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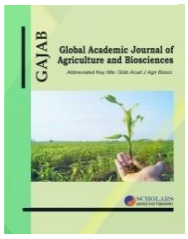

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Research Article

Physicochemical and Microbial Assay of Five Different Plastic Bottled Water in Kano

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Abstract: The study sampled five bottled water consumed in Kano which include Nestle, Faro, Cest Bon, Bigi and Aquadana bottled water (popularly consumed in market, restaurants, stadium, viewing centres, suya spots, parks among others in Kano). Analysis was done using standard method and results obtained for the physicochemical and microbial assay was below the guidelines limit of WHO, indicating the suitability of the plastic bottled water analyzed for the aforementioned parameters. Hence, the populist believed bottled water is safe for consumption; thorough monitoring survey is needed to enhance the quality and safety sustenance.

Keywords: Microbial, physicochemical, assay.

INTRODUCTION

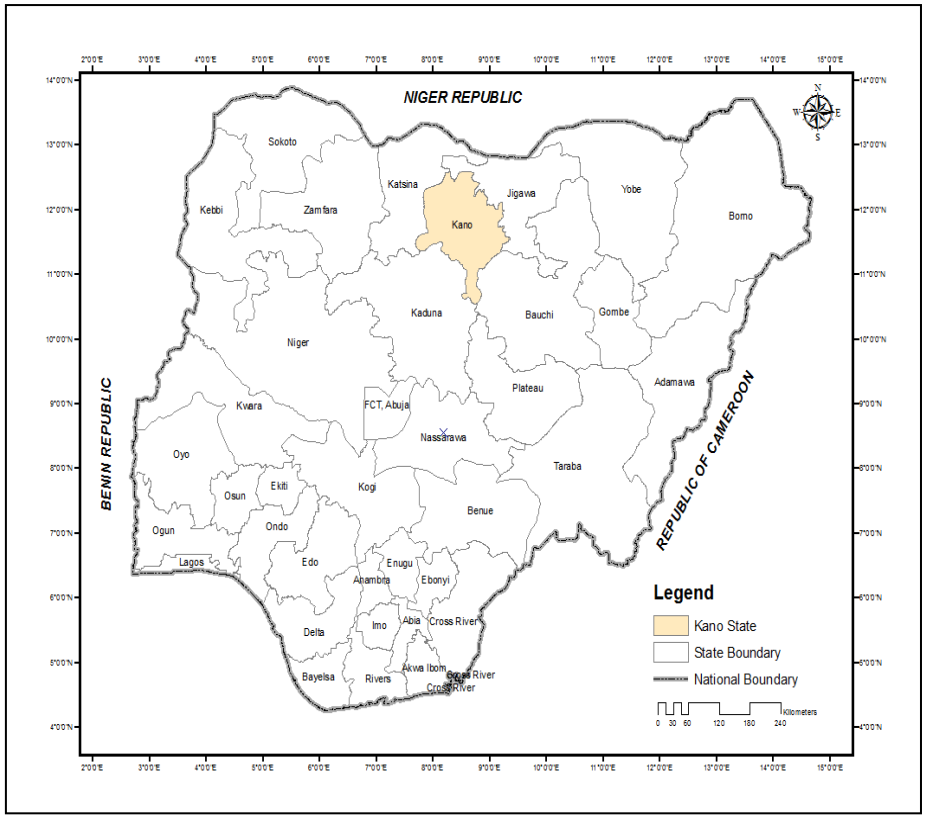
Water is an essential part of human nutrition, both directly as drinking water and indirectly as constituent of food. Potable water is literarily drinking water, because of the growing concern of contamination from point source and non-point source and its human health effects, consumption of tap water in Kano has decreased and consumption of plastic bottled water has increased. Quality water is hard to come by, so plastic bottle water becomes the best option (Dada and Ntukekpo,1997). According to Dada and Ntukekpo, 1997, 80% of all diseases and over 30% of deaths are related to drinking water in developing nations of the world. Plastic bottled water are produced by registered company and are regulated by National Agency for Food Drug Administration and Control (NAFDAC), Standard Organization of Nigeria (SON) and National Environmental Safety and Regulatory Enforcement Agency (NESREA).Most of the plastic bottled water are certified suitable for consumption but they are error prone to contamination and subsequently lead to pollution (Akpen, *et al*., 2018). Based on this default arising from the error through contaminated plastic bottle, cork or cover, contaminated pipe, vessel or container used, default from separation and purification process among others, informed the researcher to evaluate the physicochemical and microbial parameters in five plastic bottled water consumed in kano.

Aim of the Study:

This research is aimed at evaluating the comparative analysis of physicochemical and microbiological properties of 5 various plastic bottled water produced in Kano.

Description of Sampling Site:

Kano state is in the northern part of Nigeria, its a commercial and industrial hub in West Africa sub region. Below is Nigeria map showing Kano State.



MATERIAL AND METHODS

Analysis of the physicochemical and microbial parameters of The five (5) different plastic bottled Water In Kano is done by randomly procuring or purchasing a pack (containing twelve bottles) of bottled water produced on Monday, opening six out of it, mixing it together and collecting a composite sample of one litre each, making it a total of five samples per session (it is done similarly on Wednesday and Friday to cumulatively obtain fifteen samples), in situ analysis was done for taste, turbidity, pH, colour, odour and conductivity. Ex situ assay was done for others using standard method as recommended by America Public Health Agency (APHA) (Bamishaye,*et al*.,2011). The various plastic bottled water samples previously labeled in sample bottle and vials were taken to TAMBARAWA WATER WORKS, Kano State for physicochemical and microbial analysis.

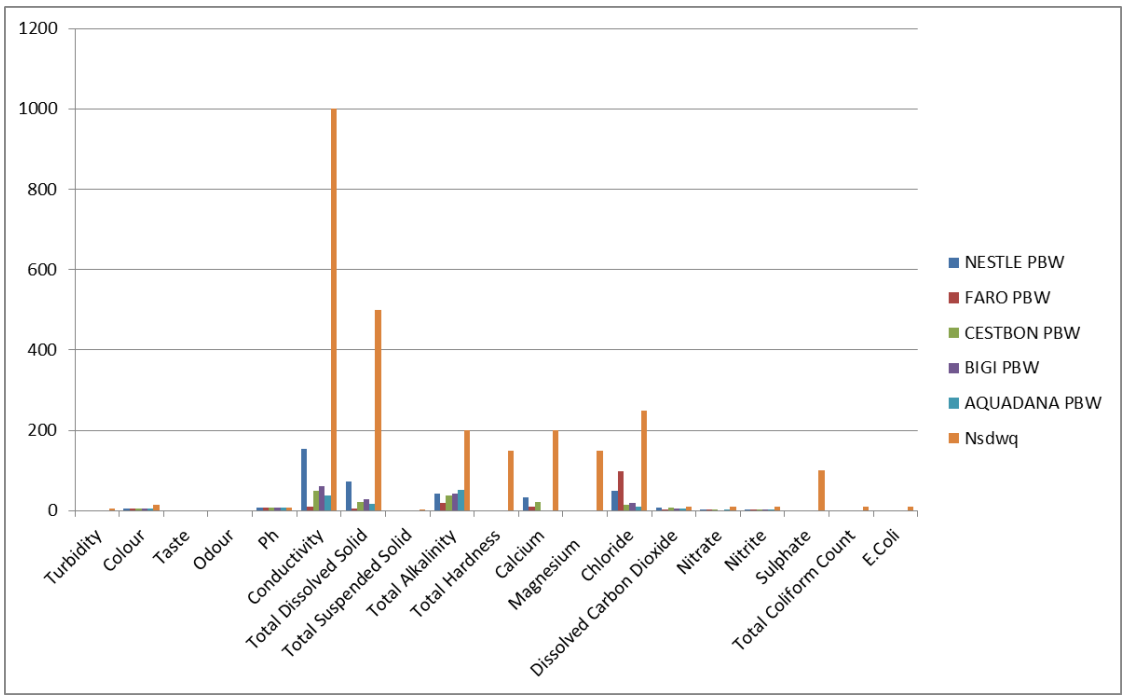
RESULTS AND DISCUSSION

Result of the various plastic bottled water samples analyzed is presented below in table 1.

TABLE 1: Show the parameters, analytical results, mean/standard deviation, maximum allowable concentration (NSDWQ) and remarks of NESTLE, FARO, CESTBON, BIGI AND AQUADANA PLASTIC BOTTLED WATER(PBW).

SN	Parameters	Mean/Sd (NESTLE PBW)	Mean/Sd (FARO PBW)	Mean/Sd (CESTBON PBW)	Mean/Sd (BIGI PBW)	Mean/Sd (AQUADANA PBW)	Nsdwq	Remark
1.	Turbidity	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	5.00 NTU	Suitable
2.	Colour	5.00±0.0	5.00±0.0	5.00±0.0	5.00±0.0	5.00±0.0	15.0 Hazen	Suitable
3.	Taste	Nil	Nil	Nil	Nil	Nil	ND	ND
4.	Odour	Nil	Nil	Nil	Nil	Nil	ND	ND
5.	Ph	7.0±0.0	7.0±0.2	6.9±0.1	6.7±0.2	7.2±0.058	6.50-8.50	Suitable
6.	Conductivity	153±1.15	10.71±0.012	48.6±0.17	60.1±0.1	37.46±0.115	1000µs/cm	Suitable
7.	Total Dissolved Solid	72.1±0.53	4.8±0.20	22.7±0.12	28.8±1.044	18.0±0.0	500mg/L	Suitable
8.	Total Suspended Solid	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	1.0 mg/L	Suitable
9.	Total Alkalinity	42.0±2.89	20±5	38.3±2.89	42.0±2.89	51.7±7.64	200mg/l	Suitable
10.	Total Hardness	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	150mg/l	Suitable
11.	Calcium	34.2±5.47	10.5±2.59	21.3±2.28	0.00±0.0	0.00±0.0	200mg/l	Suitable
12.	Magnesium	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	150mg/l	Suitable
13.	Chloride	49.2±0.17	98.7±0.0	14.8±0.99	19.0±0.0	9.8±0.0	250mg/l	Suitable
14.	Dissolved Carbon	8.00±2	2.00±0.0	7.00±1.155	5.00±1.154	6.0±0.0	10 mg/l	Suitable

15.	Dioxide Nitrate	0.76±0.058	0.1±0.0	0.56±0.058	0.0±0.0	0.4±0.0	10 mg/l	Suitable
16.	Nitrite	0.12±0.058	0.0036±0.058	0.002±0.0	0.003±0.0001	0.010±0.0001	10 mg/l	Suitable
17.	Sulphate	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	100 mg/l	Suitable
18.	Total Coliform Count	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	10cfu/100ml	Suitable
19.	E.Coli	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	0.00±0.0	10 cfu/100ml	Suitable



The table and bar chart depicted above shows the peaks, mean/standard deviation values and names of the physicochemical/microbial pollutants detected for the five bottled water analyzed. NESTLE PLASTIC BOTTLED WATER samples examined had nineteen (19) possible pollutants (physicochemical/microbial parameter or property) identified, they are viz; turbidity (0.00±0.0); colour (5.00±0.0); taste (nil); odour (nil); pH (7.0±0.0); conductivity (153±1.15); total dissolve solid (72.1±0.53); total suspended solid (0.00±0.0); total alkalinity (42.0±2.89); total hardness (0.00±0.0); calcium (34.2±5.47); magnesium (0.00±0.0); chloride (49.2±0.17); dissolved carbon dioxide (8.00±2); nitrate (0.76±0.06); nitrite (0.012±0.06); sulphate (0.00±0.0); total coliform count (0.00±0.0) and E.Coli (0.00±0.0).

Turbidity is impacted into water through accumulation of particles that are insoluble. It is directly proportional to total suspended solid and total dissolved solid. Conductivity is the concentration of ion present in the water while pH is the degree of acidity. Alkalinity is due to carbonates and hydroxides of calcium, magnesium, potassium and sodium available in rock formation, it is directly associated to hardness. The nitrate and sulphate presence in water is as a result of oxide of nitrogen and oxide of sulphate while coliform is microbial algae (Singh,and Mosely,2003).

From the nineteen physicochemical and microbial properties examined for NESTLE PLASTIC BOTTLED WATER. The result obtained and revealed shows that all the parameters and properties analyzed were below the standard guideline limit of World Health Organization (2004) and Nigeria standard limit for drinking water (with the exception of taste and odour that is non-detected).

Based on the aforementioned findings and assertion from the result analyzed, NESTLE plastic bottled water is safe and suitable for drinking, with respect to physicochemical and microbial parameters understudied.

The table depicted above shows the peaks, mean/standard deviation values and names of the physicochemical/microbial pollutants detected in FARO PLASTIC BOTTLED WATER sample analyzed. There are nineteen (19) possible pollutants (physicochemical/microbial parameter or property) identified, they are viz; turbidity (0.00±0.0); colour (5.00±0.0); taste (nil); odour (nil); pH (7.0±0.2); conductivity (10.7±0.01); total dissolve solid (4.8±0.2); total suspended solid (0.00±0.0); total alkalinity (20±5); total hardness (0.00±0.0); calcium (10.5±2.6); magnesium (0.00±0.0); chloride (98.7±0.0); dissolved carbon dioxide (2.00±0.0); nitrate (0.1±0.0); nitrite (0.004±0.06); sulphate (0.00±0.0); total coliform count (0.00±0.0) and E.Coli (0.00±0.0).

From the nineteen physicochemical and microbial properties examined for FARO PLASTIC BOTTLED WATER. The result obtained and revealed shows that all the parameters and properties analyzed were below the standard guideline limit of World Health Organization (2004) and Nigeria standard limit for drinking water (with the exception of taste and odour that is non-detected).

Based on the aforementioned findings and assertion from the result analyzed, FARO plastic bottled water is safe and suitable for drinking, when focused on the physicochemical and microbial parameters understudied.

From the table depicted, it shows the peaks, mean/standard deviation values and names of the physicochemical/microbial pollutants detected in FARO PLASTIC

BOTTLED WATER sample analyzed. There are nineteen (19) possible pollutants (physicochemical/microbial parameter or property) identified, they are viz; turbidity (0.00±0.0); colour (5.00±0.0); taste (nil); odour (nil); pH (6.9±0.1); conductivity (48.6±0.17); total dissolve solid (22.7±0.12); total suspended solid (0.00±0.0); total alkalinity (38.3±2.89); total hardness (0.00±0.0); calcium (21.3±02.3); magnesium (0.00±0.0); chloride (14.8±0.99); dissolved carbon dioxide (7.00±1.16); nitrate (0.56±0.06); nitrite (0.002±0.0); sulphate (0.00±0.0); total coliform count (0.00±0.0) and E.Coli (0.00±0.0).

From the nineteen physicochemical and microbial properties examined for FARO PLASTIC BOTTLED WATER. The result obtained and revealed shows that all the parameters and properties analyzed were below the standard guideline limit of World Health Organization and Nigeria standard limit for drinking water (with the exception of taste and odour that is non-detected).

Based on the aforementioned findings and assertion from the result analyzed, FARO plastic bottled water is safe and suitable for drinking, when focused on the physicochemical and microbial parameters understudied.

From the table depicted, it shows the peaks, mean/standard deviation values and names of the physicochemical/microbial pollutants detected in BIGI PLASTIC BOTTLED WATER sample analyzed. There are nineteen (19) possible pollutants (physicochemical/microbial parameter or property) identified, they are viz; turbidity (0.00±0.0); colour (5.00±0.0); taste (nil); odour (nil); pH (6.7±0.2);conductivity (60.1±0.1); total dissolve solid (28.8±1.1); total suspended solid (0.00±0.0); total alkalinity (42.0±2.89); total hardness (0.00±0.0); calcium (0.00±0.0); magnesium (0.00±0.0); chloride (19.0±0.0); dissolved carbon dioxide (5.00±1.15); nitrate (0.00±0.0); nitrite (0.03±0.0001); sulphate (0.00±0.0); total coliform count (0.00±0.0) and E.Coli (0.00±0.0).

From the nineteen physicochemical and microbial properties examined for BIGI PLASTIC BOTTLED WATER. The result obtained and revealed shows that all the parameters and properties analyzed were below the standard guideline limit of world health organization and Nigeria standard limit for drinking water(with the exception of taste and odour that is non-detected).

Based on the aforementioned findings and assertion from the result analyzed, BIGI plastic bottled water is safe and suitable for drinking, when focused on the physicochemical and microbial parameters understudied.

From the table depicted, it shows the peaks, mean/standard deviation values and names of the physicochemical/microbial pollutants detected in AQUADANA PLASTIC BOTTLED WATER sample analyzed. There are nineteen (19) possible pollutants (physicochemical/microbial parameter or property) identified, they are viz; turbidity (0.00±0.0); colour (5.00±0.0); taste (nil); odour (nil); pH (7.2±0.06); conductivity (37.5±0.12); total dissolve solid (18.0±0.0); total suspended solid (0.00±0.0); total alkalinity (51.7±7.6); total hardness (0.00±0.0); calcium (0.00±0.0); magnesium (0.00±0.0); chloride (9.8±0.0); dissolved carbon dioxide (6.0±0.0); nitrate (0.4±0.0); nitrite (0.01±0.0001); sulphate (0.00±0.0); total coliform count (0.00±0.0) and E.Coli (0.00±0.0).

Turbidity is impacted into water through accumulation of particles that are insoluble. It is directly proportional to total suspended solid and total dissolved solid. Conductivity is the concentration of ion present in the water while pH is the degree of acidity. Alkalinity is due to carbonates and hydroxides of calcium, magnesium, potassium and sodium available in rock formation, it is directly associated to hardness. The nitrate, sulphate and coliform presence in water is as a result of oxide of nitrogen and oxide of sulphate while coliform is microbial algae presence.

From the nineteen physicochemical and microbial properties examined for AQUADANA PLASTIC BOTTLED WATER. The result obtained and revealed shows that all the parameters and properties analyzed were below the standard guideline limit of World Health Organization and Nigeria standard limit for drinking water(with the exception of taste and odour that is non-detected).

Based on the aforementioned findings and assertion from the result analyzed, AQUADANA plastic bottled water is safe and suitable for drinking, when focused on the physicochemical and microbial parameters understudied.

CONCLUSION

The five different bottled water examined for physicochemical and microbial parameters which include Nestle, Faro, CestBon, Bigi and Aquadana bottled water. From the result obtained shows that the five different plastic bottle water is suitable for drinking as par the parameters determined. So the aforementioned plastic bottled water determined in the study is fit for drinking. The need for continual monitoring of plastic bottled water is necessary because plastic bottle water is perceived and assumed to be suitable and fit for drinking except errors from factory default, packaging materials among others that can introduce contaminant into the water. Unending monitoring assessment will bring to notice the presence of (if any) default or anomaly in the bottled water produced for public consumption. This will enhance quality sustenance and public confidence in bottle water.

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