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Evaluation of Microbiological Quality of Drinking Water from Different Water Booths in Dhaka City

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Abstract

Drinking water is very much essential as pure drinking water supports digestion, circulation and helps flush out harmful substances from human body. Microbiological test of drinking water is unavoidable as it helps to identify bacteria, virus, protozoa furthermore it confirms if the water is safe for human consumption or not. The motive of this research was to analyse the microbiological quality of drinking water from four different water booth in Dhaka city. In this research Nutrient agar media was used to perceive the total count and MacConkey agar media was used to perceive *E. coli* as well as gram negative bacteria. After observing the result, it was clear that the water of Motijheel and Mirpur is highly contaminated and observed numerous growths in nutrient agar media but both Banasree and Wari was uncontaminated. Among the four areas, *E. coli* was observed in Mirpur and Motijheel in MacConkey agar media. So, it is required to aware public for drinking contaminated water for preventing terrific health issues.

Keywords: Potable water, TNTC (too numerous to count), Gram negative bacteria, and Contamination.

1. Introduction

Every life needs water for surviving on earth. It has a huge important role for sustenance of life (Bello *et al.*, 2013). In many developing countries, outbreak of disease occur due to microbiological contamination in water, especially in polluted drinking water (Ahmed *et al.*, 2004). Diarrhea, dysentery as well as many different diseases occur due to drinking microbiologically contaminated water and chemical intoxication in water which is currently a burning issue in global public health (Isa *et al.*, 2013).

As Bangladesh is a densely populated country, the reasons behind water contamination are quite similar.

Surface water and ground water both are majorly affected via deposition of minerals, nonpoint source pollution, inadequate sanitation, etc (Geldreich *et al.*, 1990). The contaminated water with fecal material, factory waste, nonpoint source pollution can cause several diseases to the users of this water (Geldreich *et al.*, 1991). Fecal contaminant organisms are *Escherichia coli*, *Clostridia*, *Enterococci* and *Streptococci* (Binni *et al.*, 2006; Ahmad *et al.*, 2018).

As a consequence of abortive or improper application of water treatment techniques, coliforms and various pathogens can be found in water that is used for drinking (McFeters *et al.*, 1986). Nearly one sixth of

the world total population gets sick and 5 million children dies every year because of consuming contaminated water (Shittu *et al.*, 2008). As water is connected with each person's regular routine, it is mandatory to maintain its standard (Bello *et al.*, 2013). Hence to ensure the safety of water supply, one of the basic requirements is to prevent the transmission of contamination via drinking water (Ahmed *et al.*, 2004). The World Health Organization (WHO) has

already taken necessary steps to ensure safety of water in Bangladesh to promote obstructive approaches for management of water quality by using (WSP) Water Safety Plans (WHO Chronicle, 2011).

So the aim of this research was to identify the microbiological quality of water samples from water booths in different areas of Dhaka city.



Fig. 1: Water Booth in Dhaka City.

2. Materials and Methods

Institutional Clearance

This research was conducted at Microbiology Department, Lion A. Badal Eye and General Hospital and the approval was taken.

Study Population

Drinking water samples were collected from water booth in four different locations of Dhaka city. The areas were: Motijheel, Mirpur, Banasree, Wari.



Fig. 2: Water Sample Collected from Different Areas in Dhaka.

Sample Size Calculation

It was tried to collect the samples from all the different locations in Dhaka city but permission were received from four areas in Dhaka city to collect the water samples.

Materials Used

In this research, nutrient agar was used to observe total count and MacConkey agar was used to observe *E. coli* as well as other gram-negative organisms. Hi-media agar, Origin India, was used to conduct this research. Biosafety cabinet, Autoclave, incubator, hot air oven, water bath all were used Bio-base brand, origin China for this research.

Lab Procedure

Nutrient agar media and MacConkey agar media was prepared and sterilized. Water samples were serially diluted till 10^2 with distilled water and inoculation was done in Nutrient agar and MacConkey agar plate. Plates were incubated at 37 degree centigrade for 48 hours. After 48 hours, all the results were observed (Abedin *et al.*, 2020; Abedin *et al.*, 2020; Ahmed *et al.*, 2013; Abedin *et al.*, 2020; Ghosh *et al.*, 2024)

Data Analysis

IBM SPSS version 22 software was used for statistical analysis of the observed data.

3. Result and Discussion

Table 1: Result of Nutrient agar media.

| Area | Direct | Sample 10^1 | Sample 10^2 |
|-----------|-----------|---------------|---------------|
| Motijheel | TNTC | 300 | 10 |
| Mirpur | TNTC | 35 | 2 |
| Banasree | No growth | No growth | No growth |
| Wari | No growth | No growth | No growth |

TNTC = Too numerous to count.

In this research, four different areas water booth were chosen to analyse microbiological quality of drinking water sample. **Table 1** represents the total count growth results in Nutrient agar media. It was observed that TNTC (Too numerous to count) growth was observed both in Motijheel and Mirpur areas from direct sampling techniques which is very much alarming. Reduction of microorganisms was observed in different dilution factor. No growth was observed in Banasree as well as Wari area samples. As Motijheel

and Mirpur area's water was highly contaminated, so it is possible that their water purification process is not up to the mark. A research conducted in Bangladesh reported that 20% samples were found as non-potable water from their total sample size (Ahmed *et al.*, 2013). In research of Ethiopia conducted in 2011, 87.5% samples were found as non-potable, but the local community people were frequently used it (Abera *et al.*, 2011).

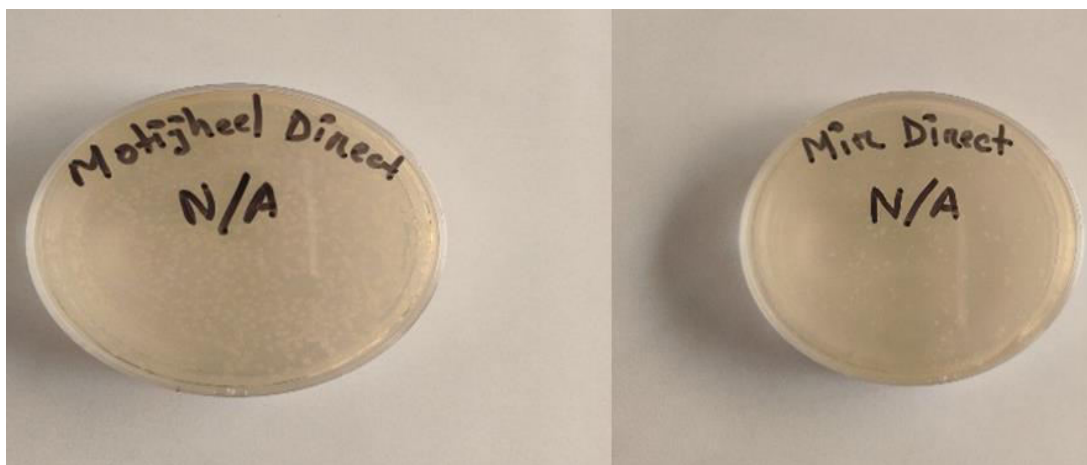


Fig. 3: Growth in Nutrient Agar.

Table 2: Result of MacConkey Agar Media.

| Area | Direct sample | Sample 10 ¹ | Sample 10 ² |
|-----------|---------------|------------------------|------------------------|
| Motijheel | 87 | No growth | No growth |
| Mirpur | 70 | No growth | No growth |
| Banasree | No growth | No growth | No growth |
| Wari | No growth | No growth | No growth |

Table 2 represents the result of selective micro-organism in MacConkey agar media, in this observation no growth were found in 02 areas (Banasree and Wari). But in Mirpur and Motijheel, a minimum growth of *E. coli* was observed. In the research of Tamil Nadu, India in 2012, the faecal coliform

bacteria and *E. coli* was observed in water sample exceeding acceptable count limits (Antony et al., 2012). In the research of Ethiopia conducted in 2011, *E. coli* was observed in an alarming count (Abera et al., 2011).

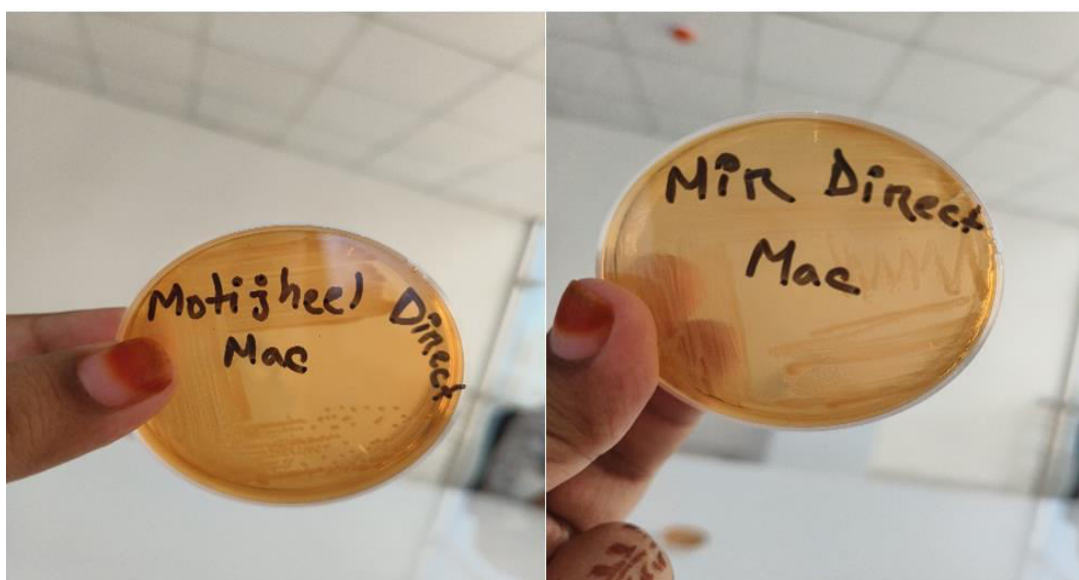


Fig. 4: Growth in MacConkey Agar.

4. Conclusion

From the different booths of Dhaka city water samples were collected and a microbial analysis test was conducted to see how purified and safe the water is. The results of the test were not fully satisfactory as pathogens were observed in water from some areas which is actually very alarming. The water purification system of these areas needs to be managed well to avoid contamination. And also the people of the areas should be more conscious about the water they are drinking. After observing the quality of the water from the samples of Motijheel and Mirpur areas, very impoverished results were observed. As huge number of populations stays in those two locations, serious diseases can be caused to them. Preventive measure should be taken to improve the quality of drinking

water. Also make people aware about the water quality to prevent disaster. Meanwhile the results in both Banasree and Wari are acceptable. So special focus should be given in the treatment procedure of water booth in Motijheel and Mirpur area.

Limitations

Due to some unavoidable circumstances sufficient size of sample couldn't be collected to conduct the test.

5. Authors Contribution

S.A.I.; M.A.; and R.A.: performed all the laboratory work, M.A.; and S.A.I.: prepared the manuscript, R.A.; and M.A.: prepared the figure and tables, Z.S.U.: advised and supervised the whole laboratory work and manuscript writing.

6. Acknowledgement

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7. Conflicts of Interest

The authors announce that there is no conflict of interest with respect to the publication of this article.

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