ASSESSMENT OF DRINKING WATER QUALITY IN THE STORAGE CONTAINERS OF DIFFERENT RESTAURANTS NEAR KUET CAMPUS

Pranto Karmakar*[1], Quazi Hamidul Bari[2] and SM Labib Redwan[3]

[1]Undergraduate Student, Department of Civil Engineering, Khulna University of Engineering & Technology (KUET), Khulna-9203, Bangladesh, e-mail: karmakarprantopk@gmail.com
[2]Professor, Department of Civil Engineering, Khulna University of Engineering & Technology (KUET), Khulna-9203, Bangladesh, e-mail: qhbari@ce.kuet.ac.bd
[3]Undergraduate Student, Department of Civil Engineering, Khulna University of Engineering & Technology (KUET), Khulna-9203, Bangladesh, e-mail: labibredwan52@gmail.com

***Corresponding Author**

ABSTRACT

Khulna University of Engineering & Technology (KUET) is one of the leading universities in Bangladesh. Almost 5,700 undergraduate students and 1,000 postgraduate students study in different engineering disciplines. Each year, nearly 1,200 students graduate from this university, spread among different engineering and non-technical administrative departments, and take part in various activities regarding national development. During their study period, due to a lack of accommodation on campus, these students have to stay outside the campus for a long period of about 1 to 2 years and rent their accommodation. During this period, a significant number of students mainly relied on the local restaurants near the KUET campus for their daily meals. There are almost 30 running restaurants near the campus, and nearly 3500 students have their meals at least twice a day in these restaurants. The students must receive healthy and hygienic food and water for proper physical and mental development. Water is a key element that the students require frequently throughout the day as they go through many activities. Thus, pure drinking water is very much required to fulfill the needs of the students. Most of the restaurants collect drinking water from local deep tube wells, which are mostly supplied to them by local vendors. This supplied water is then stored in plastic containers and later served to the customers, mainly students. This water is sometimes stored for 2 to 3 days, and the storage containers are hardly kept in check. The water served to the customers has to be potable at all costs. Water may get contaminated in different ways, such as through improper storage, equipment leaks, and unhygienic management. Therefore, to maintain the water quality of these restaurants, this study assessed drinking water quality from 20 sources. To evaluate the quality of drinking water, selected parameters, including TC and FC, are required to be examined, and these parameters will identify whether the drinking water in these restaurants is suitable for consumption.

Keywords: *Restaurants, Drinking Water, Parameters, Local Vendors, Consumption.*

1. INTRODUCTION

Two-thirds of the Earth's surface is covered with water; however, the availability of safe potable water remains a crisis for a significant portion of the global population. This issue is particularly pressing for developing countries like Bangladesh (Anwar et al., 2019), which has experienced a population surge in recent decades, resulting in one of the highest population densities among nations. The natural water sources in Bangladesh are increasingly susceptible to contamination due to human activities developed by rapid urbanisation and industrialisation (Islam et al., 2011; Hassan et al., 2011). The disposal of large quantities of toxic and hazardous waste into water bodies without proper treatment further compounds the problem (Rahman et al., 2011). Additionally, the overutilisation of groundwater is leading to a decline in the water table each year.

Water is an indispensable component of human life, constituting up to 60% of the human body. The availability of clean drinking water is vital for maintaining good health, representing a fundamental human right and an essential aspect of effective health protection policies. The importance of water, sanitation, and hygiene in the spheres of health and development has been underlined in diverse international policy forums (WHO, 2004). Over the past century, water consumption has outpaced population growth, with usage increasing at more than twice the rate of population expansion. Currently, the world's population of six billion people is utilising 54% of all available freshwater found in rivers, lakes, and underground aquifers (Chalchisa et al., 2018). There are several problems with withdrawing water from underground sources in Bangladesh. The problems are high concentrations of iron, Arsenic (Mallick et al., 2012; Shafiquzzaman et al., 2022; Shafiquzzaman et al., 2023) and salinity (Bari & Reza, 2020) in the water source. The surface water also shows faecal and other contamination (Bari, 1993; Fujii & Bari, 1993), including high salinity (Bari & Sayeed, 2022) in the southern region. Therefore, proper treatment is required before the consumption of water from those sources (Bari et al., 2009; Akter et al., 2012; Rabbani & Bari, 2021).

Water quality encircles the physical, chemical, and biological characteristics of water. In Bangladesh, water quality falls short of acceptable standards. Specifically, the water supply in restaurants across the country is often poor. The drinking water served in street food establishments in Dhaka city, in particular, is frequently unsafe, as indicated by elevated levels of E. coli, total enteric bacterial count, and total bacterial count (Shaibur et al., 2021). Contamination, whether arising directly or indirectly from human or animal excreta, especially faeces, is identified as the most widespread health risk associated with drinking water. Water storage, a fundamental component of the indirect cold water supply system and other non-piped water supply systems has been acknowledged for years as a significant source of contamination for domestic water (Manga et al., 2021).

Khulna, the largest city in southwestern Bangladesh, grapples with the scarcity of clean drinking water (Roy et al., 2019; Bari et al., 2022). Historically known as an industrial hub, the city is situated near the coastal belt, where tidal actions contribute to the intrusion of saline water. This intrusion has led to the abandonment of cultivable farmland due to increased salinity in the soil. In certain areas, the groundwater table has become contaminated with saline water, rendering shallow hand-held tube wells incapable of providing potable water (Brojen &. Bari, 2023). The study area examined in this research faces similar challenges, with insufficient access to safe drinking water, forcing residents to purchase bottled or jar water from local vendors. These vendors source water from deep tube wells, local small-scale water treatment plants, or filtered water. Unfortunately, this water often becomes contaminated with E. coli and other pathogenic microorganisms, posing a significant, though overlooked, risk to the local community.

The provision of drinking water invariably involves storage due to fluctuating consumption patterns. However, storage introduces a risk of contamination before use. This risk is particularly significant in non-piped systems and piped systems with intermittent supply, making storage a critical factor in determining water quality and, consequently, public health (Slavik et al., 2020). Thus, the proper evaluation of the Water Quality Index (WQI) is an important task to ensure safe potable water. Kumpel et al. (2016) conducted a thorough investigation into the quality of drinking water and the effectiveness of water safety management, specifically in the context of sub-Saharan Africa. The study addressed various essential elements, such as the methodologies used to evaluate water quality and the current state of water safety management practices. Luvhimbi et al. (2022) conducted a study on the water quality within Thulamela municipality, located in the Limpopo Province. The research adopted a comprehensive approach by not only searching the inherent water quality but also considering potential health risks associated with the entire journey of drinking water, spanning from its source to the point of consumption. Daniel et al. (2020) investigated the quality of drinking water in the hilly rural areas of mid and far-western Nepal. This research was distinctive in its dual perspective, assessing water quality both at the point of collection and within household storage containers, and entailed a comprehensive examination of diverse factors influencing WQI in these specific regions.

KUET stands out as a prominent institution in the field of engineering education in Bangladesh. It is situated in the Fulbarigate area, where the groundwater has elevated saline content. The surrounding residential buildings house many students in rented accommodations, contributing to significant congestion in the area. These students face potential health risks and depend on local establishments such as restaurants, tea stalls, dairy shops, bakeries, and cafeterias for daily meals. Unfortunately, these dining establishments exhibit inadequate hygiene practices, utilise problematic water sources, lack proper storage facilities, and engage in improper dish-cleaning practices. Among the selected shops and restaurants offer breakfast, lunch, and dinner options. It is essential to have clean water when consuming rice, fish, meat, vegetables, or curry. Health issues may arise from contaminated water.

Similarly, dairy products like curds, crackers, and desserts require water. In addition, bakeries often sell water-containing items like cakes, biscuits, chocolates, toast, and other snacks. Then, Tea shops provide a variety of teas, including Darjeeling tea, orange tea, green tea, masala tea, and local tea, in addition to bread, sandwiches, and toasts, all of which require potable water to prepare and consume. Potable water is necessary to run a tea stall. In offices, businesses, schools, hospitals, and other locations, a cafeteria is where people go to get food and drink while working or studying. There are numerous similar cafes around the KUET campus. A cafeteria serves a variety of foods, including salads, soups, light meals, pasta, pizza, meats, and Chinese and Indian entrees. Tea, coffee, fresh juices, soft drinks, milkshakes, cakes, pastries, ice cream, chocolate, sweets, desserts, chips, almonds, biscuits, and more are among the goodies they provide. When consuming these items, it's beneficial to drink water.

Consequently, there is a considerable risk of drinking water becoming contaminated with potentially fatal microorganisms. Given the high population density and suboptimal living conditions, the students are constantly at risk of water-borne diseases, including Cholera, diarrhoea, Typhoid Fever, and Dysentery. Moreover, as many students reside far from their families and lack immediate access to treatment, medicine, healthcare, or nutritious food when they fall ill, water-borne diseases could pose severe consequences, even leading to fatalities. Recognising the critical situation, the primary objective of this study is to assess the quality parameters of the drinking water served in the nearby restaurants on the KUET campus. Moreover, limited studies have been conducted in this area to evaluate the potential risks associated with drinking water, especially considering the vulnerable position of the student population.

2. METHODOLOGY

2.1 Study Area

Bangladesh has a division called Khulna. It's in the southwest, bordering India to the west and facing the Bay of Bengal to the south. To the north, it's near Rajshahi, Dhaka, and Barisal to the east. The region is part of the Ganges River delta, with islands in the Bay of Bengal and rivers like Madhumati, Bhairab, and Kapotaksha. In the south, you find the Sundarbans, the world's biggest mangrove forest.

The Mayur River is on the west, and Khulna City is on the north. KUET is located in Fulbarigate, northwest of Khulna City. It's about 15 kilometres from the city centre. The coordinates are 22.9006° N and 89.5024° E. The study area is around the KUET Campus at Teligati, Fulbarigate, Khulna-9203, Khulna, Bangladesh.

A survey was conducted around the KUET campus, where the students of KUET eat their daily meals and drink water from there. The quality of potable water was evaluated in this research work in terms of various parameters. Water samples were gathered for analysis from various types of shops, such as restaurants, dairy stores, bakeries, tea shops, and cafeterias. To maintain microorganisms at the proper level without being impacted by heat or light, samples are typically collected in the early morning or late evening in non-transparent bags and bottles.

2.2 Water Sample Collection

A study was conducted in KUET to evaluate the quality of potable water. Since the students eat out frequently, they drink water from nearby stores. Among the 20 samples, 12 were from restaurants, two were from dairy stores, two were from bakeries, two were from tea shops, and two were from cafeterias. Samples for testing the quality of drinking water were collected before sunrise and after sunset to ensure that microorganisms were not destroyed by heat or light. The samples are collected in non-transparent bags and bottles. A total of 12 parameters are tested to determine the quality of potable water. The samples are collected from plastic water storage at shops and taken to the lab for testing.

2.3 Assessment of Water Quality

To assess the quality of potable water, twelve distinct parameters were examined. Samples are removed from plastic storage and subjected to different water quality parameters tests at 25°C temperature. All tests are conducted in KUET's environment laboratory by following standard procedures. The parameters include pH, Turbidity, TDS, Color, Hardness, Arsenic, Iron, Manganese, Chloride, TC, FC, and Electrical Conductivity. In the study, the Bangladesh Environmental Conservation Rules (2023) by the Ministry of Environment, Forest and Climate Change are taken as the standard parameters for environmental auditing of testing the collected water samples (Bangladesh Environmental Conservation Rules, 2023).

2.4 Questionnaire Survey

This study conducted a questionnaire survey involving 117 participants. The aim is to investigate the cost of different types of water, including tap water, deep tube-well water, jar water, bottled water, and filtered water. The questionnaire included the people's opinions about the relative costs and the social acceptance of these five sources of water.

3. RESULT AND DISCUSSION

3.1 Physical Parameters of Potable Water

The investigation focused on the physical parameters—namely, pH, color, turbidity, and Total Dissolved Solids (TDS)—of the potable water near the KUET campus. While elevated levels of these parameters in drinking water typically do not pose significant health risks, consumers may find such water less appealing for consumption due to aesthetic reasons. The samples' temperatures have not been considered here, as the temperatures at the collection time were within 23-28°C, which is suitable for drinking by the standards of Bangladesh Environmental Conservation Rules (2023).

3.1.1 pH

The pH level of water is a measure of its acid and base content. A pH level above 7 indicates alkalinity, while a pH level below 7 indicates acidity. In the case of drinking water, the ideal pH range is between 6.5 and 8.5. Interestingly, a series of lab tests on 20 water samples revealed that the majority of them had a pH level of 7.5 to 8.3, as shown in Figure 1, which falls within the acceptable range for drinking water.

3.1.2 Color

To ensure water safety, the color range limit for consumption is set between 0 and 15 (PT-CO) platinum cobalt. After analysing 20 water samples, it was discovered that 13 of them had color values below 14, while the remaining 7 had values above 15, as shown in Figure 2. The water is deemed unsuitable for consumption if a sample's color value exceeds 15.

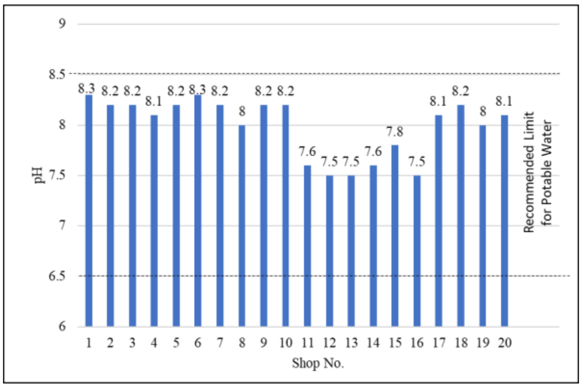

Figure 1: Comparison of pH of the Water Samples Collected from Different Selected Shops

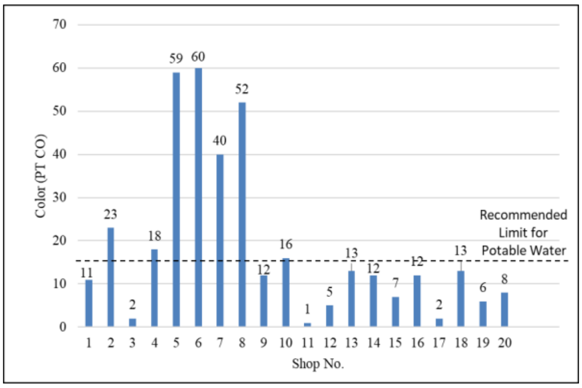

Figure 2: Equivalence of Color of the Water Samples Collected from Different Selected Shops

3.1.3 Turbidity

It is worth mentioning that the definition of 'turbidity' may vary depending on the field of study. The term is commonly used to characterise the optical clarity of a fluid, as indicated by Kitchener et al.'s (2017) research, which utilised a turbidity meter to measure the turbidity of all samples. When it comes to water quality, turbidity measures the level of cloudiness and can be likened to haze, which can affect air quality. The World Health Organization (WHO) has established a maximum allowable limit for turbidity, set at 5 NTU. The tested water samples were analysed, and the highest recorded turbidity was 4.12 NTU, as shown in Figure 3, which falls within the WHO's acceptable limit. This confirms that the water is safe for consumption.

3.1.4 Total Dissolved Solids (TDS)

TDS is an abbreviation that refers to Total Dissolved Solids. It is used to measure the amount of anything that's been dissolved in water, which could include metals, minerals, salts, ions, and organic and inorganic substances other than water molecules. If the level of TDS exceeds 1000 Parts Per Million (ppm), the water may not be suitable for drinking. After carrying out a series of tests, it was discovered that five samples had TDS levels higher than 1000 ppm, which is not safe for drinking, but 15 samples had TDS levels below 1000 ppm and were safe for consumption, as shown in Figure 4.

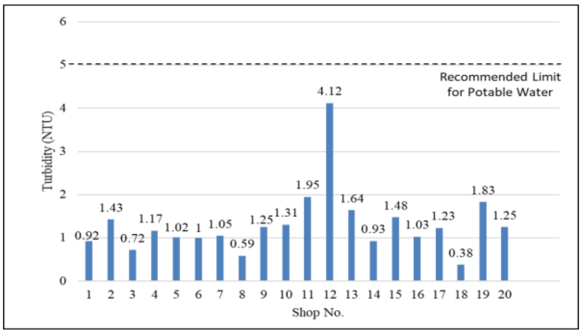

Figure 3: Comparison of Turbidity of the Water Samples Collected from Different Selected Shops

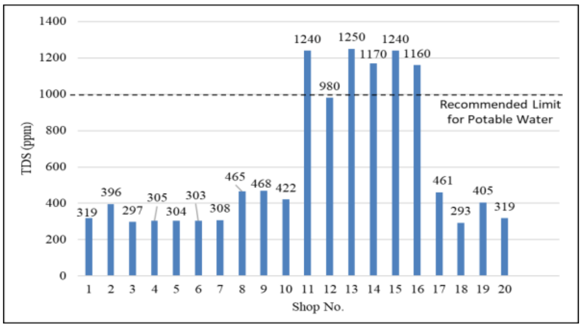

Figure 4: Total Dissolved Solids (TDS) of the Water Samples

3.2 Chemical Parameters of potable water

This section of the study examined and deliberated upon chemical parameters such as Arsenic, manganese, iron, chloride, hardness, and electrical conductivity. While short-term exposure to these substances may not result in immediate health concerns, prolonged and chronic intake can contribute to serious health conditions, including arsenic poisoning, kidney failure and, in some cases, the development of cancer.

3.2.1 Arsenic (As)

The maximum allowable limit for Arsenic is 0.05 mg/L. Arsenic can have adverse effects on various body parts, including eyes, skin, liver, kidneys, and lungs. Nonetheless, 20 samples were tested, and none had any Arsenic traces. According to the test results, the Arsenic level is within the permissible limit. The presence of Arsenic in the samples could lead to various health hazards due to its harmful effects.

3.2.2 Manganese (Mn)

The allowable limit for manganese is 0.4 mg/L. Fifteen of the 20 tested samples were within the allowable limit of 0.4mg/L for manganese in water, as shown in Figure 5. Drinking water that has exceeded the manganese limit can be detrimental to public health, leading to memory, attention, and motor skill problems. This is a significant concern, as 25% of the tested samples had increased levels of manganese.

3.2.3 Iron

Drinking water needs to have an iron level below 0.3 mg/L to be considered safe. All of the 20 samples were found to be within the safe range, as shown in Figure 6. Therefore, the water is safe to consume.

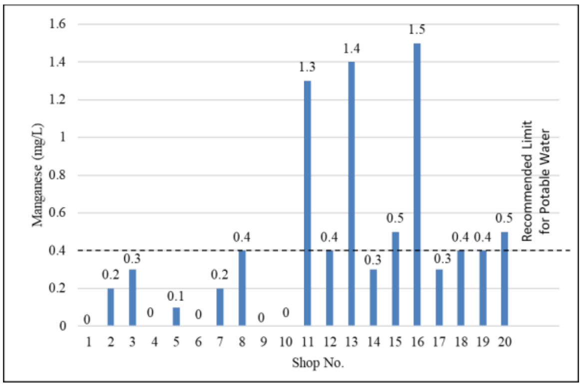

Figure 5: Comparison of Manganese of the Water Samples Collected from Different Selected Shops

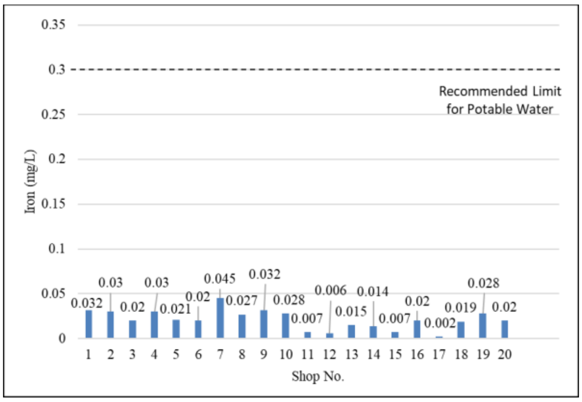

Figure 6: Comparison of Iron of the Water Samples Collected from Different Selected Shops

3.2.4 Chloride

According to the standard, the chloride level in drinking water should be no more than 600 mg per litre. Nonetheless, the analysis revealed that one of the tested samples had chloride showing out-of-range chloride levels, as per Figure 7. On the other hand, the remaining 95% of samples had chloride levels within the acceptable range.

3.2.5 Hardness

Drinking clean and healthy water is important, and water hardness is an important factor to consider. High water hardness indicates that the water contains high levels of calcium and magnesium. The recommended hardness range is up to 500 mg per litre. The hardness exceeding this range can lead to health problems and corrode plumbing systems. Hard water also increases the risk of digestive problems and kidney stones. It appears that most of the tested samples were within the acceptable range, except for two samples, which were out of range. On the bright side, these two samples only represent 10% of the total sample, as shown in Figure 8. It's crucial to understand that consuming water with high levels of hardness can be extremely damaging to one's health and can cause various problems, such as the formation of kidney stones. Therefore, students must be educated on the harmful effects of hard water, particularly in KUET, where the quality of water can be a concern. Drinking such water could lead to illness and even hamper their academic performance.

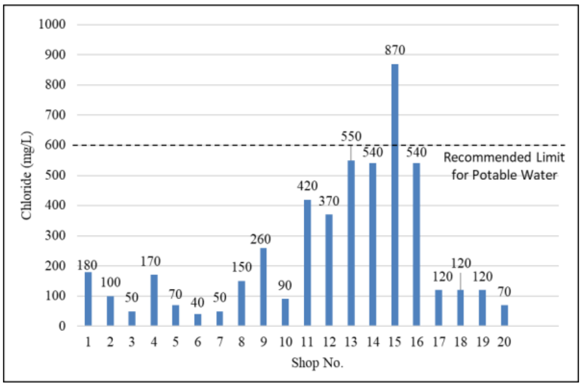

Figure 7: Comparison of Chloride of the Water Samples Collected from Different Selected Shops

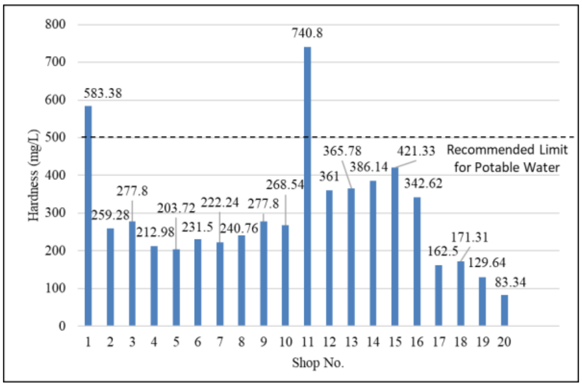

Figure 8: Comparison of Hardness of the Water Samples Collected from Different Selected Shops

3.2.6 Electrical Conductivity (EC)

Electrical conductivity levels in drinking water could be an indication of elevated levels of dissolved solids, which could include various salts and minerals. However, some minerals are essential for our health. The recommended EC limit for drinking water is 0.7 mS/cm. Among the 20 observed samples, 9 of the water samples had an electrical conductivity exceeding the recommended value, as shown in Figure 9.

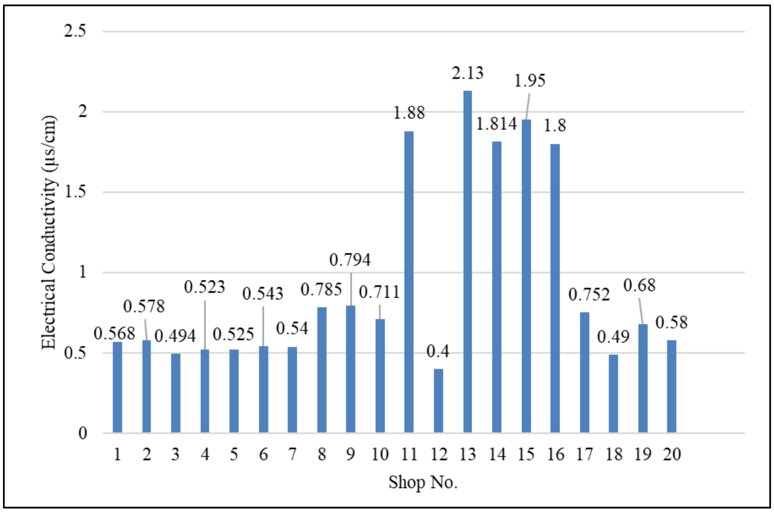

Figure 9: Comparison of EC of the Water Samples Collected from Different Selected Shops

3.3 Biological Parameters

The assessment of total coliform (TC) and faecal coliform (FC) serves as critical water quality indicators. The mere presence of even a few coliform bacteria in drinking water can precipitate acute illnesses such as diarrhoea, dysentery, and cholera, potentially leading to fatalities within a remarkably short span of 2 or 3 days.

3.3.1 Total Coliform (TC)

TC is a type of bacteria present in drinking water that acts as a marker of water quality. While some coliform bacteria are harmless, the detection of TC in water can signify that there could be problems with water treatment at the point of origin. TC is commonly found in the faeces of warm-blooded animals, and if it is detected in water, it can indicate the presence of harmful substances. Various infectious diseases can also occur. TC can contain Potential Pathogenic Organisms. Although Coliforms are not all disease-causing, they can result in various illnesses in our body when combined with drinking water, along with harmful bacteria such as E. coli or other water-borne pathogens.

Also, drinking water infected with Pathogenic microorganisms can result in water-borne illnesses such as diarrhoea, abdominal pain, nausea, and more severe diseases. The lab tested around 20 water samples and discovered that about 14 samples, 90% of the tested samples, had high levels of TC. This indicates that these waters are unsuitable for consumption and can be estimated as unsafe, as shown in Figure 10.

3.3.2 Faecal Coliform (FC)

Fecal coliform (FC), which contains dangerous germs, is a worrying phenomenon that can be seen in drinking water. One subclass of coliform bacteria is called faecal Coliform (FC) bacteria. The quality of the water is lowered when they are present in drinking water. The primary source of FC is the excrement of animals with warm blood. These faeces in the water are a sign that the water is contaminated and contains bacteria. It is not that there will be corruption if there is FC, but their presence is the cause of fear. For example, their presence indicates a Potential risk of contamination with pathogenic microorganisms that can cause water-borne illnesses like E. coli. This pathogen may include bacteria, viruses, and parasites. FC can cause more serious diseases, including diarrhoea, vomiting, and abdominal cramps.

FC Contaminated water can affect humans and cause illness. Outbreak. A large amount of FC contamination affects human health and has environmental implications. Water containing FC can come from cities or agricultural areas, which affects the ecosystems and pushes the water toward contamination. Out of the 20 samples tested, 5 showed the presence of FC, which is not ideal. FC can be harmful to drinking water. One shop had 1 FC, another had 7, and the third had 11 FC, as shown in Figure 10, which is enough fear for us now. It is necessary to address water safety through regular monitoring and be determined to ensure safe drinking water for good health. Monitoring and taking determined steps is essential to ensure water safety regularly.

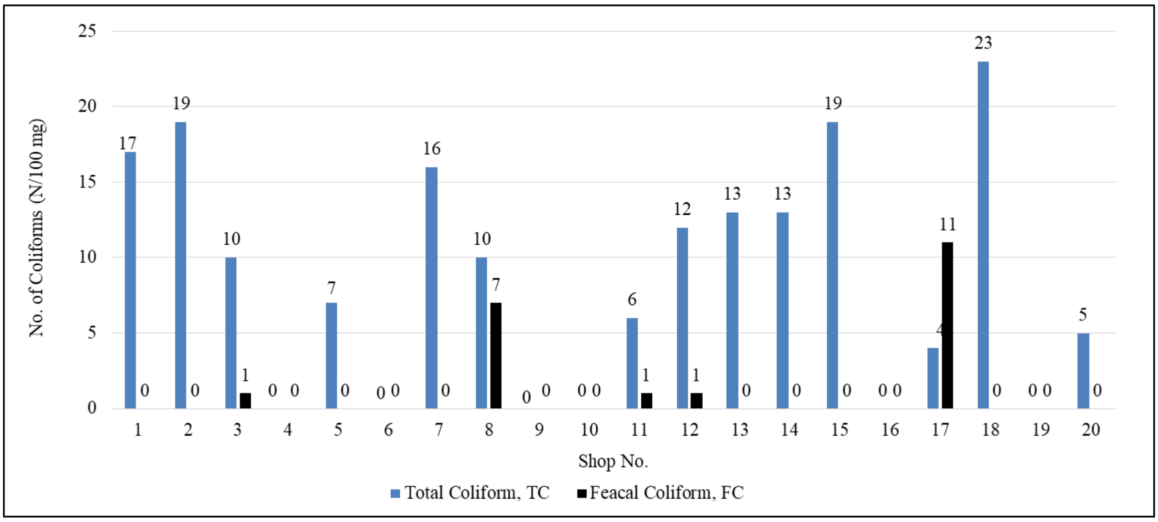

Figure 10: Comparison of Total Coliform (TC) and Faecal Coliform (FC) of the Water Samples Collected from Different Selected Shops

3.4 Risk Analysis of the Collected Water Samples from Different Restaurants

The health risks associated with potable water supplied by various establishments, including restaurants, dairy stores, bakeries, tea shops, and cafeterias around the KUET campus, are illustrated in Table 1. A checkmark (✓) indicates that the parameter is within the recommended limit, while a cross mark (×) signifies that the limit exceeds the recommended threshold.

Five drinking water samples of the 20 sampled establishments contained both faecal and total coliform, categorising them as severely risky. Additionally, nine more samples contained only total coliform, marking them moderately risky. Five samples showed the absence of total coliform and faecal coliform, indicating they are safe for consumption. Although some physical and chemical parameters in the watermarked as safe exceeded recommended limits, they were deemed not to pose significant health effects.

Table 1: Risk Analysis of the Collected Water Samples from Different Restaurants

Shop No.	**pH**	**Color**	**Turbidity**	**TDS**	**Arsenic**	**Manganese**	**Iron**	**Chloride**	**Hardness**	**EC**	**TC**	**FC**	**Risk**
1	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	Moderate
2	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	Moderate
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	Severe
4	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Safe
5	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	Moderate
6	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Safe
7	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	Moderate
8	✓	×	✓	✓	✓	✓	✓	✓	✓	×	×	×	Severe
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	Safe
10	✓	×	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	Safe
11	✓	✓	✓	×	✓	×	✓	✓	×	×	×	×	Severe
12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	Severe
13	✓	✓	✓	×	✓	×	✓	✓	✓	×	×	✓	Moderate
14	✓	✓	✓	×	✓	✓	✓	✓	✓	×	×	✓	Moderate
15	✓	✓	✓	×	✓	×	✓	×	✓	×	×	✓	Moderate
16	✓	✓	✓	×	✓	×	✓	✓	✓	×	✓	✓	Safe
17	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×	Severe
18	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	Moderate
19	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Safe
20	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	×	✓	Moderate

3.5 Findings from Questionnaire Survey

According to the majority of respondents, they received tap and tube-well water at no cost. However, purchasing jar water is necessary, and it is reasonably priced compared to bottled water, which is regarded as quite costly by those who participated in the survey. After surveying the social acceptance of various types of water, it was found that 40% of students believe tap water is fresh, odor-free, and tastes good. On the other hand, 60% of participants preferred jar water for these qualities. The majority of students (85%-90%) rated bottled water as very good. Notably, students in KUET do not use filtered water, so there is no feedback on its taste or smell. Moreover, since students do not directly use tube-well water, they did not have any opinion on it.

3.6 Significance of the Study

The critical evaluation of drinking water quality in the KUET campus area, addressing persistent health concerns and environmental sustainability, is performed. This research highlights the vital need for infrastructure improvements, policy interventions, and heightened awareness among students and the community by identifying establishments where water quality falls below acceptable standards. The insights from the questionnaire survey provide valuable information on water consumption patterns and preferences, informing policymakers about the social acceptance of different water sources and the affordability challenges faced by the student population. Overall, the study's findings present a comprehensive foundation for targeted interventions that can enhance water quality, promote public health, and ensure sustainable access to safe drinking water in the KUET campus vicinity.

4. CONCLUSIONS

This research focused on evaluating the quality of potable water collected from plastic storage tanks in various restaurants and stalls around the KUET campus. The results show only the instantaneous case; however, to make any decision, a more extensive monitoring program is required. The pH values of tested samples were typically 7.5 to 8.3. The maximum turbidity was recorded as 4.12 NTU, according to the study's measurements. The pH and turbidity both were within permissible drinking water guidelines. According to test results of TDS, 15 samples had safe levels below 1000 ppm, whereas 5 samples had TDS above 1000 ppm. Acceptable chloride levels were observed in 95 percent of the samples, while 5 percent showed higher values than permitted.

Additionally, the concentrations of iron and manganese were within the safe level for drinking. The manganese content showed good results because 15 out of 20 samples had levels of manganese that were within the acceptable range for drinking water. Color values were above 15 (Pt-Co) in 7 samples. From the hardness test, it appeared that most of the samples tested were within the acceptable range except for two. According to the arsenic test results, all of the samples were free of arsenic contamination. The findings of the TC and FC tests were concerning issues of this study. Most of the samples consisted of total coliform, and five samples contained faecal coliform. The presence of TC and FC in drinking water is completely unacceptable and could immediately harm health. Effective care should be taken by the restaurant owners for the storage of drinking water so that the water would be free from TC and FC contamination. To ensure that drinking water is safe for human consumption, water safety must be continuously monitored.

The specific findings are:

- An acceptable chloride level was observed in 95 percent of samples.
- In most of the samples, the concentrations of iron and manganese were within the safe level for drinking.
- Identification of TC in most of the samples indicates a level of contamination in this primary study. There should be more routine monitoring when making any strong decisions. However, effective care should be taken by the restaurant owners for the storage of drinking water so that the water would be free from TC and FC contamination.

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