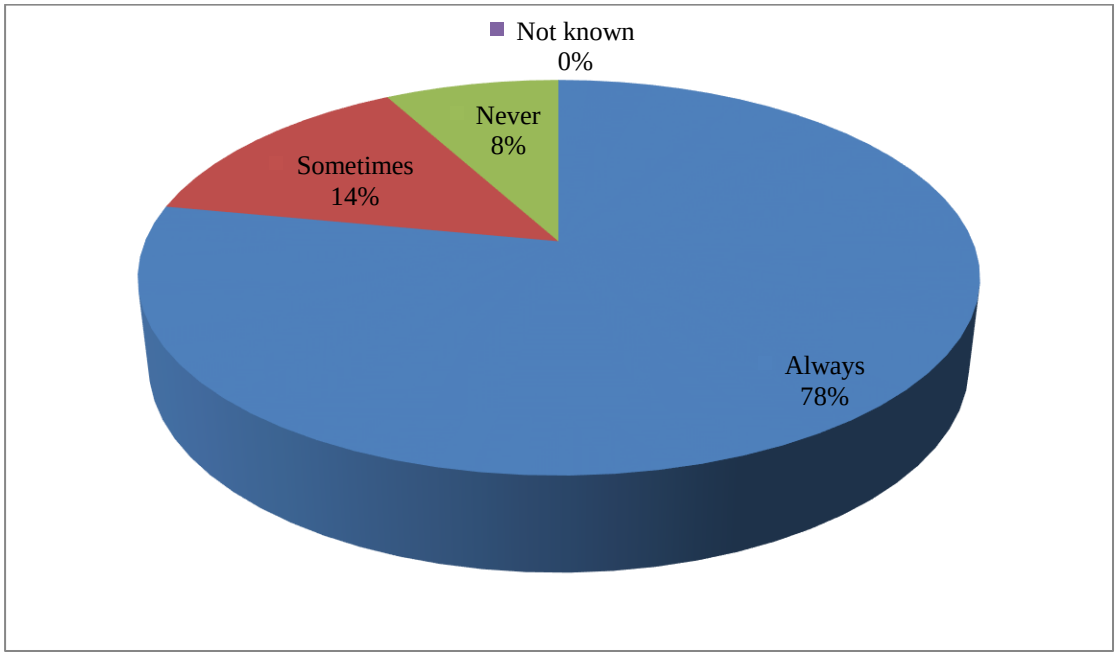


Fig 4.4.1: Buy eggs & store in the fridge

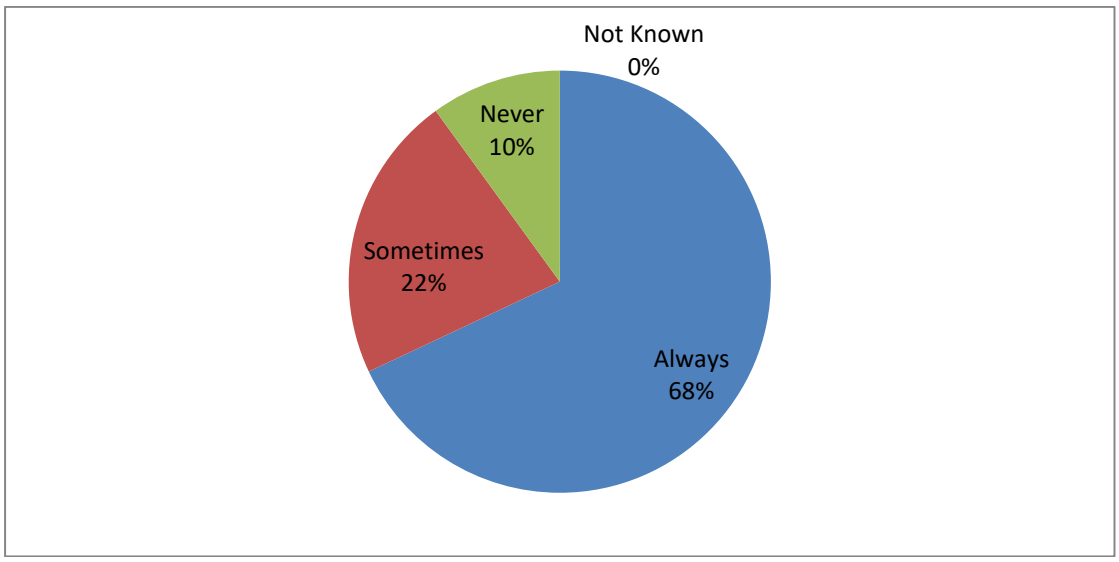


Fig 4.4.2: Store eggs with washing in the fridge

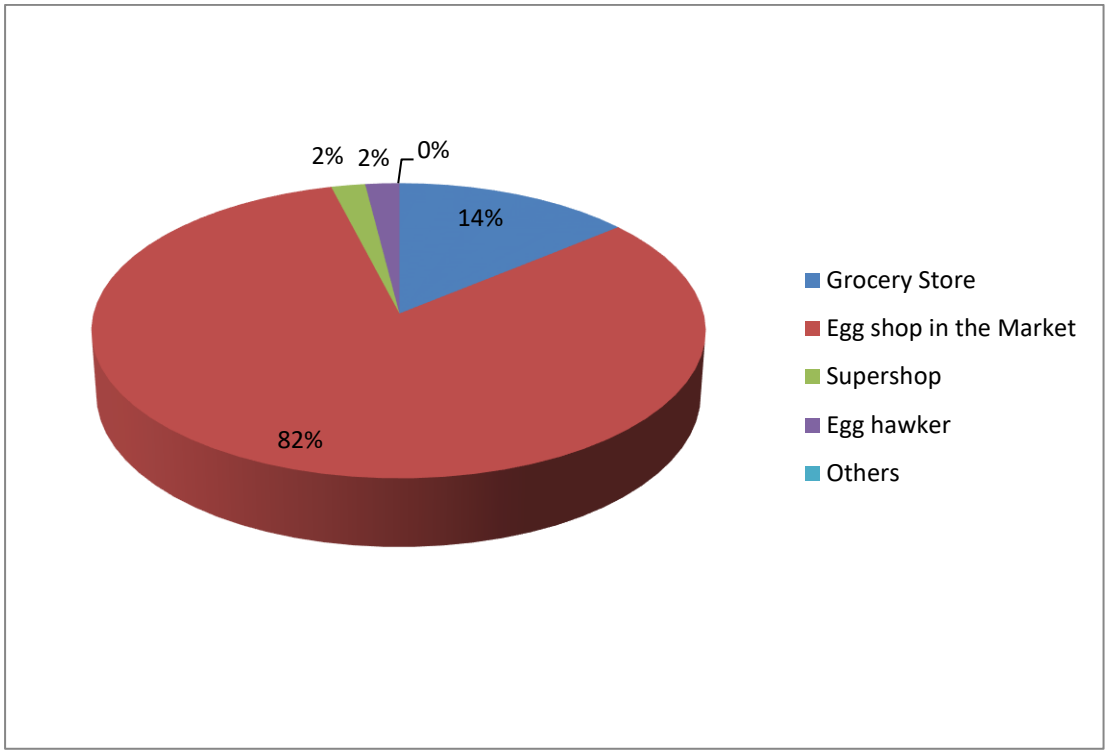


Fig 4.4.3: Source of buying eggs

Survey showed that 6% respondents buy liquid milk packaged from super shop, 6% packaged from grocery stores, Nobody (0%) purchase open liquid milk from market, 34% bringing milk from the village house for several days, 48% herdsman come here to give and sources of buying liquid milk from other source was 6% (Fig 4.4.4).

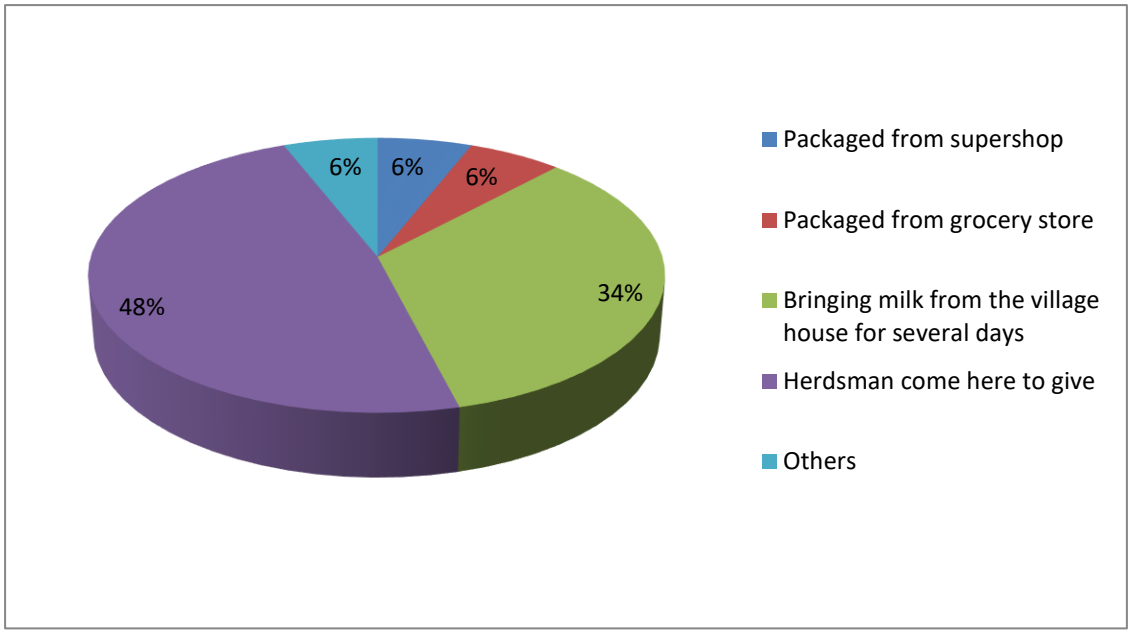


Fig 4.4.4: Source of buying liquid milk

Another survey revealed that after buying liquid milk 30% respondents first put it in a normal fridge and then eat it with fire wood, 46% put it in the deep fridge and after a few days take it down and eat it with fuel, 16% when the herdsman comes home and gives milk, immediately eats it with firewood, 4% buy a packet of milk and eat it with firewood, No one (0%) buy a packet of milk and eat it without firewood and other process 4% (Fig 4.4.5).

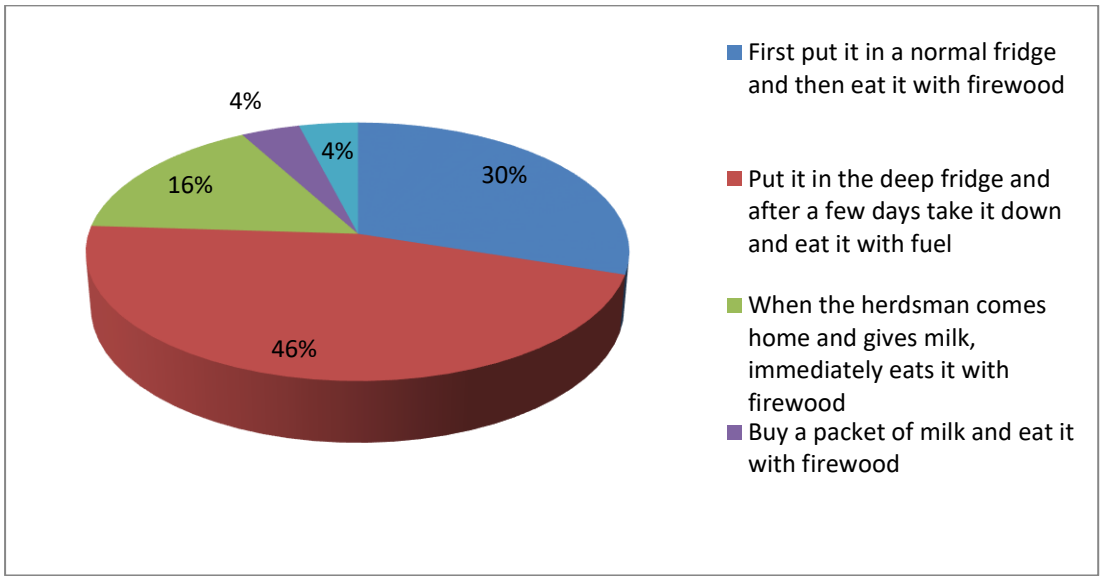


Fig 4.4.5: Process of storing liquid milk

It showed that 32% respondents always refrigerate cooked food together with other foods, 54% respondents sometimes and 14% respondents never refrigerate cooked food together with other foods (Fig 4.4.6).

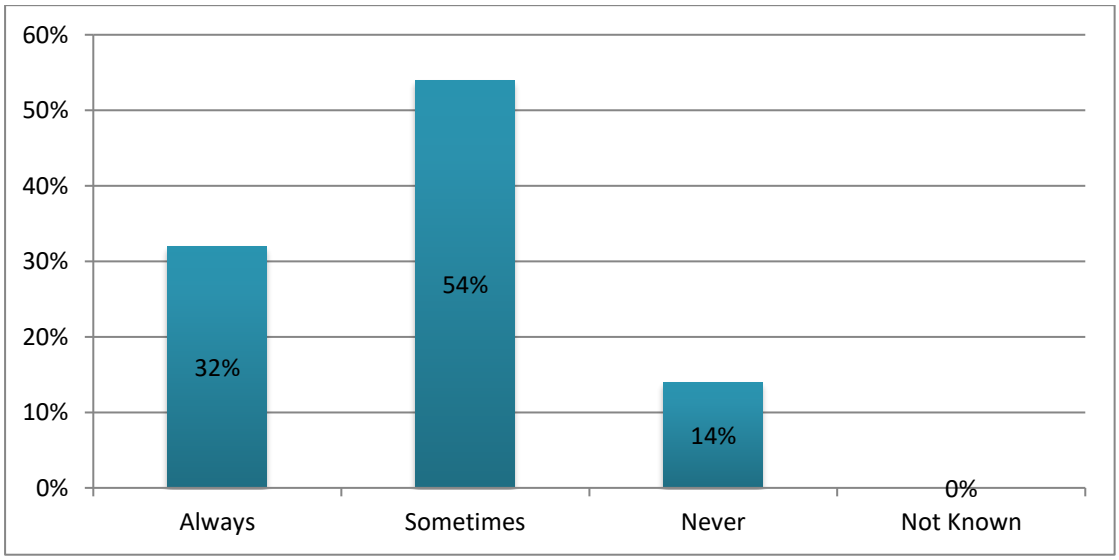


Fig 4.4.6: Refrigeration of cooked food with other foods

It also indicated that 50% respondents always refrigerate cooked food in airtight plastic boxes, 30% respondents sometimes, 18% respondents never refrigerate cooked food in airtight plastic boxes and only 2% respondents have no idea (Fig 4.4.7).

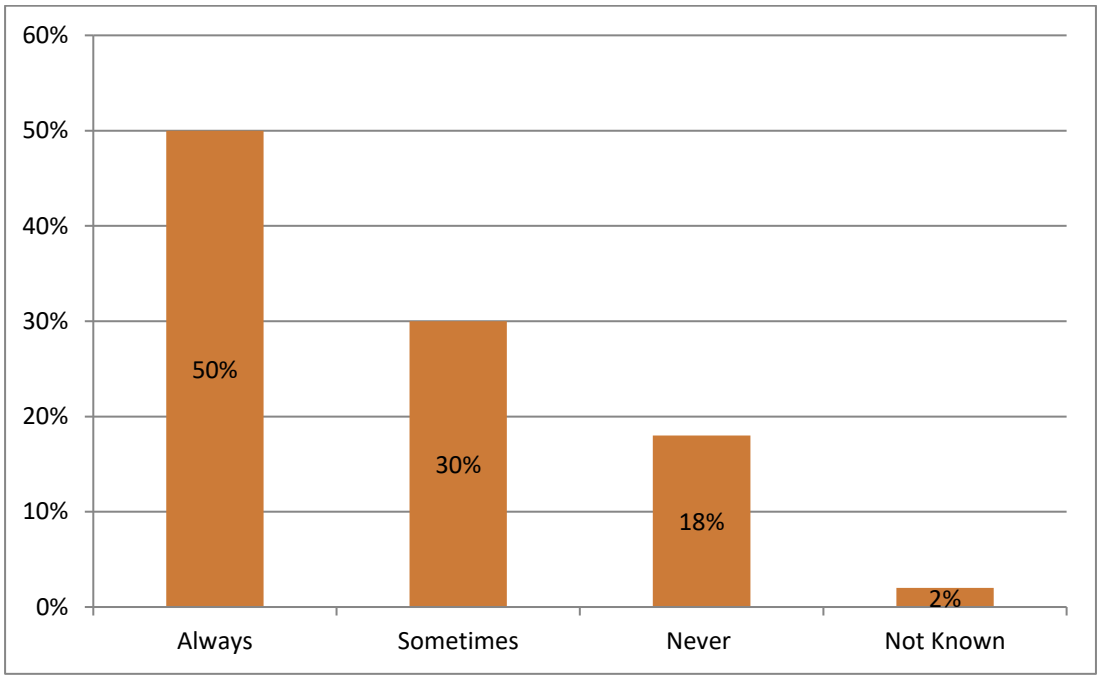


Fig 4.4.7: Refrigeration the cooked food in airtight plastic boxes

The findings revealed that 22% respondents sometimes reuse used milk packets for various purposes and 78% respondents never reuse used milk packets for various purposes (Fig 4.4.8).

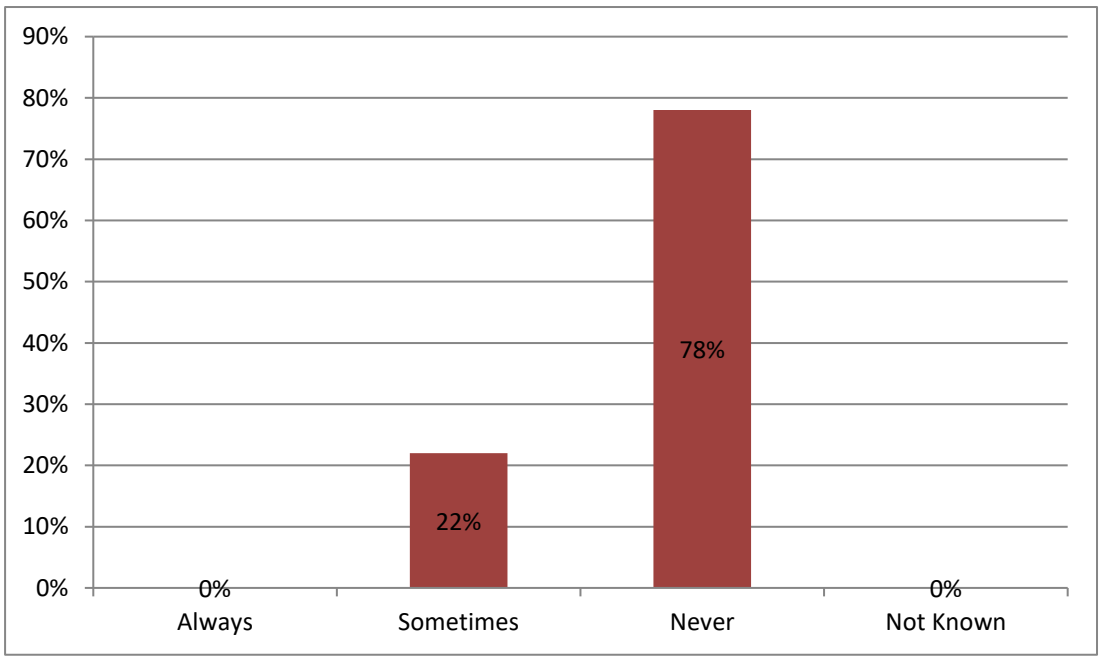


Fig 4.4.8: Reuse used milk packets for various purposes

It also notified that 30% respondents always reuse used milk bottles for various purposes, 22% respondents sometimes and 48% respondents never reuse used milk bottles for various purposes (Fig 4.4.9).

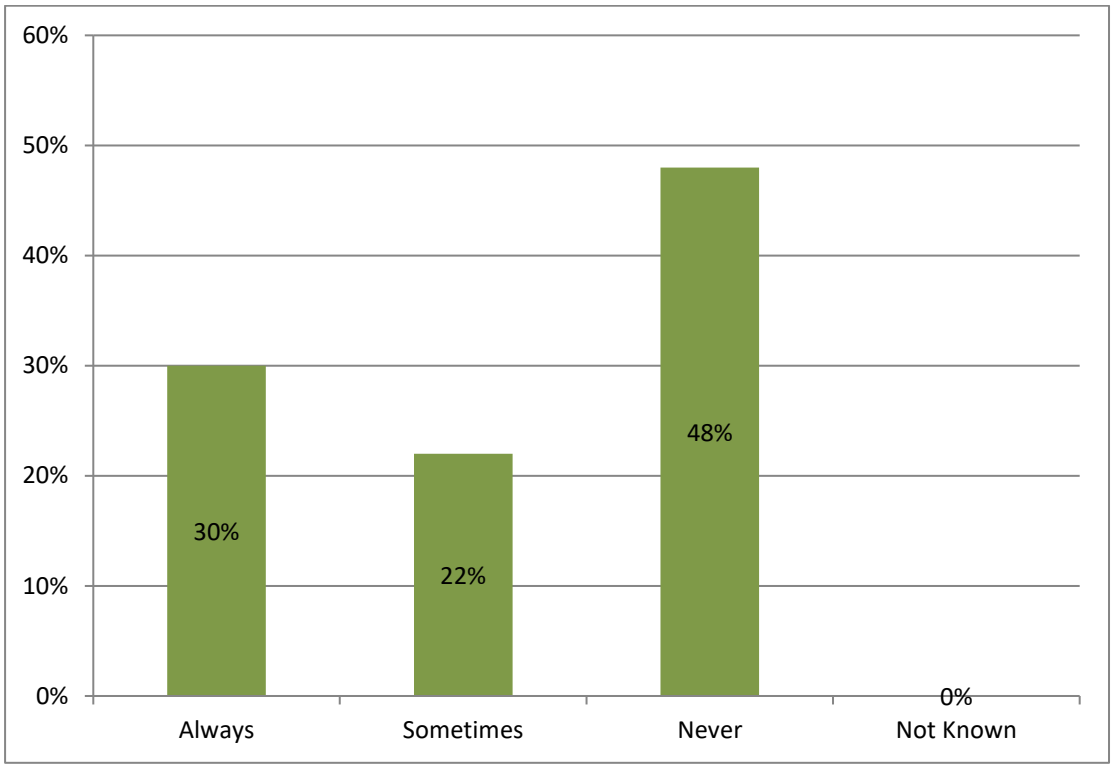


Fig 4.4.9: Reuse used milk bottles for various purposes

In the context of above result it can be said that most of the families are more conscious about food safety practices which support to less chance of outbreak of foodborne disease. These results are in agreement with those of previous researchers Kaferstein (2003) in their study explained that there are several studies which discussed the main causes of microbial contamination typically occurring in food service establishments. They are contaminated supplies, dirty food contact surfaces, poor personnel hygiene practices, inappropriate storage temperatures and insufficient cooking. WHO (2004) reported that inappropriate temperature, inadequate refrigeration, improper cooking and reheating were involved in most of the households. Improper food handling, insufficient hygiene, cross contamination and reusing leftover food were also reported among food handlers.

4.5 Assessment of Microbiological Analysis of Milk

A total of 6 liquid milk samples were collected from Sher-e-Bangla Agricultural University (SAU) Campus. Among them 4 raw milk samples from dairy farm and 2 Pasteurized milk from SAU market. The liquid milk samples were subjected to Animal Nutrition, Genetics and Breeding laboratory and Dairy Science laboratory of SAU to determine the microbial load. The results of bacterial distribution in the collected samples are as follows:

4.5.1 Total viable bacterial count (TVBC)

Total Viable Count (TVBC) of bacteria was carried out on plate count agar media using pour plate techniques. The results presented in Table 1, showed that the TVBC (cfu/ml) were (3.00±1.00) x 10^7 , (1.27±0.08) x 10^7, (4.53±015) x 10^7 and (3.52±0.08) x 10^7 for sample 1, sample 2, sample 3 and sample 4 respectively collected from different sources. The TVBC (cfu/ml) counts for pasteurized milk (samples 5 and sample 6) were (7.53±0.15) x 10^2 and (4.00±0.12) x 10^2 respectively.

Table-1: Counts of TVBC in different raw milk

Sample No.	Types of Milk	Experiment Value	Standard Value*
01	Raw Milk	$(3.00^a \pm 1.00) \times 10^7$ cfu/ml	$1.3 \times 10^7 - 5.2 \times 10^8$ cfu/ml
02	Raw Milk	$(1.27^b \pm 0.08) \times 10^7$ cfu/ml	$1.3 \times 10^7 - 5.2 \times 10^8$ cfu/ml
03	Raw Milk	$(4.53^a \pm 0.15) \times 10^7$ cfu/ml	$1.3 \times 10^7 - 5.2 \times 10^8$ cfu/ml
04	Raw Milk	$(3.52^a \pm 0.08) \times 10^7$ cfu/ml	$1.3 \times 10^7 - 5.2 \times 10^8$ cfu/ml

***Source : USPHS**

Here, Values are Mean ± SE (n=12) one way ANOVA (SPSS, Duncan method).

- ✓ Mean with different superscripts are significantly different (P<0.05)
- ✓ Mean within same superscripts don't differ (P>0.05) significantly
- ✓ SE = Standard Error

Table-2: Counts of TVBC in different brands of pasteurized milk

Sample No.	Types of Milk	Experiment Value	Standard Value*
05	Pasteurized Milk	(7.53±0.15) x 10^2 cfu/ml	Not more than 2 x 10^4 cfu/ml
06	Pasteurized Milk	(4.00±0.12) x 10^2cfu/ml	Not more than 2 x 10^4 cfu/ml

***Source : USPHS**

Here, Values are Mean ± SE (n=6) one way ANOVA (SPSS, Duncan method).

- ✓ Mean with different superscripts are significantly different (P<0.05)
- ✓ Mean within same superscripts don't differ (P>0.05) significantly
- ✓ SE = Standard Error

4.5.2 Total coliform count (TCC)

The measures of TCC (cfu/ml) were found (24.33±1.86) x 10^4 , (3.33±0.58) x 10^4, (6.00±1.53) x 10^4 and (18.00±1.73) x 10^4 in sample 1, sample 2, sample 3 and sample 4 respectively collected from different sources (Table 2). The results also stated that there was absence of TCC in both pasteurized milks (sample 5 and sample 6).

Table-3: Counts of TCC in different raw milk

Sample No.	Types of Milk	Experiment Value	Standard Value*
01	Raw Milk	(24.33^a±1.86) x 10^4cfu/ml	$1.0 \times 10^4 - 4.2 \times 10^4$cfu/ml
02	Raw Milk	(3.34^c±0.58) x 10^4cfu/ml	$1.0 \times 10^4 - 4.2 \times 10^4$cfu/ml
03	Raw Milk	(6.00^c±1.53) x 10^4cfu/ml	$1.0 \times 10^4 - 4.2 \times 10^4$cfu/ml
04	Raw Milk	(18.00^b±1.73) x 10^4cfu/ml	$1.0 \times 10^4 - 4.2 \times 10^4$cfu/ml

***Source : USPHS**

Here, Values are Mean ± SE (n=12) one way ANOVA (SPSS, Duncan method).

- ✓ Mean with different superscripts are significantly different (P<0.05)
- ✓ Mean within same superscripts don't differ (P>0.05) significantly

✓ SE = Standard Error

Table-4: Counts of TCC in different brands of pasteurized milk

Sample No.	Types of Milk	Experiment Value	Standard Value*
05	Pasteurized Milk	Nil	Nil
06	Pasteurized Milk	Nil	Nil

*** Source : USPHS**

The investigation on microbial analysis of raw and different brands of pasteurized milk was conducted to evaluate milk samples obtained from two important sources viz., raw and pasteurized milk. The study revealed that the total viable counts (TVBC) for 4 raw milk samples were ranges from $(1.27^{b}\pm0.08) \times 10^{7}$ to $(4.53^{a}\pm0.15) \times 10^{7}$ cfu/ml which was remained in the standard value ($1.3 \times 10^{7} - 5.2 \times 10^{8}$ cfu/ml) of raw milk. So, these raw milk samples can be certified as good quality milk on the basis of TVBC. In this analysis it was seen that sample 1, sample 3 and sample 4 have significant different ($P<0.05$) with sample 2 but have no significant difference ($P>0.05$) among them. The results also notified on the basis of Total Coliform Count (TCC) that sample 1, sample 3 and sample 4 were not matched with the standard value ($1.0 \times 10^{4} - 4.2 \times 10^{4}$ cfu/ml) but sample 2 was between the range of standard value. So, sample 2 can be certified as Grade-A quality raw milk. After analyzing it was seen that sample 1 has significant difference ($P<0.05$) with sample 4. Again, Sample 4 has significant difference ($P<0.05$) with sample 2 and sample 3 but sample 2 and sample 3 have no significant difference ($P>0.05$) with one another. The results of TVBC for two brands of pasteurized milk (sample 5 and sample 6) were $(7.53\pm0.15) \times 10^{2}$ cfu/ml and $(4.00\pm0.12) \times 10^{2}$ cfu/ml which was matched with the standard value (not more than 2×10^{4} cfu/ml) and there was no significance difference between sample 5 and sample 6. The results of TCC for two brands of pasteurized milk (sample 5 and sample 6) were nil (absence of coliform bacteria) also resembled with the standard value. So, these pasteurized milk also considered as good quality milk on the basis of both on TVBC and TCC value. United State standards recommended, each ml of raw milk for pasteurization must have less than 3×10^{5} cfu/ml. Unfortunately, the results of TVBC ranged from $(1.27^{b}\pm0.08) \times 10^{7}$ to

$(4.53^{a}\pm0.15)$ x 10^{7} cfu/ml is almost far greater than the United State standard. The reason for high bacteria count in the raw milks may include defective machinery and contamination such as poor processing and handling conditions and/or poor worker hygiene. Coliforms are considered as indicator organisms because their presence in food indicates some form of contamination. The coliforms standards for Grade 'A' pasteurized milk and milk products should not be over 10/ml (BSTI, 2000) and for certified pasteurized milk should not be over 1/ml. So, the present investigation however remained in the recommended level of BSTI (2002). Both pasteurized milk samples were adjusted with the BSTI level. Therefore, these pasteurized milk can be suggested for human consumption as it fulfill the recommended level of BSTI.

CHAPTER V

SUMMARY AND CONCLUSION

Present study was conducted in different residential building of SAU Campus to determine the food safety practices by residential people. The study was comprised of field survey and laboratory examination.

The survey showed that more than 60% respondents were highly educated (graduate) and most of the families were nuclear family. This survey notified that most of the family lead a moderate life as their approximate food expenditure of a family per month between the range of 10,000 taka to 30,000 taka. Surprisingly, the Survey discovered that 28% respondents have idea about food safety act 2013 and 72% respondents have no idea. It also revealed that 34% respondents have idea about food safety authority and 66% respondents have no idea. After this survey analyzing it can be said that most of the respondents have lack of knowledge about food safety authority and act 2013. This could be a reason for lacking of publicity of food safety authorities or respondents have lack of awareness on food safety issues. Another survey exposed that 44% respondents have idea about directorate of national consumer rights protection and 56% have no idea. Even only 24% respondents have idea about consumer rights protection act 2009 and 76% respondents have no idea. Survey also revealed that only 2% respondents have complained in the directorate of national consumer rights protection and 98% respondents made no complain. This result showed that most of the respondents were apathetic about their rights. This can be a cause of lack of knowledge about consumer rights and acts. Also directorate of national consumer rights protection should take initial steps to make conscious about consumer rights and acts. Having another important survey showed that 86% of children of the family of respondents always wash their hands with soap before and after eating and 14% of the children of the family of respondents sometimes wash their hands with soap before and after eating . It also visualized that 44% housekeeper (workman) always wash his hands with soap after using the toilet, 2% sometimes wash his hands with soap after using the toilet , 6% respondents do not know either wash his hands with soap after using the toilet or not and 48% respondents have no housemaid at home. In the context of above result it can be said that almost all families are conscious about their children and housekeeper are they washing their hand with soap before or after taking meal and after using the toilet. So, proper

hygienic management practiced by children and housekeeper of residential people. It also revealed that maximum respondents store eggs with washing in the fridge and eat with fire before drinking milk. Also 50% respondents always refrigerate cooked food in airtight plastic boxes, 30% respondents sometimes, 18% respondents never refrigerate cooked food in airtight plastic boxes and only 2% respondents have no idea. Therefore, analyzing this result, it can be said that most of the families are more conscious about food safety practices which support to less chance of outbreak of foodborne disease. The investigation on microbial analysis of raw and different brands of pasteurized milk was conducted to evaluate milk samples obtained from two important sources viz., raw and pasteurized milk. TVBC and TCC tests were performed to determine the microbial load. During TVBC count it was noticed that all raw milk samples were present at the range of standard value but have significant difference ($P<0.05$) among them. Pasteurized milk (sample 5 and sample 6) were also remained between the range of standard value but have no significant difference ($P>0.05$). The results of TCC for sample 1, sample 3, sample 4 were more than the standard value but sample 2 remained between the range of standard value and there was a significant difference ($P<0.05$) among the samples. The results of TCC for two brands of pasteurized milk (sample 5 and sample 6) were nil (absence of coliform bacteria) also resembled with the standard value. The present investigation however both pasteurized milk remained in the recommended level of BSTI (2002).Therefore, these pasteurized milk can be suggested for human consumption as it fulfill the recommended level of BSTI.

Recommendation

Based on the findings and conclusions of the study, the following recommendations are presented:

i. It may be recommended that attempts should be taken by food safety authority as well as DLS and other extension providers to arrange training, motivational campaigning and provide food safety guide for increasing knowledge on safe food practices.

ii. Attempts should be taken to establish adult learning centre to increase educational level as well as awareness on safe food practices.

iii. Similar studies may be undertaken in other parts of the country to verify the findings of present study.

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APPENDICES

"FOOD SAFETY PRACTICES BY RESIDENTIAL PEOPLE LIVE IN SHER-E-BANGLA AGRICULTURAL UNIVERSITY (SAU) CAMPUS AND PATHOGEN PRESENT IN MILK FOUND IN SAU MARKET: A FOOD SAFETY ISSUE"

Dept. of Animal Nutrition, Genetics & Breeding, SAU
(Funded by: Ministry of Science & Technology)

Questionnaire for Household Survey

❖ Basic Information of Respondents

1.Name:……
2. Address: Home No…… Building Name…… Floor……
Colony/ Road Name……, Mobile No……
3. Gender: Male ☐ Female ☐
4.Education Qualification:Class eight or less ☐ SSC ☐ HSC ☐ Honors ☐ Masters ☐
5. Occupation: Teacher ☐ Service Holder ☐ Business ☐ Housewife ☐
Student ☐ Others ☐…….(Please Specify)
6. Number of Family Member: …….
7. Approximate Food Expenditure of a Family (Per Month): …….. Taka

❖ Concern about Food Safety Acts and Regulations

8. Do you have idea about Food Safety Act 2013? Yes ☐ No ☐
9. . Do you have idea about Bangladesh Food Safety Authority? Yes ☐ No ☐
10.Do you have idea about Directorate of National Consumer Rights Protection? Yes ☐ No ☐
11. . Do you have idea about Consumer Rights Protection Act 2009? Yes ☐ No ☐
12. Do you complain in the Directorate of National Consumer Rights Protection? Yes ☐ No ☐
13. Have you find any remedy when complain in the Directorate of National Consumer Rights Protection? Yes ☐ No ☐

❖ Food Safety Practices by Residential People

14. Do the children of the family wash their hands with soap before eating?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
15. Do the children of the family wash their hands with soap after eating?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
16. Do the children of the family wash their hands with soap after using toilet?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
17. Does the housekeeper(workman) wash his hands with soap after using the toilet?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐ No housemaid at home ☐

❖ Food Safety Related Information

18. Do you buy eggs and store in the Fridge?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
19. If you store eggs in the fridge,do you wash the eggs and keep them in the Fridge?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
20.From which source do you buy eggs?
Grocery Store ☐ Eggs shop in market ☐ Supershop ☐ Egg hawker ☐ Others ☐
21. From which source do you buy liquid milk?
Packaged to be Supershop ☐ Packaged from Grocery store ☐ Purchase open liquid milk from Market ☐ Bringing milk from the village house for several days ☐ Herdsman come here to give ☐ Others ☐
22. How to buy and store liquid milk?
First put it in a normal Fridge and then eat it with firewood ☐ Put it in the deep freeze and after a few days take it down and eat it with fuel ☐ When the herdsman comes home and gives milk,immediately eats it with firewood ☐ Buy a packet of milk and eat it with firewood ☐ Buy a packet of milk and eat it without Firewood ☐ Others ☐
23. Do you Refrigerate cooked foods together with other foods?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
24. If other foods are refrigerated together with cooked food,do you refrigerate the cooked food in airtight plastic boxes?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
25. Do you reuse used milk packets for various purposes(packing fish/meat in deep freezer etc.)?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
26. Do you reuse used milk bottles(which the cowherd passes through the house) for various purposes (return to the cowherd the next day so that they can be reused)?
Always ☐ Sometimes ☐ Never ☐ Not Known ☐
27. How to remove other kitchen waste, including egg shells?
Give it to the garbage collector everyday ☐ Sometimes give it to the garbage collector ☐ I throw it in the garbage place everyday ☐ Sometimes i throw it in the garbage place ☐ Others ☐ ……..(Please Specify)
28. Where do you store the waste inside the house everyday before removing other kitchen waste including egg shells?
Pile it on the floor & store it on one side ☐ Put it in a polythene bag ☐ Put it in a garbage basket ☐ Put it in a bucket ☐ Others ☐ ……(Please Specify)

Interviewers Name, Sign & Date: ……..

Mobile No…….