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Assessment Of Water Quality And Dental Fluorosis In Kaltungo Area, Gombe State, Nigeria

Leatu Nathaniel Burak

College of Health Science and Technology, Kaltungo, Gombe State, Nigeria

Abubakar Bashir Abubakar

Abdullahi Liman Tukur

Department of Geography, Modibbo Addama University of Technology Yola, Adamawa State, Nigeria

Abstract: ***This study was conducted to determine the prevalence and severity of dental fluorisis among inhabitants of Kaltungo area, Gombe State, Nigeria. A total of fifty seven (57) drilled wells and boreholes water samples were collected and analysed using standard procedures for water analysis. The water samples were collected both during the wet and dry seasons in order to determine the seasonal variation in fluoride concentration. Similarly, a questionnaires were administered to 370 students from three secondary schools in the town. The Analysis of the wells and boreholes water have shown that fluoride concentration in well water is moderately high ranging from 1.11- 2.18 and 0.0-1.08 during the dry and wet seasons respectively. The results of the analysis revealed that teeth colouration has serious social, economic and health implications of the affected inhabitants of the area. Recommendations were provided such as the use of advance technology to reduce the fluorine concentration in drinking water and provision of alternative sources of water.***

Keywords: Dental, Fluorosis, Economic, Health.

I. INTRODUCTION

Ground water is a main source of water supply in most rural communities in Nigeria. It has good microbiological and biological properties in general and hence requires minimal treatment. As most parts of Nigeria people depend on ground water for consumption therefore it is necessary to investigate the chemical concentration in ground water (Bashir and Olalekan. 2012). Fluorine is a naturally occurring element (F^-). In some parts of Nigeria ground water contains high fluoride level beyond the recommended World Health Organisations upper limit of 1.5mg/l (WHO 1994).

Fluorosis is a cosmetic condition that affects the teeth. In other words it is a change in the appearance of the tooth's enamel. These changes can vary from barely noticeable white spots in mild forms to staining and pitting in the more severe forms. It is caused by overexposure to fluoride during the first eight years of life. This is the time when most permanent teeth are being formed (Michael, 2015). Abiodun *et al.,(2014)* define dental fluorosis as a chronic fluoride-induced condition in which enamel development is disrupted and the enamel is hypomineralised.

Fluoride content has always been a concern for health care professionals and water resource managers as the deficiency of the fluoride element has been associated with defective enamel formation in teeth and the excess has been associated with skeletal and dental fluorosis. Hence it is important that the fluoride consumption should be kept at an optimum level for proper development of the calcified tissues (Ashish, *et al.,* 2015).

In Nigeria, there are few studies on dental fluorosis. Dental fluorosis was reported in Southwestern and North central parts of the country. However, studies on dental fluorosis is scanty in Nigeria. In recent years there is an increasing research on dental fluorosis in North-eastern Nigeria. Studies were undertaken to find out the prevalence and severity of dental fluorosis among some communities in Nigeria.

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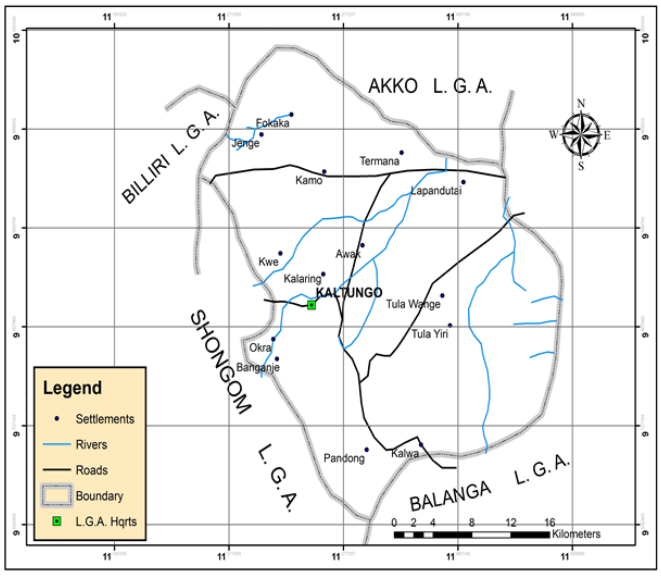
II. DESCRIPTION OF THE STUDY SITES

The study area is located between latitude 9^0 45′N and 9^0 53′N and Longitude 11^0 15′E and $11^0$27′E (see Figure 1). It is approximately 120km due south of Gombe, the state capital along A345 Federal Highway.

The climate of the area is characterized by dry and wet seasons which is associated with the two dominant opposing air masses namely; maritime air mass and continental air mass. The area has an average annual rainfall ranging between 850mm-1000mm. The rainfall is concentrated between May and September with a single maximum in July and August. The rainfall is associated with storms of high intensity.

The mean maximum monthly temperature is 37^0 C which is usually in March and April while the mean minimum monthly temperature is 18^0 C mostly recorded in December. The geology of the area is developed on complex geologic crystalline bedrocks. Although much of the area is underlain by the incised crystalline basement complex of sedimentary formation. The late cretaceous period has greatly influenced the topography of the area which lead to subsequent dissection and stream incision in the area therefore curved a landscape casuistry of rock outcrops, great residuals and pediment landscape which extend to some parts of Gombe by the North and Yamaltu by the east.

According to Usman, (2005), the study area has a soil type of mainly gleyic combisols, gleyic luvisols, eutric regosols, ferric luvisols, pellic vertisols, chromic luvisols and euric combisols. Combisols are deep, poorly drained with medium texture, and have loam; sandy loam, silt-loam or loamy sand surface horizons, while lower horizons are usually sandy clay loam. Luvisols are moderately acidic, and are shallow to moderately deep and well drained. They have gravel to loamy sand surface horizons, and have a high pH of about 5.1 – 6.0, and organic matter is moderate to high. Regosols are coarse textured soils with moderate to low organic matter content (Ray, 1999).



Source: Gombe State ministry of Land and Survey
Figure 1: The Study area

III. METHODOLOGY

The study employed the use of standard laboratory procedures to ascertain the level of fluoride in groundwater namely; boreholes and wells waters in the various locations in the study area. A total of fifty seven (57) groundwater samples were collected from boreholes and wells using stratified and random sampling techniques. Water samples were collected both in dry (march) and wet (August) seasons respectively. The groundwater samples were collected from eighteen locations in the study area.

Apparatus used in physical and chemical analysis of water samples collected for the study include pH meter (198107), EC/TDS$C^0/^0$f meter H1983 for temperature determination, pH/cond meter (198107) for temperature determination. The physical analysis of the water took place onsite. Method used for the analysis of samples is SPADNS METHOD (CODE 3647-01-SC). Fluorine determination was achieved by measuring the absorbance of an initial complex between Zirconium ion and the dye, Trisodium 2-(4-sulfophenylazo)-1,8-dihydroxynaphthaleneaq as 3, 6-disulfonate (SPADNS) and the subsequent bleaching of the complex due to reaction with fluoride ion. Sodium, Potassium and calcium concentrations were determined using ELICO CL-220 flame photometer. Total alkalinity and total hardness were measured by titrimetric method using standard sulfuric acid and standard EDTA solutions respectively. The samples were analysed at the Federal Ministry of water Resources, Gombe.

S/NO	Material	Function:
1	GPRS(etrex Germin)	Cordinates
2	EC/TDS C°/°f meter H1983	Temperature determination
3	PH meter (198107)	PH
4	PH/Cond meter (198107)	Conductivity
5	EC/TDS, C°/°f meter H1983	Calculating TDS

Source: Field work, 2015
Note: EC = Electrical Conductivity
TDS = Total Dissolved Solvent
GPRS = Global Positioning System
FMWR = Federal Ministry of Water Resources

Table 1: Materials and Function

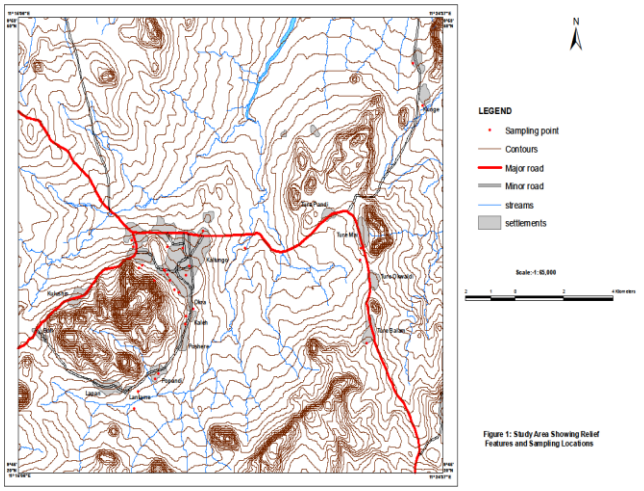
S/No	Parameter	Method Used	WHO Standard
1	Temperature	Electrometric	NS
2	pH	PH meter (198107)	6.5-8.5
3	Conductivity	PH Cond. Meter(198107)	0.07
4	TDS(mg/l)	EC/TDS, C°/°f meter H1983	
5	Turbidity NTU	Galvimetric	
6	Alkalinity	Titrimetric	NS
7	Total Hardness $Caco_3$	-	
8	Ca^- Hardness	ASS	
9	Mg^- Hardness	AAS	
10	Ca^{2+} (Mg/l)	AAS	
11	Mg^{2+} (Mg/l)	AAS	
12	Ca_3^{2-}	AAS	

13	Cl^- (Mg/l)	Hach	
14	F^-	Colorimetric	1.5mg/l
15	So_4	Hach	
16	No_3	Hach	1.0

Source: Field work. 2015

Table 2: Parameters Used for Analysis

Questionnaire was administered to selected post primary Schools in the study area to ascertain prevalence and severity of dental fluorosis among the inhabitants of the area. Simple random sampling techniques was adopted for the study. A total of 370 students were interviewed. Other information sought include perception on causes and effects of dental fluorosis. A total of six (6) wards were used for the study. The wards were Baganje, Kalargu, Termana Kalaring, Lapanditai and Awak.

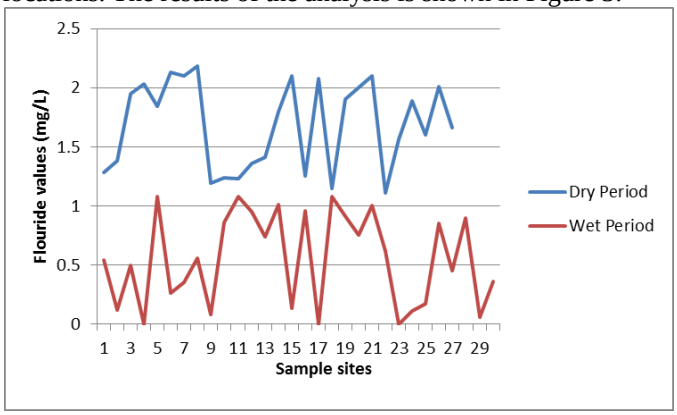


Source: Field work, 2015

Figure 2: Study Area Showing Relief Features and Sampling Locations

IV. RESULTS AND DISCUSSION

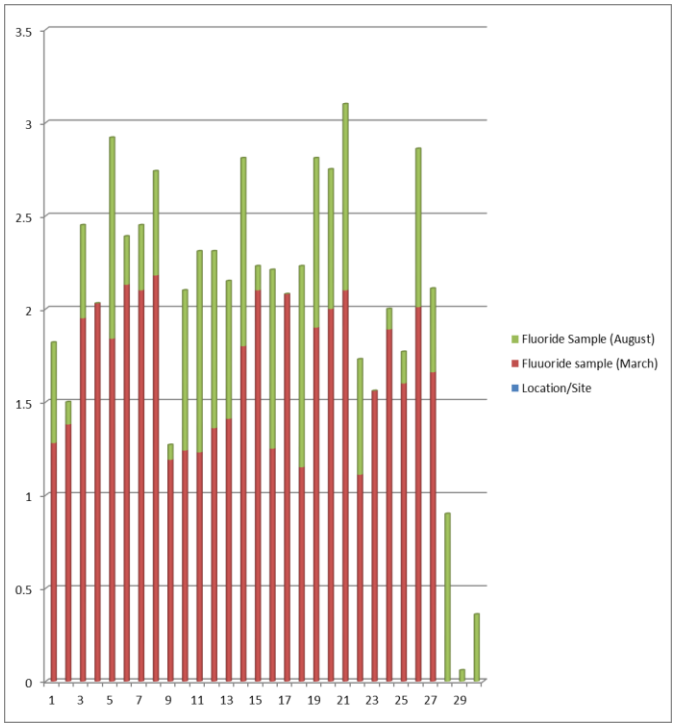
Groundwater water samples were analysed to determine fluoride contents in both dry and seasons in six different locations. The results of the analysis is shown in Figure 3.



Source: Field Work, 2016

Figure 3: Fluoride Concentrations in wet-dry seasons

Based on the chemical analysis of groundwater samples in the study area, there was variations in fluoride concentrations between wet and dry seasons. Fluoride contents was slightly high (0.1-1.08) during the dry season compared to wet season (1.11-2.18) as indicated in figure 3. The decrease in fluoride content could be attributed to dilution of groundwater due to rain water.



Source: Field work, 2015

Figure 9: Comparative chart of Fluoride Distribution in March and August

Analysis of water samples collected from boreholes and wells showed that water samples collected from Kalargu, Termana and Kalaring wards had slight and high levels of fluoride in water as presented in table 1 while Baganje, Lapanditai and Awak wards showed low fluoride levels between 1.19-1.41mg/l. The results of the analysis showed that fluorosis occurred in wards where fluoride levels were above 1.5mg/l.

Product moment coefficient for correlation was used to evaluate the association between levels of fluoride in water and the occurrence of fluorosis in each ward of the study area. There was a significant correlation ($r=0.657$) (p value < 0.0001) between high fluoride levels in water and high prevalence of fluorosis. This study agreed with several studies reported by Punitha et al., (2013) in a district regions of India.

In the studied population the occurance of dental fluorosis in this population was (52.16%) of which 201 were males and 169 were females. T-Test for significance showed that there is no statistical significant difference between males and females in the occurrence of fluorosis ($p> .05$, $CR= 2.15$).

On assessment of respondent's perception of knowledge and attitude regarding dental fluorosis, It was discovered that out of 193 respondents who are affected with fluorosis only five respondents knew they had a problem related to their teeth. Only few respondents (10-15 in number) consulted dentist for the discolouration. Out of 193 respondents only 10% knew that this problem was due to water, about 5% said it was due to eating sweets and chocolates. The respondents,

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who knew that the discolouration was due to water, continued drinking the same water as that was the only available source.

It has been noted that there is no physical, chemical and bacteriological analysis of the water periodically to analyze its Chemical properties as fit for human consumption by the water board authority.

This study showed that there were water samples that had fluoride levels around 0.0mg/l. Optimal levels of fluoride (0.6-1.2) is necessary for bone calcification and teeth formation and so water samples that contain fluoride less than 0.6 and above 1.5mg/l is not fit for consumption.

V. CONCLUSION AND RECOMMENDATION

This study shows that fluorosis is present in Kaltungo Area, of Gombe state northeast Nigeria. This study covered only six wards namely, Kalargu, Kalaring, Termana, Baganje, Lapanditai and Awak. More studies are required to know the actual extent of the problem in this area. It is important to create awareness about fluorosis and most importantly educate the people about the sources of the fluoride. Studies revealed that dietary habits can minimize the problem. Most importantly it is recommended that water that is consumed should be analysed periodically before it is distributed to the public for consumption. Community and domestic water de-fluoridation measures should be implemented.

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