AN OVERVIEW OF HYGIENE PRACTICES AND HEALTH RISKS RELATED TO STREET FOODS AND DRINKING WATER FROM ROADSIDE RESTAURANTS OF KHULNA CITY OF BANGLADESH

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ABSTRACT

The interest of people having restaurants food is increasing day by day and most of them are not aware of the consequence of eating too much restaurant food. Food from roadside restaurants is frequently contaminated by in a various way like restaurants location, raw materials used to prepare food, used utensils and equipment, storage and reheating of food, personal hygiene of vendors. Many people face various foodborne illnesses by eating contaminated food from roadside restaurants. Though the immune system of people is habituated with this food, they have that food more or less regularly here. But when the microbiological system of the body can't afford this contaminated food, people have to face some serious life danger foodborne diseases. The main purpose of the research is to find out the source of contamination of food, for this type of diseases people have to face, create awareness among people about this contaminated food and their diseases and suggest some precaution measures. Foods and water sample from different wards of Khulna city have been collected and some of the hygiene parameters like pH, Turbidity, Electrical Conductivity, Chloride, Hardness, Total Dissolve Solid, Nitrate, Iron, Arsenic, total Coliform, and Fecal Coliform of those samples are being tested in the laboratory. Though most of the drinking water and food sample from various wards of Khulna City are quite satisfying from contamination but the water sample from wards 3, 5, 21, 23 and food sample from wards 2, 17, 18 are seriously contaminated with coliforms which may cause serious waterborne as well as foodborne diseases.

Keywords: Consumer Food Handling, Consumer Perception, Foodborne Illness, Sources of Contamination, Food Safety Measure.

1. INTRODUCTION

One of the basic needs of people is food and water is another name of life where the human body consisting of 75% of water [1, 2]. In the present era of the ever-increasing population with haphazard growth in the cities and towns as well as tremendous growth in Industrialization makes people much more dependent on restaurant food rather than homemade food [3]. Roadside Restaurants are an integral part of cities with diverse communities, distinct food cultures, and large population engaged in unskilled and low paid jobs. Besides, it is a 'cherished part of local culture' that is also an attraction for tourists in many cities. In 1970, Environmental audit originated in the United States as a way of checking the weather a company was complying with a multitude of new environmental laws and regulations[4, 5]. The International Chamber of Commerce defines the "environmental audit" as the systematic examination of the interactions between any business operations and is surroundings. Two types of environmental audits are possible and these are compliance audits and management systems audits. The auditor identifies the propositions before them for analysis, obtains evidence, evaluates the same and form an opinion on the basis of his judgments which is connected through their audit report. Nowadays, public health is mostly hampered by various unknown diseases most of them are related to food and drinking water [6, 7]. The foods are manufactured in the roadside restaurants are the great source of unknown foodborne diseases as well as the water served in the roadside restaurants are the great source of unknown waterborne diseases [8]. There is so much way of contamination of foods in roadside restaurants such as preparing foods without washing hands, below quality raw materials of foods, using the same oil again and again for grilling [9]. Utensils used to serve water to the customer, the medium used to collect drinking water from the source, the pot used to keep the drinking water are the major sources of contamination of drinking water in roadside restaurants. Americans, on average, drink one liter of water a day and 95% drink less than three liters per day [10]. Up to 16 liters of water required for them who are work in a hot climate. Water is essential for life. In Bangladesh, the consumption of street foods is increasing day by day as people are currently becoming too much fond of these street foods rather than homemade food. On the other hand, sometimes people don't have any other option left without having these foods. Though people are eating these foods they have a clear perception that foods from roadside restaurants are unsafe, unhygienic mainly because of the environment under which they are prepared and consumed which exposes them to numerous potential contaminants [11, 12]. Roadside

restaurants are usually set up in a location which exposes to numerous potential contaminants since food and water are not properly covered. A large number of experimental foodborne and waterborne disease are spread through the consumption of these foods and drinking water. Roadside restaurants change to different flavor as time moves from breakfast to lunch and afternoon to evening [13]. Major customers of roadside restaurants include the common urban citizens that consist of an employee who constantly move like sale representatives and students from schools, colleges and universities for whom roadside restaurants offer a quick meal at a reasonable cost. Roadside restaurants in Khulna have experienced phenomenal growth in the last 10 years and more particularly during the last 5 years with the manifold increase in the number of customers. Our survey had to done total of 31 wards in Khulna city with a population of 1.5 million. A major reason for investigating the quality of foods and drinking water from roadside restaurants is that the graph of patients with food and water-related diseases in Khulna city is increasing day by day. Foodborne diseases severely affect infants, young children, elderly people who ultimately create a vicious cycle of diarrhea and malnutrition. Microorganisms depend on someone or something to move them around. The transfer of microorganisms from one place to another is called "contamination". The most common symptoms of foodborne disease are Stomach pains; vomiting; and Diarrhea. The symptoms depend on the cause of the disease. Symptoms are readily notified after having the food, it may take days or even weeks to appear. In the case of foodborne diseases, symptoms may identify 24 -72 hours after eating the food. Foodborne illness occurs in two different reasons. They are Food Intoxication, Food Infection. The food contamination and food adulteration situation of Bangladesh is a serious health concern. Unsafe as well as contaminated food is the foundation of many acute and chronic diseases, like diarrheal diseases to various forms of cancer. According to WHO, globally about 2.2 million people annually, of the 1.9 million are children are killed by foodborne and waterborne diarrheal diseases [14]. Though on 14 September 2015, more than 200 well equipped and environment-friendly food carts are handed over among 200 trained vendors by Khulna City Corporation with the help of FAO and Government of Netherlands, there are lots of unhygienic roadside restaurants are available around Khulna city which is the source of food and water-related diseases. As Khulna is one of the divisional as well as one of the most important economic zones with respect to Bangladesh economic condition, so the immune system and health risks factors of the people of Khulna city need to be analyzed. As Bangladesh is one of the most promising economically developing country among sub-continent countries so its economical decay will greatly impede the growth of financial condition of South East Asian countries and so it will adversely affect the world economic condition. That's why to pick these topics taking concern about the immune system of Khulna mass people.

2. CLASSIFICATION AND ORIGIN OF CONTAMINATION

Public health is facing a great risk because of increasing foodborne diseases, with most recent times of 9.4 million cases per year in the United States resulting in 1,351 deaths. There is also growing evidence that individuals of minority racial and ethnic groups suffer from greater rates of some foodborne illnesses. There are 4 types of contamination is possible which are biological contamination [15], Chemical contamination, Physical contamination [16], Cross contamination [17]. There is some common source of contamination are indicated as the Location of roadside restaurants such as over drain, side of dustbin, corner of heavy traffic roads, Place of preparation, Raw materials, Uncovered foods, Foods are expose to dust and flies, Time and temperature abuse of cooked foods, Improper food handling and waste disposal, Unsanitary handling, and Personal hygiene of vendors.

3. MATERIALS AND METHODS

Initially, the drinking water and foods from roadside restaurants were collected from various wards of Khulna city. Then the water quality parameter of drinking water and biological parameter of foods were analyzed in the laboratory to observe the standard of the drinking water and foods served in the roadside restaurants and also to study the people affected by various food borne diseases after having this food and waterborne diseases by drinking water.

3.1. Site Selection

Among 31 wards of Khulna city, food and water sample from different 11 wards had been collected. These wards are W2, W3, W4, W5, W6, W8, W9, W17, W18, W21, and W23.
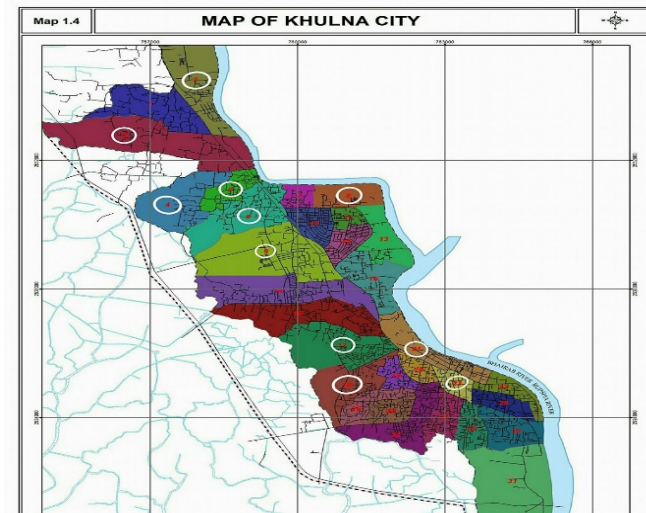
Fig. 1. Location of the selected wards in Khulna city.

3.2. Sample Collection and Laboratory Analysis

Drinking water and food samples were collected in a plastic bottle and plastic zipper bag respectively from different 11 wards of roadside restaurants. Sample water and food for test kept separated in plastic bottles and plastic zipper bag. Food samples were undergone in a customized lab preparation. Food samples were submerged in water for 24 hours then collected the water samples and tested the biological parameters like Total Coliform and Fecal coliform.

3.3. Chemical Analysis

Foods and drinking water samples were collected from roadside restaurants from different wards in Khulna city. Then water samples were undergo some laboratory analysis of qualitative hygiene parameters like pH, Turbidity, Electrical Conductivity, Chloride, Hardness, Total Dissolve Solid, Nitrate, Iron, Arsenic, Total Coliform, and Fecal Coliform [18].

3.4. Biological Analysis

Biological parameter like Total Coliform (TC) and Fecal Coliform (FC) were tested for food samples [18]. TC bacteria are not likely to cause illness, but their presence indicates that your water supply may be vulnerable to contamination by more harmful microorganisms.
FC are bacteria that are associated with human or animal wastes. They usually live in human or animal intestinal tracts, and their presence in drinking water is a strong indication of recent sewage or animal waste contamination.

4. RESULTS AND DISCUSSION

The results obtained from different tests performed to find out different parameters of drinking water and foods collected from laboratory analysis to evaluate the characteristics of drinking water and foods are described in Table 1 and Table 2.

Table 1. Different Quality Parameters of drinking water from roadside restaurants of different wards of Khulna City

Parameters	Unit	W 2	W 3	W 4	W 5	W 6	W 8	W 9	W 17	W 18	W 21	W 23	BD St.	WHO St.
pH	-	7.7	8.4	8.5	8.01	8.03	7.6	7.9	8.2	8.4	7.9	8.1	6.5-8.5	-
Turbidity	NTU	11.3	1.5	2.1	2.5	1.6	2	.8	1.7	1.3	2.5	2.3	10	5
EC	µS/cm	1422	795	950	1409	2270	1159	797	1298	691	1226	1585	1200	-
Chloride	mg/l	240	97.5	90	250	780	140	47.5	250	57.5	280	362.5	150-600	250
Hardness	mg/l	509	194	268	416	560	500	407	250	120	259	333	200-500	
TDS	mg/l	810	850	520	600	1320	320	360	620	350	280	860	1000	1000
Nitrate	mg/l	0.3	0.8	6.5	0.2	0.8	0.4	0.1	0.4	1	0.7	1	10	50
Total Iron	mg/l	0.12	0.11	0	0.03	0.12	0.04	1.1	0.09	0.11	0.1	0.14	0.3-1	0.3
As	mg/l	0	0	0	0	0	0	0	0	0	0	0	0.05	0.01
TC	No	0	3	0	7	0	0	0	0	0	2	1	0	0
FC	No	0	1	0	5	0	0	0	0	0	2	1	0	0

Table 2. Biological Quality Parameters of foods from roadside restaurants of different wards of Khulna City

Parameters	Unit	W 2	W 3	W 4	W 5	W 6	W 8	W 9	W 17	W 18	W 21	W 23	BD St.	WHO St.
TC	No	9	0	0	0	0	0	0	9	4	0	0	0	0
FC	No	5	0	0	0	0	0	0	0	0	0	0	0	0

4.1. Graphical Comparison of Results

Figure 2 illustrates the variation of pH values of different wards with the standard variation of drinking water. The standard value of pH for drinking water lies within 6.5-8.5. The wide narration in the pH value of effluent can affect the rate of biological reaction and survival of various microorganisms. All the values were within the range of standard value.
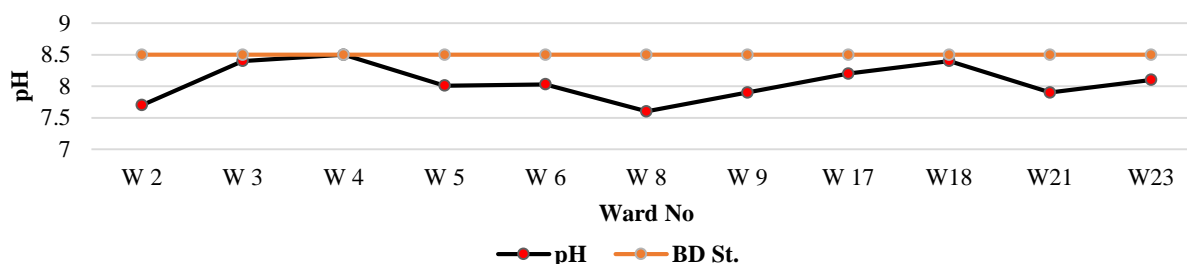

Fig. 2. Variation of pH of drinking water from different wards of Khulna city.

In figure 3, it shows that different Turbidity parameter values of different 11 wards among 31 wards of Khulna city and it indicates that all wards sample is in the standard range of Turbidity with respect of Bangladesh except ward no 2. The standard range of Turbidity in Bangladesh is 10 NTU.
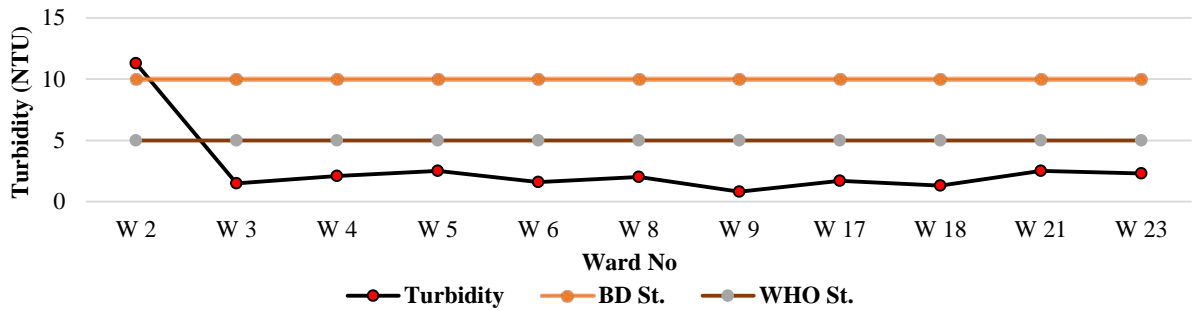
Fig. 3. Variation of Turbidity of drinking water from different wards of Khulna city.

In figure 4, it indicates that several no. of wards are exceeding the standard value of Electrical Conductivity such as wards no 2, 5, 6, 17, 23 and other different 6 wards are in the standard range. The standard value of EC in Bangladesh is 1200 µS/cm. five different wards which have higher value of EC compare with the standard value and it causes some health risks issue like nausea, cramps, diarrhea, and associated headaches.
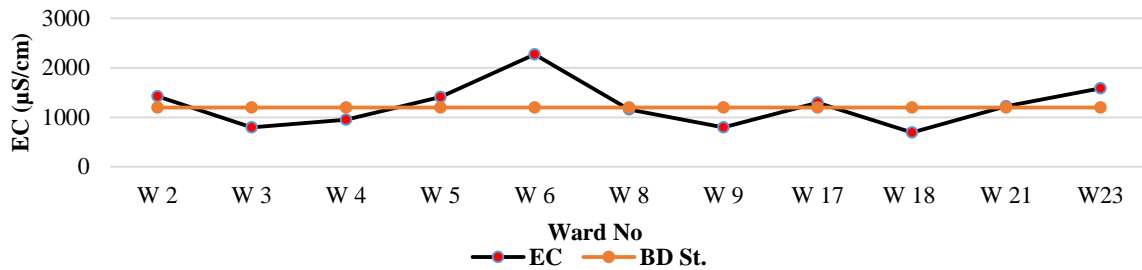

Fig. 4. Variation of Electrical Conductivity of drinking water from different wards of Khulna city.

Chloride in drinking water is not harmful, and most important parts are related to the frequent association of high chloride levels with elevated sodium levels. In figure 5 illustrates that only ward no 6 has a higher value than the standard value of chloride according to Bangladesh.
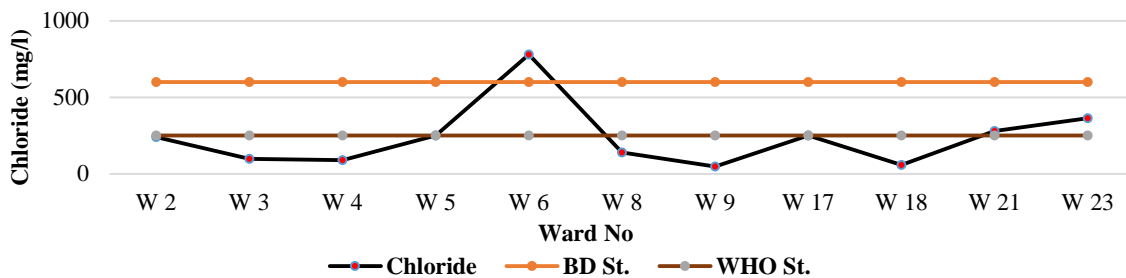
Fig. 5. Variation of Chloride of drinking water from different wards of Khulna city.

In figure 6 demonstrates, the variation of the hardness of different drinking water sample of different 11 wards. The satisfying fact is that all the different wards samples of water are in the standard range of Hardness in case of Bangladesh. So, it can assure that drinking water samples of different wards are free from any kind Hardness related hazardous effect.
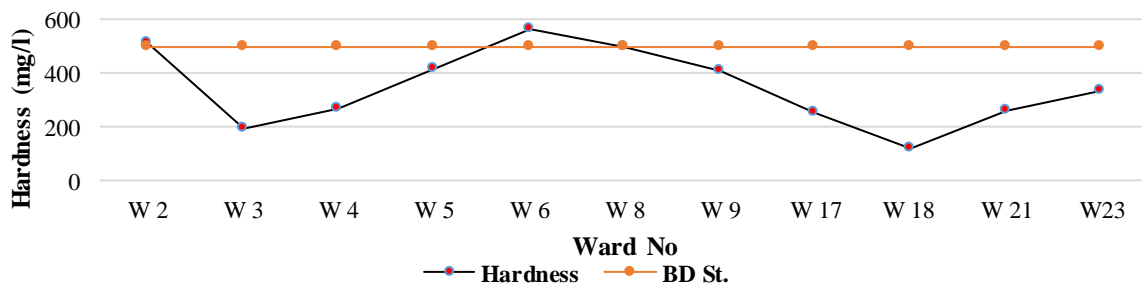
Fig. 6. Variation of Hardness of drinking water from different wards of Khulna city.

Through lab findings, It comes to know that wards no 6 exceed the standard range of TDS according to Bangladesh. But another fact is that Water with extremely low concentrations of TDS may also be unacceptable to consumers because of its flat, insipid taste. So in figure 7, it represents that water sample from ward 4, 8, 9, 18, 21 have a low concentration of conductivity which is not so good.
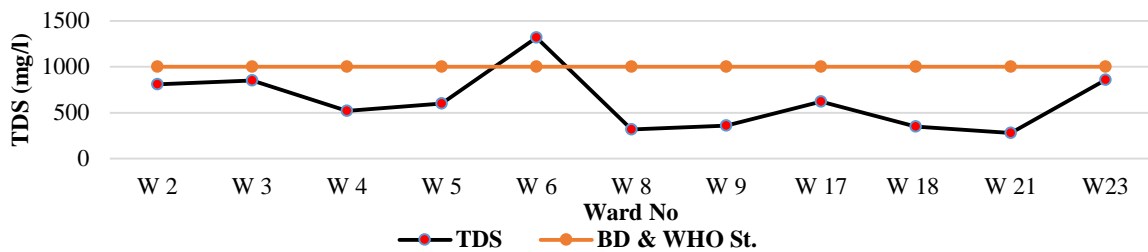

Fig. 7. Variation of Total Dissolve Solid of drinking water from different wards of Khulna city

Figure 8, illustrates the difference of nitrate concentration of different drinking water samples. Here it represents that all samples of different wards are in the range of Bangladesh Standard.
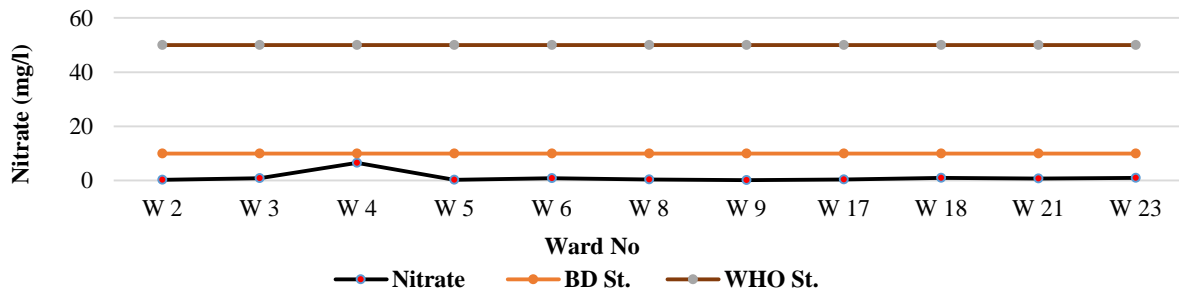

Fig. 8. Variation of Nitrate of drinking water from different wards of Khulna city.

Figure 9 presenting that value of total iron of wards no 9 exceeds the standard value of Bangladesh but all other wards sample is in the standard range.
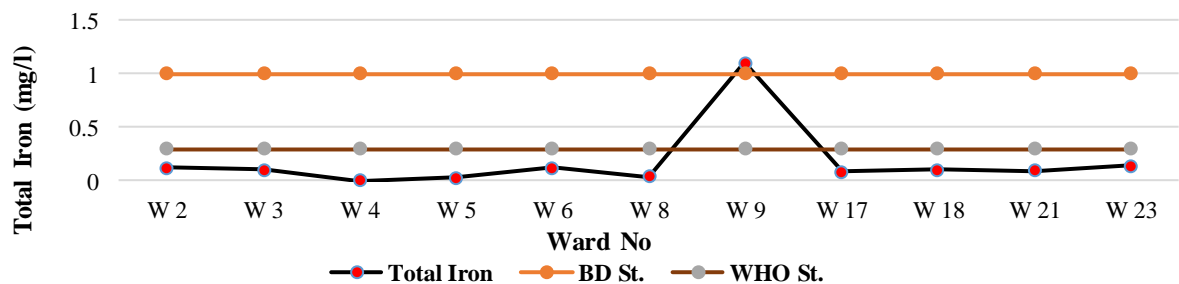

Fig. 9. Variation of Total Iron of drinking water from different wards of Khulna city.

Here figure 10 show that there was no arsenic in each one of eleven different wards water sample. It is a good scenario that roadside restaurants are offering water to their customers is free from arsenic.
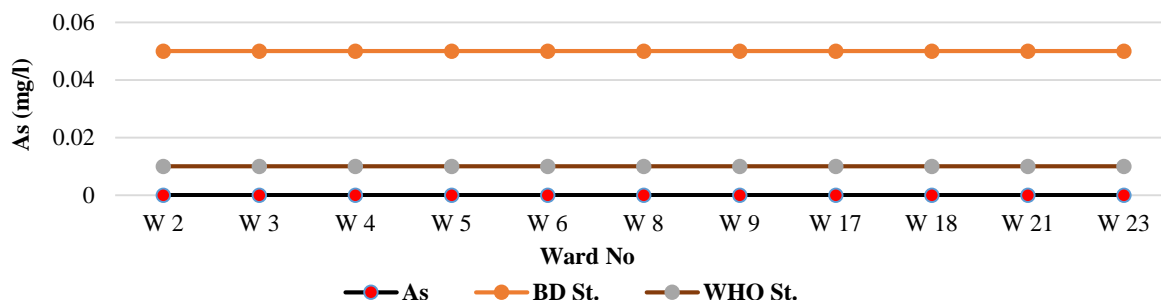

Fig. 10. Variation of Arsenic of drinking water from different wards of Khulna city.

In this figure 11, Ward no. 3, 5, 21 and 23 found out contaminated with total coliform. This water sample is vulnerable to various waterborne diseases. The presence of fecal coliform in aquatic environments may indicate that the water has been contaminated with the fecal material of humans or other animals. Large quantities of fecal coliform bacteria in the water are not harmful according to some authorities but may indicate a higher risk of pathogens being present in the water. In figure 11 presents that Ward no. 3, 5, 21 and 23 found out contaminated with fecal coliform.
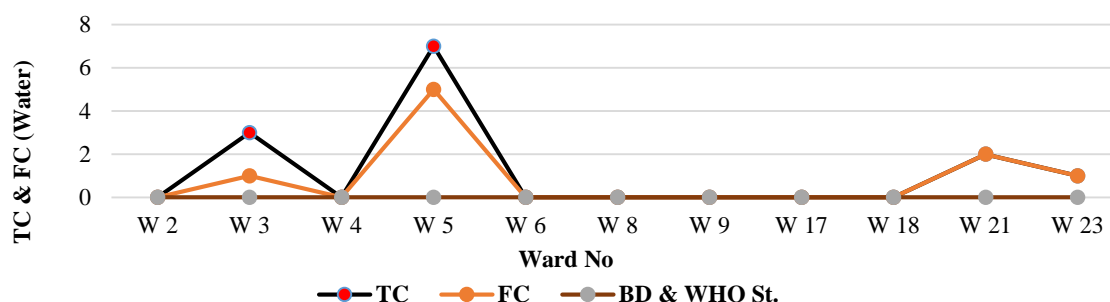

Fig. 11. Variation of Total and Fecal coliform of drinking water from different wards of Khulna city.

Ward no. 2, 17 and 18 food samples were contaminated with total coliform which indicates in Figure 12 and causes various serious foodborne diseases. Fecal coliform bacteria also constitute a group of bacteria and include those coliforms whose specificity as fecal contaminants is much higher than that of coliforms. From figure 12, it can be concluded that w2 water sample is vulnerable to various foodborne diseases as in this sample has Fecal Coliform.
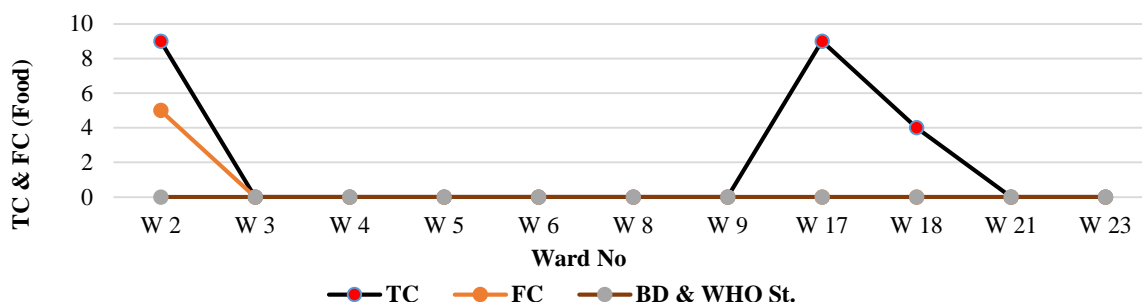

Fig. 12. Variation of Total and Fecal coliform of food from different wards of Khulna city.

Table 3. Different Quality Parameters of drinking water from roadside restaurants of different wards of Khulna City

Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
Diarrhea	2700	2658	3521	3190	3171	3010	2117	2418	1926	1918	1481

| Typhoid | 373 | 387 | 574 | 451 | 481 | 569 | 566 | 717 | 580 | 506 | 312 |
| Hepatitis A | 1 | 0 | 2 | 202 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |

In Khulna city, during the month of March and April, most of the people were affected by diarrhea due to season change contamination of food increases. During the month of August, most of the people of Khulna city were affected by typhoid. And last of all, throughout the year less number of people were suffered from Hepatitis A except in the month of April where 202 number of people were affected Hepatitis A. It was an alarming rate.

5. CONCLUSION

Most of the drinking water was found to be quite satisfying except drinking water from a few wards are contaminated with coliform which may cause serious waterborne diseases. Foods from a few wards were also contaminated with coliforms which also may cause serious foodborne diseases which are alarming for public health through most of the food sample were free from coliform contamination. From a question and answer survey, it finds out that, 43.5% of people of Khulna city mostly prefer to eat puri. 73.9% of people suffered from various foodborne and waterborne diseases. 14 people per 25 people are suffered from diarrhea which is caused due to ingestion of contaminated food and drinking water. It clearly found out that 26.1% of people have a clear perception that samosa is the most unhygienic from which various foodborne diseases produced. In case of drinking water, Ward no. 21, 23, 3 and 5 were contaminated with coliform bacteria which causes various waterborne diseases. As roadside restaurants from a ward collect drinking water from the same sources as others, so drinking water sources of Ward no. 21, 23, 3 and 5 (such as nearby ponds, tube well, and supply water) need to be examined and take preventive measures to make water sources free from contamination. There was no arsenic in each one of eleven wards water sample.

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