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Analysis of Physico-Chemical Parameters during Wet Season to Assess Water Sources Quality in Dutsin-ma Local Government Area, Katsina State

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Abstract:
In this study the Physical and chemical quality of drinking water from Boreholes, Taps, Wells, pond and Dam used in Dutsin-ma Local Government Area, Katsina State during wet season was investigated to compare their compliance with the World Health Organisation (WHO) standard. Two hundred water samples were analysed using standard analytical methods from July to November, 2018. The parameters evaluated include: colour, taste, odour, pH, chloride, phosphate, sulphate, nitrate, Hardness, electric conductivity, turbidity, Dissolved oxygen (DO), biological oxygen demand (BOD) and total dissolve solid (TDS). The results from the laboratory analysis showed that most of the samples were tasteless, colourless and odourless; and the physico-chemical parameters conform to the WHO standard except for temperature, turbidity and sulphate of some sources. Analysis of variance (ANOVA) indicates a highly significant difference (P<=0.001) in the physico-chemical properties of the water sources.The outcome of this study indicate that the water used in Dutsin-ma LGA is of good quality for consumption.
Key Word:*Water, Physical, Chemical, Analysis, Parameters.*

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I. Introduction

Water is an essential means for the continued existence of all forms of life which needs to be adequate in supply and fresh (Edema *et al*., 2011). Naturally water may contain scums which it liquefies or grips when it comes in contact with, and which may be detrimental or mild (Ogamba, 2004).

Factors such as increase in human population, industrialization, use of fertilizers in the agriculture and man-made activity has made water highly polluted with different dangerous pollutants. Therefore it is necessary that the quality of drinking water should be checked at steady time interval, because human population suffers from wide-range of water borne diseases as a result of using contaminated water (Basavaraja*et al*. 2011).

The use of manure in the developing countries has a great impact on the lives of people as they are not well aware of its harmful effects like heavy metal contamination of soils, crops and quality problems related to health. Research has proven that long term use of this sewage effluent for irrigation contaminates soil and crops to the point that it becomes poisonous to plants and causes corrosion of soil (Patil*et al*., 2012).

When plants store heavy metals in their tissues in concentrations beyond the allowable levels is seen as a threat to humans' life, and animals grazing on these crops and could lead to contamination of food chain, since soil and plants contained many poisonous metals by irrigation with water mixed with industrial waste (Adnan, 2010). The value of ground water depends upon numerous chemical elements and their concentration, which are mostly derived from the ecological data of the particular region. Pollutants such as industrial waste and the municipal solid waste have appeared to be one of the primary cause of pollution of surface and ground water (Guptaa, 2009).

In many parts of the world available water is rendered non-potable because of the presence of heavy metal in excess and the condition gets worsened during the summer season due to water scarcity and rain water discharge with contaminants such as heavy elements, metal ions and harmful microorganisms which brings serious major health problems as research has shown that inappropriate dumping of solid and liquid wastes, lack of strict enforcement of law and loose governance are the cause of deterioration of ground water quality (Guptaa 2009).

Water serves a number of essential functions which include its being a vital nutrient to the life of every cell, acts first as a building material, in the regulation of internal body temperature by sweating and respiration, metabolism and transportation of food substances, in flushing waste mainly through urination, as a shock absorber for brain, spinal cord, and fetus, forms saliva lubricates joints and many others (White *et al.*, 2005).

Water of good feature should not be chemically and biologically polluted and must be satisfactory in terms of colour, taste and odour, organic and inorganic matter in accordance with the W.H.O guidelines on the quality of drinking water (Chollom*et al*., 2013).The knowledge of water chemistry provides information on every aspect of aquatic ecological interaction which involves the source, composition, reactions and transportation of water. The quality of water is of significant importance for the mankind since it is directly connected with human wellbeing (Nagamani, 2015).

The increased use of metal-based fertilizer in agronomic activities of the farmers could result in continued rise in concentration of metal pollutions in fresh water reservoir due to the water run-off. Also faucal pollution of drinking water causes water born disease which has led to the death of millions of people (Adefemi and Awokunmi, 2010). Chemical contamination could leads to health problems especially through prolonged exposure, but for nitrate short-term exposure can cause methaemoglobinaemia "bluebaby syndrome", which can lead to death by asphyxiation in bottle-fed babies when contaminated water is used to prepare formula or where infants drink contaminated water directly (UNICEF, 2008).

II. Material And Methods

This study was conducted in order to evaluate the water sources used in the study area in terms of Physical and Chemical quality during wet season from July to November, 2018.

Study Location: This was carried out in Duitsin-ma Local Government area of Katsina State, Nigeria. Dutsin-ma became a Local Government in 1976 with inhabitants that are predominantly Hausa and Fulani by tribe whose main occupation is farming and animal rearing. The vegetation of the region is predominantly of savannah type having only about three months of rainfall annually (Ministry of Land and survey, Katsina, 2018). The climate of the area is semi-arid classified as tropical wet and dry climate (AW) in the W. Koppens' scheme with maximum day temperature of up to 38 ^{OC} in the months of March, April and May and with minimum temperature of about 22 ^{OC} in December and January. There is few household engaged in traditional fishing from the Zobe Dam (Nona.net, 2017).The main sources of drinking water in Dutsin-ma are boreholes, Dam, Wells, pond, Rain water and Tap water.

Sample size:A total of 200 water samples were analysed using standard Laboratory methods.

Sample size determination: The sample size was determined using the following equation as described by (Gupta, 2009).

N= $\boldsymbol{Z2p(1-p)d2}$

Where n= sample size

z= statistics for a level of 95% confidence interval =1.96

p= prevalence rate at 33.3% Ebonyi Nigeria by Christiana and Levi (*2015*)

d= precision (allowable error) = 5% = 0.05.The calculated sample size is 200. Hence 200 water samples were analysed in the study.

Selection of sampling sites: The sampling was done randomly. The sites were Garhi, Kagara, Kontamawa, Dabawa, Kuki, Bagagadi, Shema, Maitsani, Dagelawai, Dangaje, Dutsin-ma dam, Dutsin-ma borehole and Dutsin-ma tap.

Sample Collection: The sampling time was every week between 9 to11am on each sampling day during wet season. At each sampling, replicates water samples were collected from various drinking water sources such as covered well, uncovered well, dam, borehole, pond and tap water within the sampling area into 1mls wide mouth screw-capped cleaned plastic polyethylene bottles and immediately fixed and put in ice box jar to avoid change in water quality, Myers (2006) and carried to the Biology Laboratory of Isa Kaita College of Education, Dutsin-ma, Katsina State for physicochemical analysis.

Physical and chemical analysis were carried out like Water Temperature, pH were recorded by using Thermometer and Digital pH Meter. Conductivities were measured by using digital conductivity meter. The TDS values were measured by using TDS meter. While other Parameters Such as Hardness by Flame photometry, Calcium & Magnesium, Chloride, Sulphate and Nitrate were Estimated in the Laboratory by using Standard laboratory methods.

The results gotten were matched with the World Health Organization (WHO) standard to determine conformity with the national and international guiding principle.

Statistical analysis: The Data generated was analyzed using Analysis of Variance and DMRT-at 95% level of significance (2-way ANOVA) in SPSS 20 Statistical Package.

III. Result

The Results of the analysis is presented in the Table 1.

Table 1: Physico-chemical parameters of wet season in Dutsin-ma (July to November, 2018).

Water source	pH (ppm)	Temp.	E.C	D O Mg/L	BOD Mg/l	Turbidity	Hardness	NO_3 (mg/l)	S (mg/l)	P (mg/l)	Cl (mg/l)	TDS
Dam	7.3	28	0.05	5.3	2.8	360	35.4	11.7	174.3	40.9	57.2	320
Tap	7.26	26	0.06	4.6	3.5	98	51.2	14	664.4	34.7	71.9	473
Well	5.5	25	0.2	4.4	1.2	5.0	81.4	18.5	78.9	26.4	68.1	165
Pond	6.8	27	0.16	4.9	1.8	10	129.9	8.8	95.87	8.7	73.3	113
B/hole	6.4	25	0.4	5.1	1.9	5.7	93	14.3	335.9	48.4	107.9	240
WHO standard	6.5-8.5	25	1000	5	10	5	200	45	250	50	250	1000

The table 1 above shows the summary of mean values of physico-chemical parameters of wet season.

Result of physical analysis: The result of the physical analysis shows that samples from most of the water sources were colourless, odourless, and tasteless. The turbidity of most of the sources was within the acceptable value of WHO of ≤5NTU except Dam water with 360NTU, Tap water with 98NTU and Pond water with 10NTU mean values. The temperature of most sources was within the acceptable limit except that of Dam water with 28^{o}c which is a bit higher than the acceptable value of 25^{o}c, so also that of tap water with 26^{o}c and Pond with 27 ^{o}c. All other water sources temperature was within the acceptable limit.

Result of chemical analysis: The chemical analysis shows that the pH of all the sources was within the acceptable limit of 6.5-8.5 except that of well water which was slightly lower with 5.5ppm. Parameters like conductivity, hardness of the water, chlorides, and phosphate and nitrates and TDS are all within the acceptable limit except for the sulphate level 664mg/L in tap water which was higher than the acceptable value of 250mg/L. The Dissolved oxygen (DO) and biological Oxygen Demand (BOD) are all within the WHO limit of ≤10 and ≤5 respectively.

IV. Discussion

The physical quality parameters of the water samples collected from the study area during wet season shows that the colour, taste and odour of most of the samples are clear with no taste or smell. These determine its appealing level, that is how satisfactory and suitability the water is. This is in line with the findings of Denloye (2004). Those that were turbid such as samples from Dam, Tap and Pond water were still odourless and tasteless. The colouration could be due to the fact that it's rainy season and there is overflow of water from different routes; they therefore stand a greater risk of contamination. Hence, they recorded the highest value of turbidity which was above the limits of the WHO and this is similar to the result of Alhassan*et al.* (2008).

The temperature value of the samples from Dam and Tap were higher than the WHO limit. This is similar to the findings of Shyamala*et al.* (2008) in a study conducted in Tamilnadu, India. The level of conductivity and total dissolved solids of all the samples analyzed were in line with the WHO standard and is similar to the findings of Yusuf *et al.* (2015).

The chemical parameter pH of most samples was found to be between 6.4 and 8.1. This agrees with the report of Yusuf *et al.* (2015) and shows that almost all the samples fell within the WHO acceptable limit (6.5 – 8.5ppm).

The result of dissolved oxygen (DO) of most of the samples is also in line with WHO standard. This is similar with the findings of Shyamala*et al.* (2008). The water samples who's D.O were above the standard value are those of Dutsin-ma Dam, Maitsani pond waterand Dabawa well. This could be due to the nature of water sources by gathering water from so many ways and therefore can easily get changed.

The Biological oxygen demand (B.O.D) of all the samples with the exception of the dam, pond and some wells water are within the acceptable limits of the WHO which is ≤ 10. This is similar to the findings of John *et al.* (2010). The samples with the higher (B.O.D) values mentioned are opened and exposed sources, therefore this could be the cause of increase in biological activities. Parameters like hardness, nitrate, sulphate and phosphate are all within the acceptable limits and agrees with the findings of Benjamin and James (2014) in a study conducted in Ashanti region of Ghana.

It has been observed in this study that, during the wet season, there has been an increase in the turbidity of the water sources from the sites that were slightly turbid earlier. This could be attributed to the season. The lower temperature in the wet season could be due to the fact that the temperature of water correlates with maximum air temperature and sampling day especially surface water as mentioned by Patil*et al.* (2012). The lower total dissolved solids mean value in the wet season could be due to the water dilution effect while the lower conductivity during wet season period could be due to the effect of dilution as water volume increases with the rains. The lower pH in the wet season could be due to increase in decomposition of organic materials and the relatively higher DO mean values during the wet season could be due to lower temperature and the effect of wind action which enhances Oxygen circulation in water. This agreed with the reports of Liadi (2005)

in study of some limnological parameters in Mairuwa reservoir in Katsina State.Higher Biochemical Oxygen demand in the wet season may be attributed to higher concentration of organic material added to water by rainfall. The decomposition of which require more dissolved oxygen. This is in line with the findings of Patil*et al*. (2012).

The rise of nitrate level in the wet season could be as a result of outward run-off from the surrounding farm lands as this corresponded with the period of fertilizer application. And it is evident that water source with high level of nutrients is capable of supporting aquatic life. This can be supported by the findings of Patil*et al.* (2012). The higher wet season mean value of phosphate and sulphate may be due to surface run-off from the surrounding farm lands. This is similar to the findings of Shyamala*et al*. (2008) while the mean value for chlorides was higher in wet season. This may be an indication of pollution from domestic activities. This is in line with the findings of Shyamala*et al*. (2008).

V. Conclusion

The health implication of drinking polluted water is of great concern to the people due to the fact that water is a basic requirement for life and there has been a continued contamination of water sources as a result of human actions. In this study, the physico-chemical qualities of water sources used in Dutsin-ma Local Government Area, Katsina State were examined. Standard analytical methods were used to analyze the 204 water samples from fourteen sites collected in the wet seasons. Analyses of physical and chemical water quality parameters was carried out. The physico- chemical parameters recorded showed most parameters of the sources of water used in Dutsin-ma conform to WHO standards while ANOVA reveals a highly significant difference in all the physico-chemical properties of the water based on sources ($p<0.001$). The results of this study indicate the safety of the level of chemical parameters and the need for continuous monitoring and protection of water sources.

References

[1]. Adefemi, S. O. and Awokunmi, E. E. (2010). Determination of physico-chemical parameters and heavy metals in water samples from Itaogbolu area of Ondo-State, Nigeria, *African Journal of Environmental Science and Technology*, 4(3), pp 145-148.

[2]. Adnan, A. T., Ahmad, M. E., Irfanullah, M. M., K. and Muhammad, A. K., (2010). Evaluation of industrial and city effluent quality using physicochemical and biological parameters, *Electronic Journal of Environmental, Agricultural and Food Chemistry*, 9(5), pp 931-939.

[3]. Alhassan, A.J., Imam, A.A., Yakasai, A.M. (2008). Quality assessment of sachet water packaged around Kano Metropolis, Nigeria,*Bayero Journal of Pure and Applied Sciences*. 1(1):83-87.

[4]. Basavaraja, S., Hiremath, S. M., Murthy, K. N. S. Chandrashekarappa, K. N., Patel, A. N., Puttiah, E.T. (2011). Analysis of Water Quality Using Physico-Chemical Parameters Hosahalli Tank in Shimoga District, Karnataka, India, *Global Journal of Science Frontier, Research*, 1(3), pp 31-34.

[5]. Benjamin, S., Ngmekpele, C., James, H. E. (2014). Sachet water quality in Obuasi, Ashanti Region, Ghana, *Journal of Biology, Agriculture and Healthcare*, 4 (5), ISSN 2224-3208 (Paper) ISSN 2225-093X ISSN 2224-3208

[6]. Chollom, S. C., Iduh, M. U., Gyang, B. J., Idoko, M. A., Ujah, A., Agada, G. O., Okwori, J. A. (2013). Parasitological Evaluation of Domestic Water Sources in a rural community in Nigeria, *British Microbiology Research Journal*, *3*(3), 1–21.

[7]. Christiana, A. O., Onyenweaku L. I. (2015). Evaluation of the Parasitic Contamination of Local Sources of Drinking Water in. *IOSR Journal of Dental and Medical Sciences Ver. I*, *14*(9), 2279–861. https://doi.org/10.9790/0853-14913034

[8]. Denloye, S.A. (2004). Quality parameters for packaged water, *NAFDAC Laboratory Experience*. IPAN News.

[9]. Edema MO, Atayese AO, Bankole MO (2011). Pure Water Syndrome: Bacteriological quality of sachet- packed drinking water sold In Nigeria, *Afr. J. Food, Agricult. Nutr. Dev.* 11(1):4595-4609.

[10]. Gupta, D. P., Sunita, J., Saharan, J. P. (2009). Physiochemical Analysis of Ground Water of Selected Area of Kaithal City (Haryana) India, *Researcher*, 1(2), pp 1-5

[11]. John, A. A., Fehintolu, F. A., Asabe, C. L. (2010). Assessment Of water quality from hand dug wells In Samaru – Zaria. *Nigeria Journal of Chemical Society*, Nigeria, Zaria Chapter, 3, 42-44. DOI 10.4409.

[12]. Liadi, S. (2005). Study of some Limnological Parameters, Zooplanktoons Distribution and Potential Fish yield of Mairuwa Reservoir. A paper Presented at the Department of Biological sciences, A.B.U Zaria.

[13]. Ministry of Land and survey, Katsina, Katsina State Nigeria 2018.

[14]. Myers, M. D. (2006). Geological Survey Techniques of Water-Resources Investigations, *National Field Manual for the collection of Water- quality data. U.S*., 9, 46-50.

[15]. Nagamani, C., Saraswathidevi, C. (2015). Physico-chemical analysis of water samples. *International Journal of Scientific and Engineering Research*, *6*(1), 2149–2155.

[16]. Nona.net (2017). Dutsin-Ma (Katsina, Nigeria). http://nona.net/features/map/placedetail.2241725/Dutsin-Ma/ Accessed 10/02/17

[17]. Ogamba, A. S. (2004). Packaged drinking water, how safe? Professionalism IPAN News.

[18]. Patil, P., Sawant, D., Rn, D. (2012). Physico-Chemical Parameters for Testing of Water–a Review. *International Journal of Environmental Sciences*, *3*(3), 1194–1207. Retrieved from http://mcmed.us/downloads/ajps_2701919614.

[19]. Shyamala, R., Shanthi, M. Lalitha, P. (2008). Physicochemical analysis of BorewellWaer Samples of Telungupalayam area in Coimbatore District, Tamilnadu, India *E-Journal of Chemistry*, 5(4), 924-929 ISSN: 0973-4945; http://www.e-journals.net

[20]. UNICEF. (2008). Unicef Hand Book on Water Quality. New york: UN Plaza.

[21]. White, K. H., Marquez, R. B. R., Soward, L. R., Shankle, G. (2005). A Guide to Fresh Water Ecology. 8 (5), 3-4.

[22]. World Health Organization (WHO). (2011). Guidelines for Drinking-water Quality.WHO Press, Geneva, switzerland' 4th edition.

[23]. Yusuf, Y. O., Jimoh, A. I., Onaolapo, E. O., Dabo, Y. (2015). An assessment of sachet water quality in Zaria Area of Kaduna State, Nigeria. *Journal of Geography and Regional Planning*, *8*(7), 174–180. https://doi.org/10.5897/JGRP2015.0501.