

Bacteriological analysis of bottled drinking water - A multi-centric study in semi urban areas of West Bengal and Bihar

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Abstract

Background: Semi urban people of developing countries often suffer from water borne diseases due to inadequate and contaminated supply of Tap water for drinking purpose. Bottled water of local brands are cheap but not always potable. **Objectives:** The current prospective and multi centric study was undertaken to detect bacteriological quality of bottled water marketed at major transit points of two different semi-urban areas, one from West Bengal and another from Bihar and thus attempted to create awareness about the portability of bottled drinking water. **Methods:** A total of 30 bottles of 10 different brands were randomly selected for bacteriological analysis. 3 bottles of each brand were included in the study. Total viable count (TVC) were assessed for the bacteriological quality of samples. **Result:** Out of 30 bottles, 3 bottles of a particular local brand were found having no date of manufacture and date of expiry. Some floating bodies and deposits were found inside of another 3 bottles of a local brand. All the 30 bottles were examined for bacteriological Quality and 24 bottles (80%) were found bacteriologic ally acceptable for drinking as per national standard. **Conclusions:** Our research activity could unearth the necessities of periodic bacteriological evaluation of bottled drinking water specially of those manufactured at regional basis as well as may help to create awareness and thus to protect Public health from water-borne diseases.

Key Word: Periodic evaluation, semi-urban people, bottled drinking water, local brands, public health.

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INTRODUCTION

Usually a sealed water Bottle is considered safe for drinking purpose by people all over the world. Especially long-distance travellers, patients and patient parties coming for treatment in a city hospital from rural and semi urban areas. In Asian countries, the estimated usage rate is 27%¹ Overall bottled water use grew up from 12.8

billion gallons in 2016 to 13.7 billion gallons in 2017, an increase by 7 % in U.S.² Bottled water industry are fastest growing sectors in India due to its increasing population, as India is rated among the top ten countries in the world³. However, with increasing demand, safety and standard are often compromised even in bottled waters. The microbiological qualities of bottled water of some manufacturers have often been found to be below standard. Studies done in different parts of India and as well as in several countries of the world where microorganisms were isolated above standard levels in bottled water. Consumption of these contaminated waters lead to Several water-borne diseases like cholera, typhoid, hepatitis A and E. Even use of contaminated pipe-line water following trauma in eye was also detected as a cause of corneal ulcer⁴. This particular quality study was undertaken to assess the bacteriological quality of bottled water from different transit places and in front of hospitals sold by vendors.

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MATERIAL AND METHOD

This prospective and multi centric study was conducted in two semi urban areas at Budge Budge, in WB, which is 25 kms (apx) away from proper Kolkata and at Kishanganj, which is 65 kms (apx) away from Purnia of Bihar. This study was carried out during three months from April to June 2019. The ethical committee approval was obtained from both the institutional ethical committees. Sample (bottles) were collected from vendors at main transit sites like outside Budge Budge and Kishanganj railway stations , Bus terminus ,entrance of JIMS, Budge Budge and MGM medical college and LSK hospital, Kishanganj. 30 bottles of sealed drinking water, 3 bottles each of 10 different brands were collected from different places of Budge Budge, W.B and Kishanganj, Bihar. In a previous study, conducted in 2018 at Mangalore city of south India, 24 water bottles were selected³. Hence, we have decided to collect at least 30 water bottles to have a reproducible result. The bottles collected were inspected for sealed cap, turbidity of water, batch number, date of manufacture, place of manufacture, date of expiry and process of purification. Printed I S I certification symbol from Bureau of Indian Standards as per Govt. notification was searched for and printed Licence numbers were noted. Usually drinking water treatments are done by various techniques like Sand filtration, Carbon and micron cartridge filter, by Membrane filter, UV Rays, Ion exchange and Reverse osmosis etc. Free chlorine level is also maintained. Containers are also checked for leakage, suspended materials etc. A periodic in-house test as internal quality control is also done⁵. We have examined all the collected 30 bottles for Microbiological Standard in our departmental laboratory both at JIMS, Budge Budge and MGM medical college, Kishanganj, by analysis of T V C (Total Viable Count) alone using the standard Plate count

method within 1 hour of purchase⁷. TVC s are good indicators of general contaminations and of the overall quality of the production^{5,6}. A qualitative estimate of the concentration of micro organisms in water was tested by C F U per millilitre of samples⁶. The determination of total bacterial count was done by serial dilution and pour plate technique. 10 fold dilutions were done for each bottle with sterile water. 1 ml from 10th tube was taken twice and inoculated in two sterile Petri plates. Then 20 ml of melted Double strength MacConkey's agar pre - cooled to 50 degree centigrade was added to each plate and mixed thoroughly (in 2 plates). Allowed to solidify. 1 plate incubated at 22 degree centigrade for 48 hour other plate incubated at 37 degree centigrade for 48 hour. At the end of incubation period, the number of bacterial colonies in both the plates were counted and average count was reported as CFU/ml^{3,9}. Accordingly to the BIS standard, TVC must be below 100 CFU/ ml of sample at room temperature⁸.

RESULT

All 30 bottles were sealed properly but only 24 bottles (80%) were ISI certification labelled. These 24 bottles were manufactured by 4 National, 2 Multinational and 2 by local National companies. The other 6 (six) bottles which were manufactured by 2(two) other local companies. 3 bottles of one local brand, which were without date of manufacturing and date of expiry. Other 3 bottles from another local company were found where drinking water were contaminated with floating / suspended materials. These six bottles, after bacteriological examination showed, TVC count ranged from 200-400 CFU/ml. So, these 6 bottles without ISI certifications (25% of all national brand companies bottles) were bacteriologically unacceptable.

Table 1: Total number of bottles - National and Multinational brands with ISI certifications.

Total number of bottles examined	Number 30
National brands (including 2 local brands)	Number 18 (60%) with ISI
Multinational brand	Number 06 (20%) with ISI
Local National brands :	Number 06 (20%) without ISI

Table 2: Relation between ISI Certification and Bacteriological acceptability

Total 10 Brands and 30 bottles	ISI certifications and acceptability (%)
6 National (including with 2 Local brands) , 18	18 bottles (60%) and 18 bottles (100%)
2 Multinational brands, 06	06 bottles (20%) and 06 bottles (100%)
National (2 local brand), without ISI , 06 :	06 bottles (20%) and all unacceptable.

Table 3: Total number of Bottles of National brand and Total number of bacteriologically unacceptable Bottles amongst National brands

Total bottles of National brands- 24	Bacteriologically unacceptable= 6(25%)
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DISCUSSION

Safe drinking water supply for the community is always a major concern. Bacteria has been known to multiply in pipes of water distribution systems. They grow in bottled drinking water although the reason is still unknown. Some scientists believe that biological material present in the bottles are responsible.¹⁰ Different private sectors at Multinational or national level manufacturing bottled water to meet the increasing demand. There are also some local brands, preparing bottled drinking water. During this course, they often compromise with the quality of drinking water which directly affect the public health. In our study, 30 bottles of sealed drinking water of 10 different brands, were collected randomly from different vendors of different areas of Budge Budge, south Kolkata, West Bengal and Kishanganj, Bihar, of which 24 bottles (80%) were considered as safe for drinking purpose after bacteriological quality assessment in departmental microbiology laboratories of both the medical colleges. Remarkably all these 24 bottles were ISI certified. So, all bottles Certified by ISI were 100% microbiologically safe as per our study. Whereas 6 bottles of 2 local national brands, not certified by ISI, tles were found microbiologically unacceptable. So, out of 24 bottles prepared by National companies, 6 bottles were unacceptable for drinking (25%). In one study at Mangalore, in 2002, where Researcher have reported 66.7 % of bottled water sample were safe for drinking¹¹. There are other Indian studies where the acceptability rate varies from 60%^{12,13} to 90 %¹⁴. In another retrospective study ,in Ethiopia, in 2018, 222 bottles were collected from 2008 to 2015, where 40% sealed sample were found to be unsafe¹⁵. In a study, at Dharan, Nepal, 100 samples tested, of which 76 samples collected from Tap water and 24 bottles of sealed water collected from local vendors. According to this study 87.5% of bottled water were found contaminated¹⁶. So, our study report on safety of drinking water (80%) is quiet consistent in compare to other Indian studies. But the rate of safety and potability of bottled water in few other developing countries were not satisfactory in compare to ours.

CONCLUSION

Access to safe drinking water is considered to be a human right, not a privilege, for every man, woman and child (world bank, 2018). A great number of microbial pathogens are transmitted through drinking water. Now a days people are carrying bottled water as they consider it safe and easy to carry at anywhere .According to the demand, there are so many growing bottling plants here and there, but safety and quality are not maintained properly in all those plants. Microbiological quality of drinking water is not only related to water suppliers and

consumers but it has its impact on public health directly. As many outbreaks have been reported due to contaminated drinking water¹⁷. There was evidence of Norovirus outbreak in Spain linked with bottled Water in 2016¹⁸. So regular supervision for the quality is a must. Regarding certification, authority should look after this thoroughly. After this study, our recommendation is regular bacteriological analysis of water source before bottling and checking for proper sterilisation. Lastly to supply safe and potable water, it should be properly stored and filtered. People should also examine the ISI Certification label printed over the bottle before purchase of any.

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