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Assesement of Physico-Chemical Parameters of Water Sources during Dry Season in Dutsin-Ma Local Governnment Area, Katsina State

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Abstract:*Considering the significance of water to public well-being, this study was carried out to determine the physico chemical parameters of drinking water from Boreholes, Taps, Wells, Pond and Dam used in Dutsin-ma Local Government Area, Katsina State during dry season to determine the quality of water used for drinking in Dutsin-ma. Two hundred water samples were analysed using standard analytical methods from March to June 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 sources were colourless, odourless and tasteless and most of the physico-chemical parameters conform to the WHO standard except the turbidity and hardness of few sources. Anova indicates a highly significant difference (P<=0.001) in the physico-chemical properties of the water sources and there was however no significant difference in the DO (p<=0.892). The results of this study point out that drinking water sources used in Dutsin-ma is of good quality for human consumption but there is need to improve the treatment of tap water to make it more suitable.*

Keywords:*Water, Physical, Chemical, Analysis.*

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I. Introduction

Water is described as one of the naturally occurring substances on earth, and a vital requirement for life by being among the most precious and important natural resources for life on earth as well as a basic requirement in the life of all living organisms ranging from the simplest to the most complex organisms. Waterconstitutes a combination of hydrogen and oxygen atoms (H_2O) and described as the most abundant compound (70%) on earth surface (White *et al.*, 2005).

The quality and accessibility of drinking water is essential in the man's unceasing existence and body functioning (Alli*etal*., 2011). Making a portable water obtainable to the population is necessary to prevent health threats (Rahmanian*et al.*, 2015). It has been revealed by the World Health Organisation (2011) that 75% of all the diseases in developing countries are associated with drinking water that is polluted.

The chemicals used in the water treatment or construction materials used in the water supply system bring about the formation of the chemical by products of which some are harzadous, as such now the drinking water can be a disease spread vehicle (Chigor*et al*., 2012). Sources of water such as wells, bore holes, ponds and streams need to be protected against contamination by harmful chemical substances (Chollom*et al*., 2013).

According to Reda (2016) the problems associated with chemical components of water arise primarily from their ability to cause bad health effects after prolonged periods of exposure, of particular concern are contaminants that have cumulative poisonous properties, such as heavy metals and substances that are carcinogenic. The most common problems in household water supplies may be attributed to hardness, iron, sulphides, and disease producing pathogens among others (Rafiei*et al*., 2014).

Water of good quality should be free from chemical which act together with ground water and alter the pH and other water quality parameters and must be suitable in terms of its physical appearance such as colour, the taste should be acceptable as well as its odour, they should be in accordance with the World Health Organization guidelines on the quality of drinking water as cited by (Ani and Itiba, 2015). To realize this, different water sources such as wells, bore holes, ponds and streams require protection against contamination by possible parasites, micro-organisms and harmful chemical substances.

Drinking contaminated water that does not meet the potability standards, threaten human health. The water can be detrimental when you have pathogens and chemicals that can be harmful to the body, causing diseases (Chigor*et al*., 2012).Thus, regular physico-chemical, evaluation of water source must be carried out to determine or check the effectiveness of drinking water treatment process.

According to Tsai *et al*. (2003); and Wasserman *et al*. (2004) continuing exposure to chemicals in drinking water may affect cognitive development and that consumption of lead leads to majorbehavioural change and cognitive impairment in children which can last a lifetime and contributes to a horrible cycle of malnutrition and poverty. Other chemicals can also have effects: for example, children exposed to high levels of arsenic during early childhood score significantly lower on neurobehavioral tests than children not exposed to arsenic. High levels of manganese in water can also have neurological effects (Wasserman *et al.*, 2006).

II. Materials and Methods

Study Area

Dutsin-ma is one of the oldest Local Government Area's (L.G.A) of Katsina State. Its headquarters is located in the town of Dutsin Ma. The L.G.A has an area of 527 km² and a population of 169,671 at the 2006 census (Nona.net, 2017). Dutsin-ma became a Local Government in 1976 with inhabitants that are predominantly Hausa and Fulani by tribe. Their main occupation is farming and animal rearing. The Zobe Dam lies to the south of the town of Dutsin Ma. The main sources of drinking water in Dutsin-ma L.G.A are boreholes, Dam, Wells, Rain water, Pond and Tap water. The area extends between latitudes 12 0 29′ 0 ″ and 12 0 12 ′ 30 North of the equator and longitude 07 0 22 ′0 and 07 0 33′ 0′ East of the Greenwich meridian and 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). Moreover, 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 o C in the months of March, April and May and with minimum temperature of about 22 o C in December and January. There is few household engaged in traditional fishing from the Zobe Dam (Nona.net, 2017).

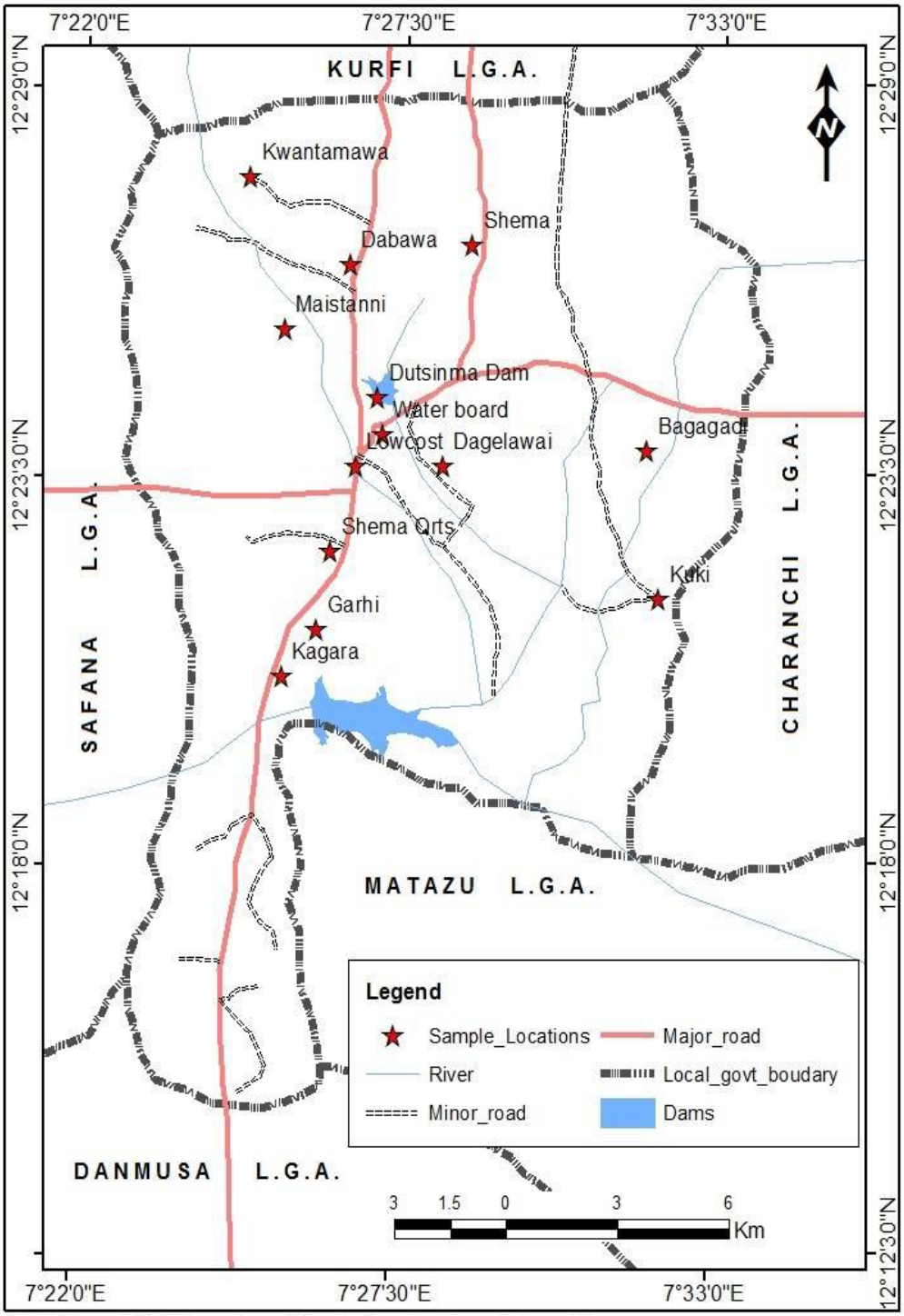

Fig.1:Map of Dutsin-ma Local Govt. Showing Sample Locations
Sourece:- Ministry of Lands & Surveys Katsin.

Sample Collection

The sampling was done randomly and the sites were Garhi, Kagara, Kontamawa, Dabawa,Kuki, Bagagadi, Shema, Maitsani, Dagelawai, Dangaje, Dutsin-ma dam, Dutsin-ma borehole and Dutsin-ma tap. Therefore, thirteen different locations were sampled. The water sources include covered well, uncovered well, dam, borehole and tap water within the sampling area. The water was collected into 1litre cleaned plastic polyethylene bottles. The sampling time was every week between 9 to11am on each sampling day during dry season. At each sampling, replicates water samples were collected from various drinking water sources and were taken to the Biology Laboratory of Isa Kaita College of Education Dutsin-ma, Katsina State in an icebox jar to avoid changes in the water quality. Earlier to the sampling all the bottles were washed and rinsed thoroughly with distilled water. Physical and chemical analysis were carriedout using standard analytical methods on each of the replicate samples in the laboratory to determine the overall drinking water quality. The results gotten were matched with the World Health Organization (WHO) standard on drinking water quality parameters to determine conformity with the guiding principle.

III. Results And Discussion

The result of the physico-chemical analysis of the water sources used in Dutsin-ma Local Government Area Katsina state is presented in Table 1.

Table 1: Summary of physico chemical parameters during dry season(March-June, 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	6.97	34	0.12	1.7	0.5	110	44.2	12.8	186.7	40.9	53.2	594
Tap	6.53	28	0.13	1.9	0.6	5	37.9	11.1	161.6	17.4	59.2	494
Well	6.58	25	0.16	1.5	0.4	75	439	1.9	0.22	10	132.2	303
Pond	8.28	28	0.07	1.6	0.7	5	668	1.2	0.02	3.3	126.6	640
B/hole	10.76	25	0.43	2.3	0.9	5	286	11.4	175.1	17.6	99.8	652
WHO standard	6.5-8.5	25	1000	5	10	5	200	45	250	50	250	1000

Physico-chemical parameters ofdry season in relation to sources

Result of physical analysis

The result of the physical analysis as seen from table 1above shows that Dam water was the most highly turbid with mean value 110NTU which is above the acceptable value of ≤ 5. It is followed by well water with 75 NTU. The mean value of temperature of Dam water was 34^{o}c which is above the acceptable limit of 25^{o}c, so also that of tap and pond with 28^{o}c respectively. All the remaining physical parameters of the sources mentioned above and otherswere colourless, odourless, and tasteless. The Electrical conductivity and Total dissolved solids of all the sources were within the acceptable limit as acknowledged by (WHO, 2008).

Result of chemical analysis

The table 1 above shows that the pH value of water from borehole 10.76ppm was above the acceptable range of 6.5 to 8.5ppm. Likewise the hardness of well water with the mean value 439mg/L was above the standard of WHO of 200mg/L, but the nitrates, phosphate, sulphate, chloride as well as BOD and DO are all within the acceptable limit of WHO. All the parameters of pond water were within the acceptable limits of WHO except forhardness whose value was 668mg/L. For the borehole water, its hardness 236mg/L was slightly above the acceptable limits of 200mg/L. Anova indicates a highly significant difference ($p< 0.001$) in all the parameters across the sources except for temperature and DO ($p\leq 0.1$ and $p\leq 0.2$ respectively.

IV. Discussion

The water quality parameters that are physical such as colour, taste and odour of most of the sources in this study which was during dry season showed they are clear with no taste or smell. This shows how satisfactorily the water can be. This is in line with the findings of Yusuf *et al*. (2015). Those that were turbid such as samples from Dabawa well, Kontamawa well and Garhi well were still odourless and tasteless. The colouration could be due to the nature of their location being them well water with rocks segments inside the wells. The other turbid samples were the Dutsin-ma Dam and Maitsani pond water that collects run-off 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 agrees with the findings of Alhassan*et al.* (2008).

The temperature values of the sources such as Dam, Pond and Tap that were higher than the WHO limit could be attributed to the rise in the environmental temperature. This is similar to the findings of Liadi (2005) and that 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. This is similar to the result of Reda(2016), Yusuf *et al*. (2015) and Rahmanian*et al*. (2015).

The pH of most water sources was found to be between 6.5 to 8.2ppm which shows that the water sources pH fell within the WHO acceptable limit (6.5 – 8.5ppm). This agrees with the report of

Yusuf *et al.* (2015), Reda(2016) and Rahmanian*et al*. (2015). The level of nitrate in the water sources ranging from 1.2 to 12.8 was within the acceptable limit of WHO of 45mg/l. This is in line with the findings of Nagamani (2015). The Chlorides and Sulphate levels were also within the acceptable range. This corresponds with the results of Nagamani(2015) and also the findings of Eric and Isaac (2013), shymala *et al*. (2008).

The values of dissolved oxygen (DO) of the water sources was within the acceptable limit of WHO of less than or equals to 5. This is similar to the findings of Shyamala*et al.* (2008) and Nagamani (2015).The Biological oxygen demand (B.O.D) of all the water sources was within the acceptable limits of the WHO which is ≤ 10. This is similar to the findings of John *et al*. (2010).

In this study the mean for temperature of all the study sites was higher in the dry season when compared with that of wet season. The temperature variation throughout the study period compares well with the ranges reported for other water bodies in Nigeria such as Mairua reservoir (Liadi, 2005). The lower temperature in the dry season could be due to the fact that the temperature of water connects with maximum air temperature and sampling day especially surface water as cited by Patil*et al*. (2012).

Total dissolved solids (Tds) of all the sourcesstudied were averagely higher in the dry season than the values obtained during wet season except for Dagelawai well and Garhi well. This differs from the findings of Liadi (2005) in Mairua reservoir, Funtua, Katsina State.The mean for conductivity of the water samples from Dutsin-ma dam, Dutsin-ma tap and Dutsin-ma borehole collected and analysed during dry season was higher than that of rainy season. This is in line with the findings of Patil*et al*. (2012). The higher conductivity values during the dry season may be as a result of evaporation with consequent reduction in volume thereby increasing the ionic concentration of the water sources.

The variation observed with the pH values of most sources was that the mean for pH of the dry season was slightly higher than that of the rainy season. This may be attributed to low decomposition of organic materials during that period. This is in line with the findings of Yusuf *et al.* (2015).

The relatively higher mean values in water hardness in the dry season than wet season may be due to the termination of the rain and effect of evaporation in the dry season. This is similar to the findings of Liadi (2005) and the findings of Eric and Isaac (2013).

The lower mean value of Dissolved Oxygen during the dry season could be due the fact that Oxygen deficiency is common in water bodies, especially during warm, dry, summer months despite the fact that they were within the acceptable limit. Similarly, the lower mean value of Biochemical oxygen demand during dry season when compared with that of wet season could be due to decrease in the concentration of organic material in the water.

The mean value of nitrate level found in the dry season was lower than that of the wet season. This may be attributed to concentration effect due to reduction in water volume. The lower mean value of phosphate and sulphatein the dry season could be due to absence of decaying macrophytes in the water sources which is a source of phosphate for pond at the beginning of summer and other littoral sediment for the remaining sources. Similarly, the mean value for chlorides in the dry season was lower than that of the wet season.

V. Conclusion

The analysis of physical and chemicalwater quality parameters of thirteen different sampling sites representing five different sources of water in Dutsin-ma Local Government Area of Katsina State was conducted. The result shows that Electrical conductivity, TDS, Chlorides, nitrates, sulphate, hardness, phosphate, BOD and DO of the water sources are all within the acceptable limit of WHO. However, the turbidity of Dam and well water was well above the desirable limit and the hardness of tap, pond and borehole has also exceeded the desirable limits which are due to the termination of the rain and effect of evaporation in the dry season. In conclusion, from the results of the present study it may be said that the sources of water in Dutsin-ma is though fit for domestic and drinking purpose but still need treatments to minimize the contamination especially the hardness level of tap water.

References:

[1]. Alli, J.A., Okonko, I.O., Alabi, O.A., Odu, N.N., Kolade, A.F., Nwanze, J.C., Onoh, C., M. C. (2011). Parasitological evaluation of some vended sachet water in Southwestern Nigeria. New York Science journal, 4(10), 84–92.

[2]. 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.

[3]. Chigor, V. N., Umoh, V. J., Okuofu, C. A., Ameh, J. B., Igbinosa, E. O., Okoh, A. I. (2012). Water quality assessment: Surface water sources used for drinking and irrigation in Zaria, Nigeria are a public health hazard. Environmental Monitoring and Assessment, 184(5), 3389–3400. https://doi.org/10.1007/s10661-011-2396-9

[4]. 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.
[5]. 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
[6]. Eric, D.B., Isaac, K. F. (2013). Quality Analysis of Plastic Sachet and Bottled Water Brands Produced or Sold in Kumasi, Ghana.International Journal of Development Sustainability, 2 (4), 2222-2232 ISSN: 2168-8662 www.isdsnet.com/ijds ISDS Article ID: IJDS13081701
[7]. 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.
[8]. Ministry of Land and survey, Katsina, Katsina State Nigeria 2018.
[9]. Nagamani, C., Saraswathidevi, C. (2015). Physico-chemical analysis of water samples. International Journal of Scientific and Engineering Research, 6(1), 2149–2155.
[10]. Nona.net (2017). Dutsin-Ma (Katsina, Nigeria). http://nona.net/features/map/placedetail.2241725/Dutsin-Ma/ Accessed 10/02/17
[11]. 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.pdf
[12]. Rafiei, A., Rahdar, M., Valipour, N., R. (2014). Isolation and Identification of Parasitic Protozoa in Sampled Water from the Southwest of Iran. Jundishapur Journal of Health Sciences, 6(4), 10–13. https://doi.org/10.5812/jjhs.23462.
[13]. Rahmanian, N., Ali, S. H., Homayoonfard, M., Ali, N. j., Rehan, M., sadef, Y., Nizami, A. S. (2015). Analysis of Physico-Chemical Parameters to evaluate the Drinking water Quality in the State of Perak, Malaysia. Journal of Chemistry, 10, 10.
[14]. Reda, A. H. (2016). Physico-Chemical Analysis of Drinking Water Quality of Arbaminch Town. Journal of Environmental and Analytical Toxicology, 6, 356. https://doi.org/10.4172/2161-
[15]. 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
[16]. Tsai, S.Y., Chou, H.Y. (2003). The effects of chronic arsenic exposure from drinking water on the neurobehavioral development in adolescence. Neurotoxicology 24(4-5), 747-53.
[17]. Wasserman, G.A., Liu, X.H. (2006). Water Manganese Exposure and Children's Intellectual Function in Araihazar, Bangladesh. Environmental Health Perspectives, 114(1), 124-129.
[18]. White, K. H., Marquez, R. B. R., Soward, L. R., Shankle, G. (2005). A Guide to Fresh Water Ecology. 8 (5), 3-4.
[19]. WHO Geneva, (2008), Guidelines for drinking-water quality (electronic resource), 3rd edition incorporating 1st and 2nd addenda, Volume 1, Recommendations.
[20]. World Health Organization (WHO). (2011). Guidelines for Drinking-water Quality.WHO Press, Geneva, switzerland' 4th edition.
[21]. 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

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