



Research article

## Bacteriological Quality Assessment of Drinking Water from Different Sources within Khulna University

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### ABSTRACT

Water is a vital element for the survival of every being on earth including humans. However, many people fall into illness and even face death due to the unavailability of safe drinking water. Therefore, a cross-sectional study was carried out to isolate and detect the microbial contamination in drinking water from 10 different sources (including water from five residential halls, three academic buildings and two tea stalls behind the life science school) within Khulna University. Drinking water collected from Khan Jahan Ali Hall (KJH) showed the highest total coliform concentration ( $7.2 \times 10^3$  CFU/100ml), whereas the lowest value ( $0.33 \times 10^3$  CFU/100ml) was in water from Bongomata Begum Fazilatunnessa Muijb Hall (BFH), indicating the contamination of the water. Moreover, fecal coliform (*Escherichia coli* is  $2 \times 10^3$  CFU/100 ml) was also present in drinking water of BFH source. Conversely, water samples collected from three academic buildings showed no bacterial growth, likely due to the use of filtration systems. This absence of contamination may explain the greater preference for water from these sources, reflecting a higher level of trust in its quality. The microorganisms responsible for the observed microbial contamination were identified as *Yersinia* spp., *Klebsiella* spp., *Salmonella* spp., *Escherichia coli*, *Shigella* spp., and *Vibrio* spp. This study concludes the presence of gram-negative bacteria in several water sources within Khulna University necessitates water treatments to ensure safe drinking water.

### Introduction

The quality of drinking water directly impacts individuals' health, social, and economic well-being. It is critical to identify whether water is fit to drink and of a quality that is suitable for humankind consumption. The most prevalent and pervasive health risk linked to drinking water is an infectious disease brought on by harmful bacteria, viruses, and parasites (Lanrewaju et al., 2022). It is estimated that approximately 829,000 people every year die from diarrhea as a direct result of contaminated drinking water (Mustafa & Hassan, 2024). The tenth most common cause of death in low- and middle-income nations is disease associated to diarrhea. Research published by the World Health Organization (WHO) indicates that diarrhea directly causes 7.5 deaths per 100,000 people in Bangladesh (Hasan & Suman, 2021).

Water that appears to be safe to drink may be contaminated with bacteria that are odorless, tasteless, and

visually invisible. Even clear water that tastes delicious and has a variety of bacteria present may not be safe to drink. *Shigella* spp., which causes dysentery, *Salmonella enterica* produce disease like typhoid, and *Vibrio cholerae* induces cholera, are some of the traditional waterborne enteric pathogens that are particularly harmful to human health (Kristanti et al., 2022). *Escherichia coli* (*E. coli*) is the most well-known and effective enteric bacteria for water contamination and is responsible for severe diarrheal disease (Ashbolt, 2004).

Coliform bacteria are referred to as indicator organisms as they are capable to identify the possible presence of disease-causing bacteria in water (Wen et al., 2020). It is not a given that consuming water that contains coliform bacteria will make you sick. Instead, their presence shows that there is a conduit for bacterial contamination between a source and the water supply. Water systems look into coliform bacteria findings to

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determine how the contamination entered the water. Bacteria found in drinking water suggest that there may be pathogens or creatures that cause disease, in the water system. Most microorganisms that might contaminate water sources originate from human or animal excrement (Payment & Locas, 2011).

Although the evaluation of supply water (Nasrin et al; 2005; Uddin et al, 2006 and Fahmida et al; 2013), pond water (Siddique et al; 2022) of Khulna city corporation and drinking water (Mou et al; 2024) in different restaurant adjacent to Khulna University campus, south west coastal area (Islam et al., 2023; Islam et al; 2011; Billah et al., 2019.), selected area of Khulna city/ city corporation (Md Nazmul Hasan, 2009; Mujibor Rahman, 2022) has been carried out. But these studies on water quality in Bangladesh have focused on municipal or rural water sources, with limited attention to institutional settings such as universities (Mina et al., 2018 ; Mousumi et al., 2025). So, there is a significant lack of data regarding bacteriological safety at institutional level. This study was undertaken to investigate the presence of coliform as well as harmful bacteria in drinking water from ten different locations within an institution like Khulna University. The novelty lies in its localized approach, using standardized microbiological methods to assess potential fecal contamination. The outcomes of this study are expected to serve as a basis for raising awareness, guiding water management practices, and promoting public health within the university community. Moreover, understanding of students' drinking water preferences was analyzed that provides insights into the trust and satisfaction levels associated with the existing water supply system available on campus. To determine whether water is contaminated or contains microorganisms that are pathogenic or indicative of fecal pollution, a bacteriological analysis must be conducted. Therefore, the objectives of the study were to detect the concentration of total coliforms and *Escherichia coli*. (that are indicative of fecal contamination also) and to isolate and compare the microbial contamination among various water sources within Khulna University.

## Materials and Methods

### The Study Area

This research focuses on evaluating the bacteriological quality of drinking water from various sources within Khulna University. The university is home to approximately 3,000 students and a significant number of faculty members and staff are employed here also. Moreover, students who live off-campus but study at the university spend the entire day on campus and rely on these water sources for drinking. It is responsible for meeting the water needs of all dormitory residents. Ensuring the safety and quality of the drinking water is therefore essential. Given these factors, Khulna University has been selected as the study area.

### Sample sources and Collection process

Water samples were collected from ten different drinking water sources across Khulna University. These included five residential halls—Aparajita Hall (AHW), Bangamata Begum Fazilatunnesa Mujib Hall (BFHW), Khan Bahadur Ahsanullah Hall (KBHW), Khan Jahan Ali Hall (KJHW), and Jatir Janak Bangabandhu Sheikh Mujibur Rahman Hall (JBHW)—as well as three academic buildings: Satyendra Nath Bose Academic Building (SBAW), Acharya Jagadish Chandra Bose Academic Building (ACAW), and Jibanananda Das Academic Building (JAW). Additionally, samples were taken from two tea stalls- Tapan tea stall (TSTW) and Humayun tea stall (TSHW) located behind the Life Sciences School. In the residential halls, drinking water was supplied through submersible pumps and reserved in tanks located in front of the hall canteens—common drinking points for students. Samples were collected from the taps that are attached with the reserved water tank. In the academic buildings, drinking water was collected at the points from where it is reserved and supplied for the students and others. In case of the tea stalls, the water was drawn from a deep tube well and stored in plastic bottles by the vendors.

Water samples were collected from each location twice at 24-hour intervals using sterile 500 ml bottles and were thoroughly mixed. After 15 days, a second set of samples was collected from the same locations following the same 24-hour interval protocol. To prevent any degradation in quality, the samples were immediately placed in insulated foam containers with ice packs, maintaining a temperature of 4–6 °C during transportation (Bartram et al., 2003). Upon arrival at the laboratory, the samples were transferred into autoclaved conical flasks under aseptic conditions. Each flask was accurately labeled and sealed with aluminum foil to maintain sterility. Samples were then kept at room temperature and processed within two hours—or cultured immediately—to ensure reliable results. All procedures were carried out aseptically to avoid external contamination (Kumpel & Nelson, 2013; Sanders, 2012).

### Total plate count

The total plate count (TPC) method was employed to enumerate the total viable bacteria. A series of dilutions up to  $10^{-6}$  was organized by transmitting one ml of the primary dilution into test tubes containing 9 ml of the water sample (Manzanas et al., 2023). To determine the TPC, one milliliter of a  $10^{-1}$  dilution of the homogenate was transferred onto a nutrient agar plate and spread evenly using sterile glass spreaders. Then, the petri dish was placed in an incubator at 37°C for 24 hours. 30-300 colonies were counted in plates after incubation (O'Toole, 2016). To calculate the TPC, The colony count in the dilution was multiplied by the corresponding dilution factor (Esmaeelian et al., 2020).

### Total coliform count (TCC)

The total coliform bacteria were enumerated by transferring one ml of a  $10^{-1}$  dilution onto a MacConkey agar plate and spreading it with sterile glass spreaders (Jung & Hoilat, 2025; Abdulbaqi et al., 2024). The petri dish was incubated at  $37^{\circ}\text{C}$  for 24 hours. Subsequently, typical pinkish colonies, indicating lactose-fermenting bacteria, were counted, while non-lactose-fermenting bacteria appeared colorless. The results were expressed as colony forming units per ml (CFU/ml) (Oyewale et al., 2024).

### Isolates identification

Bacterial isolates were determined using a marginally modified version of the method (Hussain et al., 2013). The cultures were visually inspected to notice the colonial morphology, to observe their shape and staining reaction, Gram's staining from the colonies (Claus, 1992) was performed. Different biochemical tests such as, catalase test, Oxidase test, Methyl red test, Voges- Proskauer (VP) test, citrate utilization test, TSI test, Nitrate reduction test, Urease test and gelatin hydrolysis test were also used to characterize the isolates (Khan et al., 2019 ; Hussain et al., 2013).

### Fecal coliform test

Membrane filtration technique (MFT) was used to identify fecal coliform in the water samples using Millipore membrane filtration system (Khan et al., 2017). Drinking water samples were filtered using Millipore membrane filters ( $0.45\ \mu\text{m}$  pore size and 47 mm diameter) at a vacuum pressure of 5 to 15 mmHg. Organisms accumulate on the surface of the membranes. These membrane filters were then employed on the Membrane Fecal Coliform Agar (m-FC agar) surface and incubated at  $35^{\circ}\text{C}$  for 24 hours. The colonies shaped on the surface of the m-FC agar were calculated with the aid of colony counter. Blue color colonies were produced on m-FC medium which considered as fecal coliform. The results were expressed in the method of colony forming unit per 100 ml as CFU/100 ml, e.g.; 24 CFU of *E. coli* or coliforms / 100 ml (Aziz et al., 2024; Saima et al., 2023 ; Barnes et al., 1989)

### A survey of consumption patterns and statistical analysis

To know student preferences of drinking water on campus, the survey was conducted using Cochran random sampling formula (Sathyanarayana S. S. et al., 2024). This is remarkable since there is no bias; certain candidates are equally likely to be chosen.

Cochran's random sampling formula,

$$n = \frac{z^2 p (1 - p)}{e^2}$$

Where, n = sample size, e = desired level of precision, the margin of error, p = the fraction of the population (as percentage) that displays the attribute, z = the z-value

At 95% confidence level with no prior knowledge of population proportion ( $p = 0.5$ ) and  $\pm 5\%$  margin of error ( $e = 0.05$ ) the z value is 1.96

$$\text{Sample size, } n = 1.96^2 \times 0.5 \times (1 - 0.5) / 0.05^2 = 384.16 \approx 385$$

Thus, theoretically the minimum size of the sample should be 385.

The respondents for this survey were students of Khulna University who had spent a significant amount of time on campus. A structured questionnaire was designed, focusing on various aspects of potable water sources at the university including their types, quantity, safety, quality, and appearance (e.g., color). Data were collected using both in-person interviews and an online survey method. The collected data were analyzed and validated using GraphPad Prism software, version 8.0.2 (Liu et al., 2020). Mean of TCC and TPC was calculated by Microsoft excel version 2016.

## Results

### Total plate count and the concentration of total coliforms

Enumeration of bacteria in the water samples is presented in Table 1. The highest total plate count (TPC) was recorded in Khan Jahan Ali Hall, with  $8 \times 10^3$  CFU/ml, while the lowest was found in Begum Fazilatunnesa Mujib Hall, at  $0.35 \times 10^3$  CFU/ml. The TPCs for the other residence halls were as follows: Khan Bahadur Ahasanullah Hall –  $1.2 \times 10^3$  CFU/ml, Jatir Janak Sheikh Mujibur Rahman Hall –  $1.15 \times 10^3$  CFU/ml, and Aparajita Hall –  $4.8 \times 10^3$  CFU/ml. No viable bacterial counts were detected in any of the three academic buildings. Among the tea stalls, Tea Stall Tapan and Tea Stall Humayun recorded TPCs of  $3.4 \times 10^3$  and  $5.8 \times 10^3$  CFU/ml, respectively.

The highest total coliform count (TCC) was observed in Khan Jahan Ali Hall (Table 1) as like TPC, with a concentration of  $7.2 \times 10^3$  CFU/ml indicating potential contamination or poor water hygiene. Other residential halls, including Khan Bahadur Ahsanullah Hall, Jatir Janak Bangabandhu Sheikh Mujibur Rahman Hall, Aparajita Hall, and Begum Fazilatunnesa Mujib Hall, recorded TCCs of  $1.1 \times 10^3$ ,  $1.05 \times 10^3$ ,  $4.5 \times 10^3$ , and  $0.33 \times 10^3$  CFU/ml, respectively. Notably, all three academic buildings showed zero total coliform presence. Tea stalls exhibited considerable microbial presence including  $3 \times 10^3$  CFU/ml and  $5.6 \times 10^3$  CFU/ml. in Tea Stall Tapan, Tea Stall Humayun respectively.

In most samples, TCC was slightly lower than TPC, as coliforms represent a subset of total viable bacteria.

### Identification of bacterial isolates in drinking water of various sources

Different bacterial isolates exhibited distinct colony morphologies (Table 2) on MacConkey and Nutrient Agar. Gram staining revealed that all isolates were Gram-negative and rod-shaped. To identify the bacterial genera,

nine different biochemical tests were conducted. Based on the results of these tests, six different bacterial species were presumptively identified (Table 2).

Microbial contamination and presence of fecal coliform bacteria *Yersinia spp* is found in the drinking water collected from KJHW; *Klebsilla spp* is found in the drinking water collected from KBHW and JBHW; *Salmonella spp* is found in the drinking water collected from AHW; *Escherichia coli* is found in the drinking water collected from BFHW; *Shigella spp* is found in the drinking water collected from TSTW and *Vibrio spp* is found in the drinking water collected from TSHW.

The total fecal coliform count for *Escherichia coli* in the drinking water collected from Begum Fazilatunnessa Mujib Hall (BFHW) was  $2 \times 10^3$  CFU/100 ml, as shown in Table 3. In contrast, no fecal coliform was detected in the drinking water samples from the other six sources. This indicates that the BFHW water supply may have been contaminated with fecal matter, posing a potential health risk to residents. The presence of *E. coli*, a key indicator of fecal contamination, suggests that either the water treatment process was inadequate or the distribution system was compromised.

**Table 1:** Enumeration of total plate count and the concentration of total coliform in water sample from 10 different sources within Khulna University.

Sampling Sources	Replication No of sample	Mean TPC (CFU/100ml) in Nutrient Agar Plate	Mean TCC (CFU/100ml) in MacConkey Agar Plate	Comparison among sources of drinking water
SBAW	02	0	0	No bacterial growth detected
ACAW	02	0	0	
JAW	02	0	0	
KJHW	03	$8 \times 10^3$	$7.2 \times 10^3$	Highest bacterial and coliform counts
KBHW	02	$1.2 \times 10^3$	$1.1 \times 10^3$	Moderate
JBHW	02	$1.15 \times 10^3$	$1.05 \times 10^3$	Slightly lower
AHW	03	$4.8 \times 10^3$	$4.5 \times 10^3$	High bacterial and coliform levels
BFHW	02	$0.35 \times 10^3$	$0.33 \times 10^3$	Lowest among residence halls
TSTW	03	$3.4 \times 10^3$	$3 \times 10^3$	Moderate contamination
TSHW	03	$5.8 \times 10^3$	$5.6 \times 10^3$	High contamination, second only to KJHW
AWC	-	No Growth	No Growth	Confirmed sterile

Bangladesh Standards (BS)- for TCC is 0 (BSTI 2006)  
World Health Organization (WHO) guidelines- for TCC is 0. (WHO 2017)

\*SBAW-Sattendra Nath Basu Academic Building; ACAW- Acharya Jagadish Chandra Bose Academic Building; JAW- Jibananda Das Academic Building; KJHW- Khan Jahan Ali Hall; KBHW- Khan Bahadur Ahasanullah Hall; JBHW- Jatir Janak Bangabandhu Sheikh Mujibur Rahman Hall; AHW- Aparajita Hall; BFHW- Begum Fazilatunnessa Mujib Hall; TSTW- Tea stall Tapan; TSHW- Tea stall Humayun and AWC- Distilled & autoclaved water as control.

**Table 2:** Isolation of bacteria by morphological, gram staining and biochemical tests

Isolate source	Gram Staining	Cell morphology	catalase	Oxidase	Methyl Red test	VP test	Citrate utilization test	TSI test*	Nitrate reduction test	Urease test	Gelatin hydrolysis test	Estimated bacteria
KJHW	-	Rod	+	-	+	-	-	A/A	+	+	-	<i>Yersinia spp</i>
KBHW&JBHW	-	Rod	+	+	+	+	+	K/A	+	+	-	<i>Klebsilla spp</i>
AHW	-	Rod	+	-	+	-	+	A/K	+	+	-	<i>Salmonella spp</i>
BFHW	-	Rod	+	-	+	-	-	A/K	+	-	-	<i>Escherichia coli</i>
TSTW	-	Rod	+	-	+	-	-	A/A	-	-	-	<i>Shigella spp</i>
TSHW	-	Rod	+	-	-	+	-	A/A	-	-	-	<i>Vibrio spp</i>

\*Note=A/A (No Gas, No H<sub>2</sub>S), K/A (Gas, No H<sub>2</sub>S), A/K (No Gas, No H<sub>2</sub>S); \*\*KJHW- Khan Jahan Ali Hall; KBHW- Khan Bahadur Ahasanullah Hall; JBHW- Jatir Janak Bangabandhu Sheikh Mujibur Rahman Hall; AHW- Aparajita Hall; BFHW- Begum Fazilatunnessa Mujib Hall; TSTW- Tea stall Tapan; TSHW- Tea stall Humayun.

**Table 3:** Microbial contamination and presence of fecal coliform in the drinking water samples within Khulna University

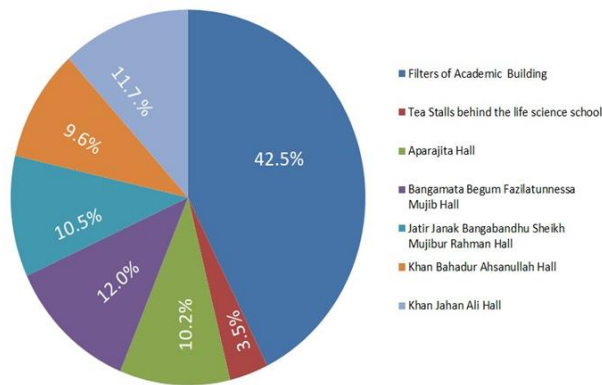
Isolates	Bacteria	Fecal Coliform Counts
KJHW	<i>Yersinia spp</i>	0
KBHW	<i>Klebsillaspp</i>	0
JBHW	<i>Klebsillaspp</i>	0
AHW	<i>Salmonella spp</i>	0
BFHW	<i>Escherichia coli</i>	$2 \times 10^3$
TSTW	<i>Shigella spp</i>	0
TSHW	<i>Vibrio spp</i>	0

Fecal coliform count must be 0 (zero) per 100 mL of drinking water -DPHE & JICA (2009))

According to the World Health Organization guidelines, the unacceptable level of fecal coliform or E.coli is. >0 per100ml (WHO, 2017).

\*KJHW- Khan Jahan Ali Hall; KBHW- Khan Bahadur Ahasanullah Hall; JBHW- Jatir Janak Bangabandhu Sheikh Mujibur Rahman Hall; AHW- Aparajita Hall; BFHW- Begum Fazilatunnessa Mujib Hall; TSTW- Tea stall Tapan; TSHW- Tea stall Humayun

**Student preferences of drinking water on campus (Khulna University)**



**Figure 1:** Student preferences of drinking water on campus

**Student preferences of drinking water on campus (Khulna University)**

Access to safe and clean drinking water is essential for maintaining student health and academic performance, especially in university settings where large populations depend on shared water sources. Understanding students' water consumption habits, preferences, and perceptions can help identify potential gaps in water quality, accessibility, and safety.

In the survey conducted, out of 539 respondents, the majority were male students, accounting for 58.7%, while female students made up 41.3% of the total.

Approximately 42.5% of students preferred drinking filtered water from their academic buildings, as shown in Figure 1. Many students residing in the residence halls also reported accessing drinking water from these academic facilities. In terms of regular water consumption habits, students utilize multiple sources. A total of 10.2% of students collect drinking water in bottles from Aparajita Hall, 12% from Bangamata Begum Fazilatunnessa Mujib Hall, 9.6% from Khan Bahadur Ahasanullah Hall, 11.7% from Khan Jahan Ali Hall, and 10.5% from Jatir Janak Bangabandhu Sheikh Mujibur Rahman Hall. In contrast, only 3.5% of students reported collecting drinking water

in pots from the tea stalls located behind the life science buildings. The preference for academic building water suggests higher trust in its quality, yet the use of multiple sources reflects varying levels of access and reliability across campus

**Discussion**

**Presence of fecal coliform in drinking water**

Contamination of drinking water is one of the greatest health problems worldwide, particularly in developing countries. This study aimed to analyze the bacterial contamination in drinking water of various sources within Khulna University that are used by the students as well.

The detection of *Escherichia coli* (*E. coli*) at a concentration of  $2 \times 10^3$  CFU/100 ml in the drinking water from Begum Fazilatunnessa Mujib Hall (BFHW) indicates significant fecal contamination, raising critical concerns about water safety and public health. *E. coli* is widely recognized as a key indicator organism for fecal pollution in water bodies (Ashbolt et al., 2001). Its presence strongly suggests that the water supply has been exposed to human or animal waste, potentially harboring other pathogenic microorganisms, including *Salmonella*, *Shigella*, and *Vibrio* species. According to World Health Organization (WHO) guidelines, drinking water should contain zero detectable fecal coliforms or *E. coli* in any 100 ml sample (WHO, 2017). The measured count of  $2 \times 10^3$  CFU/100 ml exceeds this standard by a significant margin, indicating the water is not safe for human consumption without treatment. Similar findings have been reported in studies from other university and institutional settings, where *E. coli* was the most frequently isolated coliform species from potable water sources (Ahmed et al., 2019; Islam et al., 2021). The water supply in five residential halls is provided through tap lines, which is the main issue leading to bacterial contamination. At the tea stalls, water is collected and stored in plastic bottles, which is another factor contributing to the increased bacterial count and was in agreement with the other findings (Rygal et al., 2020 ; Loucif et al., 2020). To mitigate risks, interventions such as improved water treatment systems, proper handling practices, and routine disinfection (e.g., chlorination or UV treatment) are essential for maintaining water safety.

Membrane filtration technique was used for ensuring the fecal contamination, which was agreed with Molelekwa et al., 2014. Because *Enterobacteriaceae* family are responsible for fecal pollution, they are measured indicators of it (McLellan & Eren, 2014). *Escherichia coli* was found as the fecal coliform bacteria, suggests fecal contamination, which was concordance with Paruch & Maehlum et al., (2012).

### Detection of bacteria in drinking water

Predicted bacterial organism by gram staining and biochemical test in drinking water from 7 sources within Khulna University was similar to (Clark et al., 1982) results. The bacterial genera isolated in this study were *Yersinia*, *Klebsiella*, *Salmonella*, *Escherichia coli*, *Shigella* and *Vibrio* which was similar also with some other observations (Dissasa et al., 2022), (Cabral, 2010) & (Loucif et al., 2020).

The presence of various pathogenic bacteria in different water sources on campus raises significant public health concerns. *Yersinia spp.* was detected in the drinking water sample collected from Khan Jahan Ali Hall (KJHW), which is notable as *Yersinia* species, particularly *Y. enterocolitica*, are known to cause gastrointestinal infections and can survive in cold water systems (Bottone, 1997), acute diarrhea, mesenteric adenitis, terminal ileitis, and pseudo appendicitis (Perdikogianni et al., 2006). *Klebsiella spp.* was identified in water samples from Khan Bahadur Ahasanullah Hall (KBHW) and Jatir Janak Bangabandhu Sheikh Mujibur Rahman Hall (JBHW). *Klebsiella species* are opportunistic pathogens associated with waterborne outbreaks and are often used as indicators of biofilm formation and water system contamination (Podschun & Ullmann, 1998), pneumonia, bloodstream infections, wound or surgical site infections, and meningitis (Wu et al., 2017). *Salmonella spp.* was detected in the water from Aparajita Hall (AHW). The presence of *Salmonella*, a well-known causative agent of typhoid fever, or paratyphoid fever, abdominal pain, diarrhoea, nausea and sometimes vomiting (O'Neill et al., 2024) and other enteric diseases, and highlights the inadequacy of current water treatment measures (Levantesi et al., 2012). *Escherichia coli* was found in the drinking water collected from Begum Fazilatunnessa Mujib Hall (BFHW), with a fecal coliform count of  $2 \times 10^3$  CFU/100 ml, as previously discussed. The detection of *E. coli* underscores the possibility of recent fecal pollution and the need for immediate corrective action. *Escherichia coli* may cause urinary tract infection, abdominal and pelvic infection, pneumonia, bacteremia and meningitis (Filipic et al.,

2024). *Shigella spp.* was present in water samples from the tea stall near the life science buildings (TSTW). *Shigella* is highly infectious and a major cause of dysentery, mainly bacillary dysentery worldwide as well as tenesmus (Shooraj et al., 2024), often spreading through contaminated food and water, especially in areas with poor sanitation (Kotloff et al., 1999). *Vibrio spp.* was detected in the drinking water collected from another tea stall (TSHW). Certain *Vibrio* species, such as *V. cholerae*, are the causative agents of cholera (Albert et al., 2024) and thrive in aquatic environments, particularly under warm conditions with poor water hygiene (Colwell, 1996).

These findings point to the widespread presence of waterborne pathogens in campus water sources, particularly in residential halls and informal sources such as tea stalls. This highlights the urgent need for improved water treatment, routine microbiological testing, and infrastructure upgrades to ensure safe drinking water for all students.

### Conclusion

This study summarized that drinking water quality collected from various sources within Khulna University contaminated with various disease causing bacterial species. Strains of *Yersinia*, *Klebsiella*, *Salmonella*, *Shigella* and *Vibrio* are commonly found in water samples and *Escherichia coli* show the fecal coliform contamination, which is also alarming. Regular Microbiological Testing by establishing a water quality monitoring committee, installation and maintenance of filtration systems and collaboration with health authorities can ensure the continuous supply of microbiologically safe drinking water in the campus.

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### Conflict of Interests

The authors declare no conflict of interest.

### Authors' contributions

SK and SAS conceptualized the study and designed the methodology. SK wrote the original manuscript and revised the project. SAS and SK organized the tables and figures. AA and SS supervised the entire study. The authors engaged in discussions regarding the results and reached a consensus on the final manuscript.

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