QUALITY ASSESSMENT OF CHEMICAL COMPONENTS OF SACHET WATERS CONSUMED BY RESIDENTS IN BAYELSA STATE, NIGERIA

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ABSTRACT

Aim/Objective: This study evaluates the chemical quality of sachet waters sold and consumed by residents of Bayelsa state in comparison with WHO and national standards. Five commonly sold brands of sachet water were chosen. A total of fifteen sachets per brand of water were purchased randomly at different places and used for this study. Seven chemical parameters (Th, Pb, Fe, Zn, Cr, Cd & Cu) were analyzed at the Bayelsa State Water Board Quality Control Laboratory. **Results:** Findings from this study shows Th 17.10mg/l in sachet water ABC and E while D has 34.21mg/l compared with WHO and national standard permissible range of 100 to 150mg/l. Traces of 'Cu' was absent from among the different samples obtained for this study. Heavy metals such as Pb,Cr and Cd were not observed in all the samples. However a small concentration of "Fe" (0.01 and 0.02mg/l) was found in sample C and E only compared with WHO (0.3mg/l) standard. **Conclusion:** This study shows that the different brands of sachet water tested were chemically safe and suitable for drinking purpose. However water concentration ≤ 50ppm (50mg/l) in terms of hardness is considered soft though with no significant physiological health risk but may thus lack some beneficial minerals such as Mg^{2+} and Ca^{2+}. Hence regular consumers of these waters can do well by supplementing their diets with food rich in the minerals lacking in soft waters.

Keywords:

Chemical, hard, Sachet, Standards, water.

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INTRODUCTION

Water is essential for all metabolic reactions for life, indispensable requirements, most valuable and most commodity use by man and derived more benefits than any other resources on the earth. The human body consists of 50% - 60% of water. Water plays a critical role as a life sustainer in ecological function, food production, economic activities, health and recreation, thermoregulation, protection, cushioning of body vital organs, breathing and transportation of nutrients and oxygen in the body. Water is therefore an asset, a necessity for good health as well as a basic right to man when it is available in safe and secured amount but becomes an agent of public health problems when it is neither safe not wholesome(Ritabrata*et al.,* 2019; Khwaja &Amit, 2020; Adebayo & Olajumoke, 2021; Safia *et al.,* 2021).

The continued existence of man on earth over the years which has brought about urbanization, industrialization, organizations, institutions and increase in population has placed a very high demand and pressure on the significance of wholesome water by releasing various compounds and substances directly or indirectly into water sources. Water which by virtue of it's polarity, is a universal solvent which dissolve, suspends, and absorb substances introduce into it. This has made sources of water a global public health issue as it's quality is being modified and altered. Unsafe drinking water has been implicated for numerous public health problems such as water borne diseases (diarrhea, cholera, dysentery, typhoid, polio), morbidity and mortality among under five children, elevated values of chemicals and metals dangerous to health (Yirdaw & Bamlaku, 2016; Taiwo*et al.,* 2018; Omoniyi, 2020; Raphael *et al.,* 2021).

Alternatively, the provision of safe drinking through proper treatment of water supply sources and packaged in sachets for sales become imperative. Sachet water is water obtained from water supply sources which has undergone treatment and packaged and sealed in polyethylene bags, distributed and commercially sold for drinking purpose. Today, drinking of sachet water has become a household norm on a daily basis in recent times (; Ishaya *et al.,* 2021Adewale *et al.,* 2022; Misha *et al.,* 2022; Solomon *et al*., 2021).

However, the reality of the extent to which Water supply sources have been contaminated through increasing environmental pollution, gas flaring, release of soot, oil exploration and exploitation, oil spillage, climate change, flooding, use of pesticides, poor waste disposal and salt water encroachment has raised serious concern by the government, teaming public, organizations, households and individuals in terms of proper treatment, compliance to treatment standards, required regulations, proper hygiene practice and profit motive without compromise (Geraldine & Hycienth, 2022).
This indeed has necessitated the need for continuous assessment of sachets water quality with respect to it's safety and suitability for drinking purpose among residents in Bayelsa state.

MATERIALS AND METHODS

Study Design

The study was conducted in Ogbia and Yenagoa LGA, South -south geopolitical zone in the Niger Delta region of Nigeria. A descriptive cross sectional study involving laboratory test of samples of sachets water was adopted.

Sampling Technique

Five commonly (A, B, C, D & E) sold brands of sachets water were purchased at various places from shops and vendors within Ogbia and Yenagoa LGA. A total of seventy five (fifteen sachets water per brand), were purchased, cautiously handled and transported via a clean plastic bucket with a tight fitting lid to the Bayelsa State Water Board Quality Control Laboratory. These sachets of water were all conveniently tested for seven chemical parameters (TH, Pb, Fe, Zn, Cr, Cd& Cu).

INSTRUMENTS

Standard procedures were used with the following equipment/ materials: HACH spectrometer, Ferro Very Iron Reagent powder pillow, chroma Ver 3 Reagent powder pillow, Buffet powder pillow, Copper Ver 1 Reagent powder pillow, calibrated air droppers, EDTA Reagent powder pillow, Zinc Ver 5 Reagent powder pillow, measuring cylinder, autoclave, testubes, cyclohexanone.

I**NCLUSIVE CRITERIA:** Only sachet waters produced in Bayelsa state was used for this study
EXCLUSIVE CRITERIA: Waters produced outside Bayelsa state were excluded from this study.

Data Analysis

Data obtained from the laboratory test were analyzed descriptively using spss version 24.0 and compared with international and national (NSDWQ) acceptable standards.

RESULTS

Table 1: Chemical Quality of Sachets water weighted average values and International/National Standards

Chemicals	Unit	A	B	C	D	E	I/S (WHO)	N/S NSDWQ
Th	Mg/l	17.10	17.10	17.10	34.21	17.10	100	150
Fe	Mg/l	0.00	0.00	0.01	0.00	0.02	0.3	0.3
Cu	Mg/l	0.00	0.00	0.00	0.00	0.00	2.0	1
Pb	ppm	0.00	0.00	0.00	0.00	0.00	0.05	0.01
Cd	ppm	0.00	0.00	0.00	0.00	0.00	0.005	0.003
Zn	Mg/l	1.00	0.00	1.00	0.51	2.00	5	3
Cr	ppm	0.00	0.00	0.00	0.00	0.00	0.05	0.05

Source: Lab. Test 2025

KEY: A, B, C, D& E: Five brands of Sachet Water
Th: Total Hardness
Pb: Lead
Fe: Iron
Zn: Zinc

Cr: Chromium
Cd: Cadmium
Cu: Copper
I/S: International Standards
N/S: National Standard
WHO: World Health Organization
NSDWQ: National Standard of Drinking Water Quality
Weighted average samples tested were recorded and data were descriptively placed side by side with international and national standards.

DISCUSSION

Analytical results from the five brands of Sachet Water revealed traces of hardness but was found within acceptable standards of international and national standards of 100mg/l and 150mg/l respectively. This implies that drinking these Sachet Water would not have negative health implications (cardiovascular problems, reproductive failures, kidney dysfunction) associated with total hardness found to be higher than permissible ranges (Sengupta, 2013).The results showed average zero trace of lead, chromium, cadmium and copper. Brand sachet water D had 34.21mg/l of total hardness higher than the others. Brand sachet water E had highest concentration of Iron and Zinc (0.02mg/l & 2.00mg/l). However, the result was found within (WHO) and national (NSDWQ) acceptable standards.

This result was consistent with Augustine *et al*, (2019); Adefemi &Azeez (2019), and Gana *et al*, (2021) but non consistent with Oyelude and Ahenkorah, (2012).

Iron (Fe)

Tested results of Iron from the five brands of Sachet Water fall within acceptable international and national standards of 0.3mg/l respectively. There were zero trace of Iron in brands Sachet Water A, B and D but found traces in brands Sachet Water C and E (0.01mg/l & 0.02mg/l) respectively. This study shows that these Sachet waters were safe and suitable for human consumption though soft and below but without outstanding physiological health risk implications. When the percentage of Iron is above international and national standards , health issues such as chemochromatosis, stomach upsets, nausea, damage to liver, pancreas may arise among consumers (Hague Quality of water, Maryland, 2019). This result was consistent with Augustine *et al*, (2019); Onilude & Dibua, (2007) but at variance with Emenike*et al.,(*2017); Ajayi*et al.*, (2008).

Zinc (Zn)

Similarly, the result of Zinc from the brands of sachet water sold was found to fall within international and national standards with traces in brands A, C, D & E (1.00mg/l, 1.00mg/l, 0.5mg/l & 2.00mg/l). This also implies that these brands of sachet water were safe and suitable for drinking purpose with less negative health implications compared with WHO standard of 5mg/l. drinking water which contains Zinc above international and national standards (gastrointestinal issues, poisoning, neurotoxic, cardiovascular disorders) (Mahipal, Rajeev, &Lalit (2019). The result was inline with Adewale*et al*, (2019); and Augustine *et al*, (2019).

Copper (cu), Lead (Pb), Cadmium (Cd), and Chromium ((Cr)

The average results of Copper, Lead, Cadmium and Chromium from the brands of sachet water were found to be zero. Zero result implies that the natural source of water may have been properly treated to remove these chemicals to meet up with international and national standards of 0.005mg/l; 1mg/ , 0.003mg/l, and 1mg/l respectively. These brands of sachet water were found to be safe and suitable for drinking purpose without negative health implications that may have arisen from higher values above standards such as allergic dermatitis, cancer, kidney damage, fragile bones, stomach irritation, damage to blood cells, brain, liver, hormonal imbalance, infertility (Levallois, 2018; NIH, 2020; U.S. EPA, 2013). This result agrees with Augustine *et al,* (2019); Gana *et al,* (2021); Dibua *et al,* (2017) but disagrees with Singla *et al.*i, (2014); and Emenike*et al,* (2017).

CONCLUSION

The five brands of sachet water investigated interms of the seven chemical parameters were found to be of good chemical quality, safe and suitable for drinking purpose. However, we recommend that a monitory system chaired by regulators be put in place to ensure that waters are treated not below acceptable standard range as observed in some parameters from this study.

CONFLICT OF INTEREST: None declared

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