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ORIGINAL ARTICLE

MICROBIAL EXAMINATION OF BOTTLED WATER AVAILABLE IN LOCAL MARKET OF SRI GANGANAGAR, RAJASTHAN

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ABSTRACT:

Background: Pathogens enter water via fecal contamination that can lead to severe and widespread human illness from drinking, swimming and bathing waters. However bottled water is supposed to be free from any microbial contamination. **Aim:** The present work evaluated the microbial level of six samples of bottled water collected from local market of Sri Ganganagar, Rajasthan. **Materials and method**: Six samples (Aquafina, Xalta, Bilseri, Kingfisher, Gallon , and Bailley) were analyzed for total viable count and coliform count. The serial dilution such as 10^{-2} was prepared for the study of microbial load. The pour plate method was employed for the estimation of microorganisms. The MPN method was employed for the detection of coliform. **Results:** The total viable count ranged from 1.0 x 10^2 to 16.78 x 10^2 TVC/ml. The average of three replicates were taken as recording. The coliform bacteria were not detected in any of the bottled water sample. It was however; found that total viable count of all bottled water samples was much higher than the IBWA standards. **Conclusion:** The microbial quality of bottled water samples were not appropriate as per IBWA as samples showed higher bacterial count which can further effect the health of the consumer.

Key Words: Bottled water, MPN method, Coliform

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INTRODUCTION

The objective of microbial examination of any food or food product is its freedom from fecal pathogens, toxic bacteria and high viable count. The most common water contaminants are Coliform bacteria. Common sources of bacteria are waste, septic systems and surface water that gets into the well.

The presence of indicator organisms within recommended limits is of prime importance in the quality of bottled water (1,2). The permissible limit for total viable count is less than 200 TVC/ml (3). Further total viable count reflects the conditions in which the food was produced, packed, stored and handled. Total viable count can be used to predict the shelf life or keeping quality of the product.

Epidemiological studies suggest a positive relationship between high concentrations of *E. coli* and enterococci in ambient waters and incidents of Gastrointestinal illnesses associated with recreational activities (4). Research supports use of *E. coli* and enterococci rather than the broader group of fecal coliforms as indicators of microbiological pollution. Consistent quality and taste are two important of the principle differences between bottled water and tap water (5).

Pathogens enter water via fecal contamination that can lead to severe and widespread human illness from drinking, swimming and bathing waters (6). Sources

of fecal contamination in surface waters include wastewater treatment plants, septic systems, domestic and wild animal manure, and storm runoff. Direct testing of individual pathogens is not cost-effective or practical; scientists have identified indicator organisms to indicate the presence of more harmful pathogens (7).

In view of the above findings the present research work was carried out to determine the microbial status of the bottled water being sold in local market of Sri Ganganagar, Rajasthan.

MATERIALS AND METHODS

Sampling:

Six samples of bottled water were collected (Table 01) from a local market. These all samples are easily available in any market of Sri Ganganagar, Rajasthan. Samples were carefully selected while examining their sealed packing. Samples were taken to Beck.G method and stored in the refrigerator for microbial examination.

Preparation of nutrient media:

Nutrient agar medium (g/L) peptone 5.0, Beef extracts 5.0, Agar Agar 15.0, was used for determining the total viable count of the bottled water.

Sampling techniques

Total viable count:

The total microbial colonies of the samples were counted by pour plate method and incubated for fixed period at 37^0C for 24 – 48 hours. Colony count method was used to estimate the bacteriological load of the organism.

Table 1: List of manufacturers of different bottled water samples

SAMPLE	MANUFACTURERS
Aquafina	Varun Beverages Ltd,Plot No.290-292,RIICO Ind.area Phase VII,Chopanki,Bhiwadi,Rajasthan.
Xalta	Sadioura Brothers,Sunam Road,Village Longowal,Distt.Sangrur,Punjab.
Bilseri	Aqua home Appliances,G-92,Phase II RIICO Ind.Area,Hunumangarh,Jn.,Rajasthan.
Kingfisher	Sai Foods, Timber Market,Rajpura Punjab Distt.-Patiala.
Bailley	Jallan Food Product Govindgarh,Khasra no.1566/2, Village dhoblai, Jaipur.Rajasthan.
Gallons	Aqua Rius Purification Pvt.Ltd.SKS ind.Area Jaipur Road Distt.Siker.Rajasthan.

Table 2: Standards drafted by International Bottled Water Association (IBWA)

Total Viable Count/ml	No more than 100
Most Probable Number (MPN)	< 101 subject to the frequency of Opportunity for water analysis.

Table 3: Microbial Examination of Aquafina Bottled Water

		Characteristics of Predominant Colonies			
Sr. No.	**TVC/ml**	**Colour**	**Morphology**	**Gram Staining**	**Coliform**
1.	12.51×10^2	White	Cocci	+	-
2.	11.23×10^2	Off white	Rod	_	-
3.	12.83×10^2	White	Cocci	_	

Table 4: Microbial Examination of Xalta Bottled Water

	Characteristics of Predominant Colonies				
Sr. No.	**TVC/ml**	**Colour**	**Morphology**	**Gram Staining**	**Coliform**
1.	15.65×10^2	Yellow	Cocci	+	-
2.	14.77×10^2	Off white	Rod	-	-
3.	14.29×10^2	White	Rod	_	-
Mean	14.90×10^2	-	-	-	Nil

Table 5: Microbial Examination of Bilseri Bottled Water

		Characteristics of Predominant Colonies			
Sr. No.	**TVC/ml**				**Coliform**
		Colour	**Morphology**	**Gram Staining**	
1.	1.0×10^2	Off white	Cocci	_	-
2.	1.3×10^2	White	Rod	_	-
3.	1.25×10^2	Yellow	Cocci	+	-
Mean	1.18×10^2	-	-	-	Nil

Table 6: Microbial Examination of Bailley Bottled Water

	Characteristics of Predominant Colonies				
Sr. No.	**TVC/ml**	**Colour**	**Morphology**	**Gram Staining**	**Coliform**
1.	16.78×10^2	Off white	Rod	_	-
2.	15.64×10^2	White	Cocci	+	-
3.	14.61×10^2	White	Cocci	_	-
Mean	15.7×10^2	-	-	-	Nil

Table 7: Microbial Examination of Gallon Bottled Water

Sr. no.	TVC/ml	Characteristics of Predominant Colonies			Coliform
		Colour	Morphology	Gram Staining	
1.	12.61 x 10^2	White	Cocci	_	-
2.	15.81 x 10^2	Off white	Rod		-
3.	14.21 x 10^2	White	Cocci	_	-
Mean	14.21 x 10^2	-	-	-	Nil

Table 8: Microbial Examination of Kingfisher Bottled Water

Sr. No.	TVC/ml	Characteristics of Predominant Colonies			Coliform
		Cooler	Morphology	Gram Staining	
1.	15.81 x 10^2	Yellow	Cocci	+	-
2.	14.85 x 10^2	White	Cocci	+	-
3.	16.37 x 10^2	Off white	Rod	_	-
Mean	15.67 x 10^2	-	-	-	Nil

Detection of coliform

The coliform organisms were determined by standard multiple tube fermentation technique (8).The results were compared with International (Table 2) standards drafted for total viable count and coliform count (3).

RESULTS:

The data of table 5 showed that Bilseri bottled water had lowest total viable count which was 1.0 x 10^2 TVC/ml; it was within permissible range and is according to national and international standards (3). It must be recommended that a low total viable count does not always represent a safe product as other factors and parameters should also be considered, and the product should be recommended on an aggregate basis (9). Some organisms produced toxin that remain stable under condition that may not favor survival of microbial cell (10).

Highest contamination was observed in Kingfisher bottled water and Bailley bottled water that was 16.37 x 10^2 to 16.78 x 10^2 TVC/ml respectively(Table 6&8). In both samples gram positive and gram negative bacteria were found. The high total viable count not only indicated improper hygienic condition in processing but it was also definitely contradictory to the claim of manufacturers. Total counts of microorganisms can be used as an indicator of the sanitary quality of bottled water. Total viable count may reflect the handling history of freshness of the product. Total viable count may be taken to indicate type of sanitary

control exercised in the production, transport and storage of bottled water.

DISCUSSION:

Microbial contamination of bottled water can be influenced by variety of factors such as source of bottled water; water may be contaminated during processing and packaging.

The mean value of Aquafina , Xalta and Gallon bottled water sample were 12.19 x 10^2 TVC/ml(Table 3) which is not in accordance with the international standards (3). It is much higher than the limits. The results revealed after testing the bottled water available in market show poor water quality, even for some renewed brands. The bacteria examined during tests were mostly cocci.

Total viable count of Gallon bottled water and Xalta bottled water was also higher that was 15.81 x 10^2 TVC/ml and 14.90 x 10^2 TVC/ml respectively. In Gallon bottled water there were only the gram negative bacteria was found but in Xalta bottled water both gram positive bacteria and gram negative bacteria were found. It was found that bacterial population varied quite markedly in each of the samples.

High bacterial counts among different samples may be due to unclean utensils and containers, particularly place and atmosphere where bottled water were processed. The coliform bacteria were absent in all the samples tested. Coliform counts are generally used as an indicator of possible fecal contamination, potential for the presence of pathogenic species and reflect the hygiene standards adopted in the food's preparation
(11,12,5). Improper handling and storage can allow the level to increase.

The results of present study depicted that the total viable count of all bottled water samples were higher than the permissible range (3). The coliform bacteria were absolutely absent in all bottled water samples. This is a matter of great satisfaction that pathogenic bacteria in particular have not been found in all water samples. The total viable count shows that mostly non pathogenic bacteria were present. The overall quality of bottled water sample is satisfactory but still need further precautionary measures are suggested in order to improve the quality of bottled water.

CONCLUSION:

The study concluded that viable count of all the bottled water samples was higher than recommended levels of IBWA. Hence the study emphasizes that quality of bottled water should be carefully monitored to assure safe drinking water for the consumer.

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