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# Exploring E.Coli and Coliform in water at slums and residential area of Tricity (Mohali, Panchkula and Chandigarh)

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***Abstract:*** *Human health depends on having access to clean water, yet dangerous microbes, especially those originating from faeces, pose serious risks. Clean water is essential for health, but contamination with harmful microorganisms, particularly from faecal sources, poses serious risks. A study conducted in Tricity (Mohali, Chandigarh, and Panchkula) during different seasons (2023-2024) found high levels of coliform and E. coli bacteria, especially during the monsoon. Factors such as sewage overflow, stagnant water, and poor sanitation contributed to contamination, with Chaunki (PKL) and Mohali (Sector 91, Bhankarpur) being the most affected areas. Some locations, like Dadu Majra and Kishangarh, had lower contamination levels. The study highlights the urgent need for improved sanitation, water treatment, and regular monitoring to prevent waterborne diseases.*

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## I. Introduction:

Access to clean water is essential for life, yet contamination with harmful microorganisms poses a significant threat to human health. Ensuring a water supply that meets established quality standards—sufficient, safe, and readily available—is crucial for fostering a healthy lifestyle. Contaminated water, particularly with pathogenic microorganisms, becomes unfit for human consumption, underscoring the importance of reliable water quality management [2]. Waterborne diseases such as diarrhoea, cholera, typhoid fever, and dysentery are primarily linked to the consumption of unsafe water and inadequate hygiene practices. Faecal contamination of water sources can introduce enteric pathogens, including *Salmonella spp.*, *Shigella spp.*, *Vibrio cholerae*, and *E. coli* [3-5]. These microorganisms, commonly found in the faeces of both humans and animals, may enter community water supplies through leaching or poorly treated sewage. The World Health Organization (WHO) has developed a classification and color-coding system for *E. coli* colonies based on their concentration per 100 mL of water sample. Any drinking water supply can be microbiologically compromised due to inadequate sanitation and unsanitary practices. The primary risk to the microbiological safety of drinking water stems from the presence of human and animal faeces. Although water is essential for survival, contamination can turn it into a conduit for infectious diseases within communities [6]. Exposure to waterborne pathogens can result in both acute and chronic health problems. Ingesting contaminated water may lead to infections such as cholera, typhoid fever, hepatitis, cryptosporidiosis, and giardiasis. Common symptoms include fever, fatigue, weight loss, vomiting, abdominal cramps, diarrhoea, and stomach pain [7-9]. In severe cases, these illnesses can be fatal [10]. Vulnerable populations—including infants, young children, pregnant women, the elderly, and immunocompromised individuals—are particularly susceptible to these infections and may experience more severe symptoms [11].

To assess microbial contamination and identify specific pathogens, laboratories employ various microbiological water analysis techniques. Since comprehensive testing for all potential pathogens is costly and labour-intensive, select microorganisms that share the same sources as human pathogens are used as indicators of contamination [12-13]. The use of indicator microorganisms for detecting faecal contamination in water dates back to 1914, when the U.S. Public Health Service approved coliform bacteria analysis. The presence of these indicator organisms in water suggests a high likelihood of faecal contamination and, consequently, the potential presence of harmful pathogens [14]. To determine contamination sources, water samples are analysed before and after the decontamination of tubewell mouths, helping distinguish whether the pollution originates from the water aquifer or the tubewell itself. Generally, deep underground aquifers are considered reliable water sources.

Given the health risks associated with coliform bacteria in drinking water, it is crucial to implement appropriate standard methods for detecting and quantifying *E. coli* and coliform bacteria [15-16]. A variety of traditional and modern techniques are available for this purpose, including Multiple test tubes fermentation method (MPN), Membrane filtration technique (MF), Enzyme-based approaches, Molecular methods.[17-18] By employing these standardized testing methods, authorities can ensure the microbiological safety of drinking water, mitigate public health risks, and safeguard communities from waterborne diseases.

## II. Materials & Methods

Water sampling was carried out from 10 areas of Tricity of Mohali, Chandigarh and Panchkula during the pre-monsoon, monsoon and post-monsoon seasons in 2023-2024 to assess the biological constituents present in a water body. The objective of the sampling process was to ensure that the water samples were handled with utmost care to prevent any significant alterations in their composition prior to testing. Each bottle was meticulously labelled with the sample number and the date of collection, and they were securely placed in a bag for transport to the testing location. Sampling occurred across three distinct seasons in the year 2023-2024. Standard methods were employed for the analysis of water samples obtained from various sampling locations during the three seasons.

## III. Results and Discussions:

The on-site analysis of samples was done to note down the colour, odour, pH. Rest of the parameters were recorded in the lab.

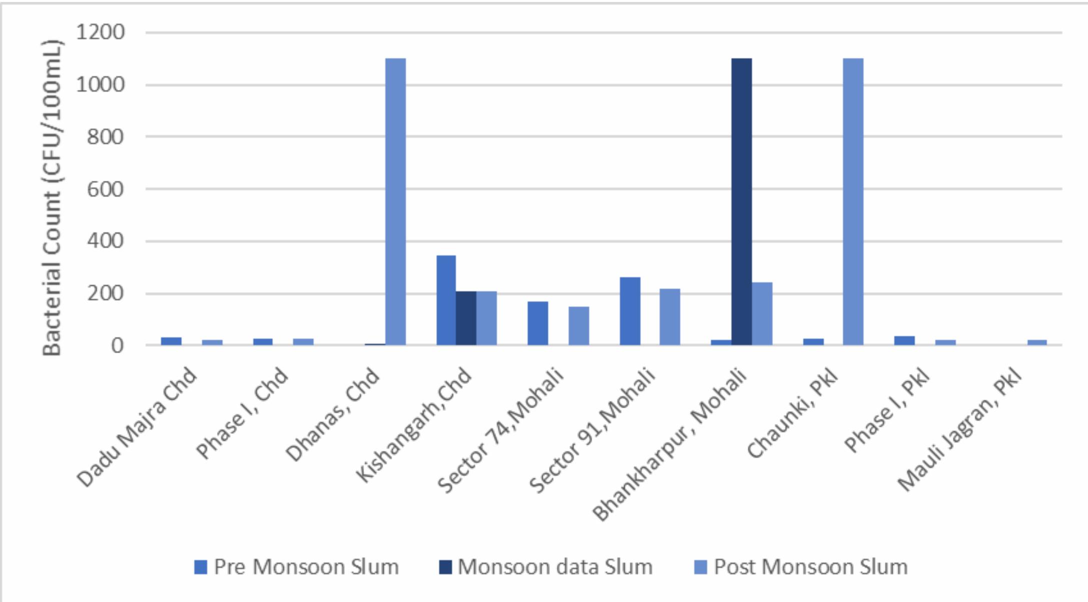


**Fig. 1: Presence of total coliform bacteria present in the drinking water in 10 slum areas of Tricity during three seasons.**

The graph illustrates the bacterial count (CFU/100mL) across various slum areas, with samples taken before, during, and after the monsoon season. The x-axis denotes different locations, while the y-axis indicates the bacterial count. Three distinct data series—Pre Monsoon Slum, Monsoon Data Slum, and Post Monsoon Slum—are represented using varying shades of blue.

The bacterial levels in Kishangarh, Chandigarh, Chaunki, PK1, and Phase I of PK1 are notably elevated during the Pre-Monsoon and Post-Monsoon periods, with measurements surpassing 1000 CFU/100 mL, indicating substandard water quality. Additionally, locations such as Sector 74 and Bhankharpur in Mohali have shown an increase in bacterial counts following the monsoon, suggesting potential contamination linked to stagnation or nutrient runoff. Conversely, Dadu Majra, Phase I (Chandigarh), and Mauli Jagran (PK1) consistently exhibit lower bacterial counts across all seasons, which may reflect better water quality or reduced external pollution. In some regions, the monsoon appears to have temporarily lowered bacterial levels, likely due to dilution effects. However, in areas severely affected, bacterial levels tend to rise again post-monsoon, likely due to environmental factors such as sewage overflow, stagnant water, and increased organic waste. The influence of the monsoon on bacterial counts varies by location, resulting in either increases or decreases. Further research is essential to identify contamination sources and to develop effective water purification strategies. Regions like Kishangarh, Chaunki, and Phase I (PK1) display critically high bacterial levels and necessitate urgent measures to improve water quality.

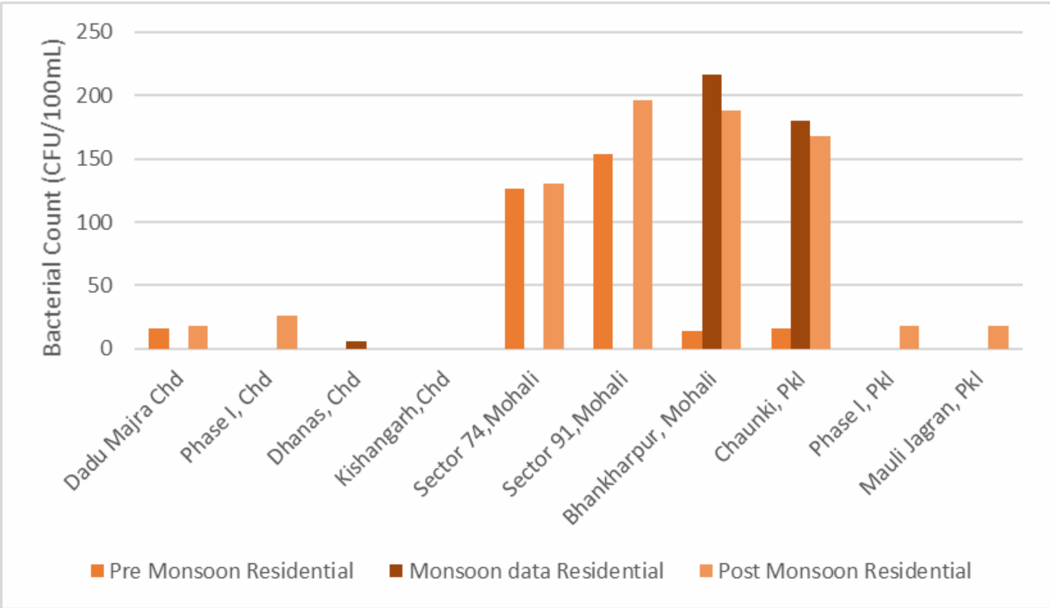


**Fig. 2: Presence of total coliform bacteria present in the drinking water in 10 residential areas of Tricity during three seasons.**

Several areas, including Dadu Majra, Phase I, Dhanas, and Kishangarh (Chd), have been identified as exhibiting low levels of bacterial contamination across all three observed time periods. In contrast, the air colonies in the PKL (Chaunki, Phase I) and Mohali (Sector 74, Sector 91, Bhankarpur) regions displayed significantly higher levels, occasionally exceeding 150 CFU/100 mL. This increase can be attributed to factors such as substantial surface runoff, inadequate drainage systems, and the mixing of sewage during the monsoon season. Most locations indicate a rising trend in bacterial counts, with the most pronounced increases occurring during the monsoon in areas like Mohali (Sector 91, Bhankarpur) and PKL (Chaunki). Notably, Mohali (Sector 91, Bhankarpur) and PKL (Chaunki) experienced the highest spikes in contamination during this period. While some sites show a slight reduction in bacterial counts after the monsoon, likely due to dilution or improved water treatment, areas such as Sector 91 (Mohali) and Chaunki (PKL) still exhibit high contamination levels, suggesting ongoing pollution sources. Contributing factors include rainwater runoff introducing pollutants into water bodies, leaking sewage lines contaminating groundwater and piped water supplies, insufficient chlorination, and inadequate water treatment practices. The elevated presence of organic matter following the monsoon fosters bacterial growth. High bacterial counts pose significant risks for waterborne diseases, including diarrhoea, cholera, and typhoid. Therefore, immediate action is required in heavily contaminated regions, such as Mohali and PKL, to enhance water safety. Regular monitoring, effective chlorination, and improved sanitation infrastructure are crucial to reducing contamination risks.

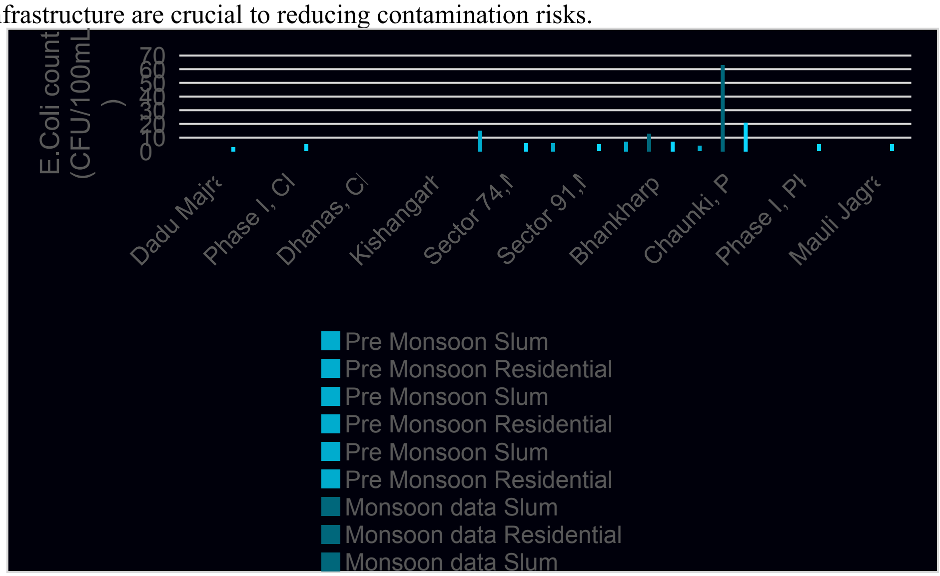


**Fig. 3: Presence of E.Coli bacteria present in the drinking water in 10 residential areas of Tricity during three seasons.**

The graph shows the levels of E. Coli contamination (CFU/100mL) in drinking water in ten Tricity residential neighbourhoods throughout the pre-, monsoon, and post-monsoon seasons. One of the main markers of faecal pollution, which presents substantial health hazards, is the presence of Escherichia coli (E. Coli) in water.

Throughout all three seasons, there is very little E. Coli present in a number of areas, including Dadu Majra, Phase I (Chd), Dhanas, and Kishangarh. This implies that these places have rather acceptable water quality and efficient water treatment. Because of increased water stagnation, sewage leaks, and runoff from polluted surfaces, E. Coli levels typically rise during the monsoon season. The highest level of contamination is found in "Chaunki, PKL," where the monsoon season causes a huge surge (over 60 CFU/100mL). This implies that there is a lot of water contamination in this region. E. Coli levels decrease in some places after the monsoon, suggesting that circumstances may have improved due to natural dilution or water treatment methods. Nonetheless, there is still a noticeable bacterial presence in Chaunki (PKL) and a few other places, indicating ongoing sources of contamination. leaking of sewage into pipelines that supply drinking water. Water supplies are being degraded by surface runoff. inadequate infrastructure for water treatment or chlorination. Poor sanitary standards in places that are severely impacted. A significant risk of waterborne illnesses like cholera, typhoid, diarrhoea, and dysentery is indicated by elevated E. Coli levels. To guarantee clean drinking water, immediate action is needed in high-risk locations, especially in Chaunki (PKL).To stop more contamination, improved water treatment techniques and routine monitoring are essential. In conclusion, the data shows that E. Coli contamination varies seasonally, with the monsoon season being the most crucial time. While some regions continue to have decent water quality, others—particularly Chaunki (PKL)—show dangerously high levels of contamination that call for immediate action. To guarantee safe drinking water in every residential area, proper water treatment, infrastructure upgrades, and public health initiatives are required.

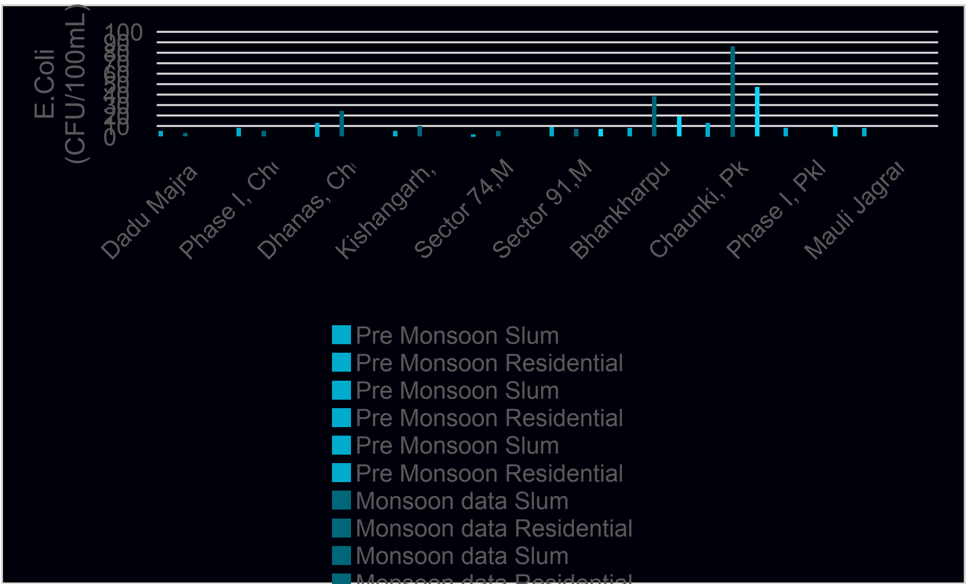


**Fig. 4: Presence of E. coli bacteria present in the drinking water in 10 slum areas of Tricity during three seasons.**

E. Coli levels in a number of slum neighbourhoods, including Dadu Majra, Phase I (Chd), Dhanas, and Kishangarh, are low throughout the year, indicating that the water quality or treatment efforts in these areas are comparatively superior. Surface runoff, sewage leaks, and water stagnation are the main causes of the E. Coli contamination that is seen in most places during the monsoon season. During the monsoon season, Chaunki (PKL) has the highest contamination, surpassing 80 CFU/100mL.There are also discernible increases during the monsoon season in other places, like Sector 91 and Bhankarpur in Mohali. In many regions, E. Coli levels drop after the monsoon, perhaps as a result of better water treatment or natural dilution. After the monsoon, Chaunki (PKL) still maintains significant levels of contamination, which suggests lingering pollution sources and poor sanitation. sewage and water pipelines that are broken or leaking. surface runoff from inadequately maintained restrooms. inadequate treatment of drinking water and a lack of chlorination. Monsoon seasons are marked by increased human activity and waste accumulation. Particularly in susceptible slum communities, elevated E. Coli levels significantly increase the risk of watery illnesses such cholera, dysentery, typhoid, and diarrhoea. To guarantee access to safe drinking water, immediate action is required in high-risk communities, particularly Chaunki (PKL) and other impacted places. To stop contamination in the future, greater water treatment, better sanitation, and routine monitoring are crucial. In conclusion, the data indicates significant seasonal fluctuations in E. Coli infection, with the monsoon season being the most crucial time. Some slum areas, like Chaunki (PKL), have dangerously high bacterial presences, necessitating immediate sanitation and water safety measures, while other slum areas retain minimal contamination levels. To safeguard the locals from waterborne illnesses, adequate chlorination, infrastructural upgrades, and public health campaigns are required.

## IV. Conclusions:

Waterborne illnesses such as diarrhoea, cholera, typhoid fever, and dysentery arise from the consumption of contaminated water, which is often associated with inadequate sanitation and hygiene practices. This study evaluated microbial contamination in drinking water across ten sites in the Tricity area (Mohali, Chandigarh, and Panchkula) during the pre-monsoon, monsoon, and post-monsoon seasons of 2023-2024. The key findings reveal that bacterial contamination, including the presence of coliforms and E. coli, varies with the seasons. Factors related to the monsoon, such as sewage overflow, stagnant water, and surface runoff, lead to heightened levels of contamination. Certain locations, particularly Chaunki (PKL), Mohali (Sector 91, Bhankarpur), and slum areas, displayed alarmingly high bacterial counts, which pose significant health threats. Conversely, some areas, like Dadu Majra and Kishangarh, exhibited comparatively lower levels of contamination, likely due to more effective water management practices. The study highlights the urgent need for enhanced sanitation infrastructure, effective chlorination, and regular monitoring of water quality to mitigate contamination risks and avert waterborne diseases. Immediate action is necessary in the most affected areas to guarantee access to safe drinking water.

## V. Acknowledgement

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