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Determination of Concentration of Flouride in Some Boreholes (A case study of Monguno Local Government Area)

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Abstract Fluoride is a natural mineral that protects and strengthened teeth against cavity. It is usually found in lower concentration in drinking water and foods. The concentration in seawater averages 1.3 (ppm). Fresh water supplies generally contain between 0.01-0.3ppm, whereas the ocean contains between 1.2 and 1.5ppm. In some locations, the freshwater contains dangerously high levels of fluoride leading to serious health problems. Fluoride is used in water fluoridation and in many products associated with oral hygiene. However, the threshold concentration of fluoride as recommended by World Health Organizations (W.H.O) and Standard Organization of Nigeria are in the range 1.0-1.5mg/l. this paper is aimed at determining the concentration of fluoride in some borehole within monguno township of Monguno Local Government Area, Borno State and also determine whether or not the brown teeth coloration of most of the inhabitant has link with the concentration of fluoride.

Keywords Fluoride, mineral, borehole

Introduction

Fluoride is a natural mineral that protects and strengthened teeth against cavity. It is usually found in lower concentration in drinking water and foods. The concentration in seawater averages 1.3 (ppm). Fresh water supplies generally contain between 0.01-0.3 ppm, whereas the ocean contains between 1.2 and 1.5 ppm. In some locations, the freshwater contains dangerously high levels of fluoride leading to serious health problems. Fluoride is used in water fluoridation and in many products associated with oral hygiene. However, the threshold concentration of fluoride as recommended by World Health Organization and Standard Organization of Nigeria are in the range 1.0-1.5mg/l [1].

The dental caries reducing effect become progressively less below this level, while above, not only is there a little further benefit to be derived, but there is an increased possibility of melting in the permanent teeth, particularly at a concentration in excess of 2 ppm. Fluorides exist as the ion F" in drinking water, the parent being compound completely dissociated. Because of this case fluoride form either insoluble salt or undissociated complexes, the influence of other ions in water upon the availability and effectiveness of fluoride must be considered [2].

The ingestion of fluoride during the pre-eruptive development of the teeth has a cariostatic effect (it reduces the risk of dental caries) due to the uptake of fluoride by enamel crystallites and formation of fluorhydroxyapatite, which is less acid soluble than hydroxyapatite. Fluoride in the oral fluids, including saliva and dental plaque, also contributes to the cariostatic effect. This post eruptive effect is mainly due to reduced acid production by plaque bacteria and to an increased rate of enamel remineralization during an acidogenic challenge [3-4].

Dental fluorosis, also called mottling of tooth enamel, is a developmental disturbance of dental enamel caused by excessive exposure to high concentrations of fluoride during tooth development. The risk of fluoride overexposure

occurs at any age but it is higher at younger ages. In its mild forms (which are its most common), fluorosis often appears as unnoticeable, tiny white streaks or specks in the enamel of the tooth. In its most severe form, tooth appearance is marred by discoloration or brown markings. The enamel may be pitted, rough and hard to clean, [5]. The spots and stains left by fluorosis are permanent and may darken over time.

Teeth are generally composed of hydroxyapatite and carbonated hydroxyapatite; as the intake of fluoride increases, so does the teeth's composition of fluorapatite. Excessive fluoride can cause white spots and, in severe cases, brown stains, pitting, or mottling of the enamel. A tooth is no longer at risk of fluorosis after eruption into the oral cavity. At this point, fluorapatite is beneficial because it is more resistant to dissolution by acids (demineralization). Although fluorosis usually affects permanent teeth, occasionally the primary teeth may be involved [6].

Objectives

- The objective of this study is to determine the concentration of fluoride in some selected boreholes within Monguno township of Monguno L.G.A.
- To determine whether or not the brown teeth coloration of most of the inhabitant has link with the concentration of fluoride, as concentration above 1.5mg/l cause teeth coloration.

Methodology

Study Area

Monguno Local Government Area, which is located in the northern part of BornoStatehas an area of 1,913 km^2 and a population of 109,851 as at 2006 census. The people are predominantly farmers. The commonest agricultural practice in the village is subsistence farming with much usage of manure and little usage of chemical fertilizers. Brown teeth characterize most of the people, which is the purpose of the research.

Samples Collection

After due consideration of security, accessibility and human activity around the sampling point, the samples were collected in(3) batches using clean containers, labeled and transported immediately to the laboratory in a container of ice for analysis.

Table I Shows randomly selected sample locations, sources and sample identification code.

Table 1

Sample Location	Source Of Supply	Sample Identification Code
Abbari 1	Borehole	SP1
Abbari 2	Borehole	SP2
Hausari	Borehole	SP3
Gen. Hospital	Borehole	SP4
Irrigation	Borehole	SP5
Kuya	Borehole	SP6
Kwata	Borehole	SP7
Ajari 1	Borehole	SP8
Ajari 2	Borehole	SP9
Rest House	Borehole	SP10
Central 1	Borehole	SP11
Central 2	Borehole	SP12
Science	Borehole	SP13
Charamari	Borehole	SP14
TashanBaga	Borehole	SP15

Determination of Fluoride

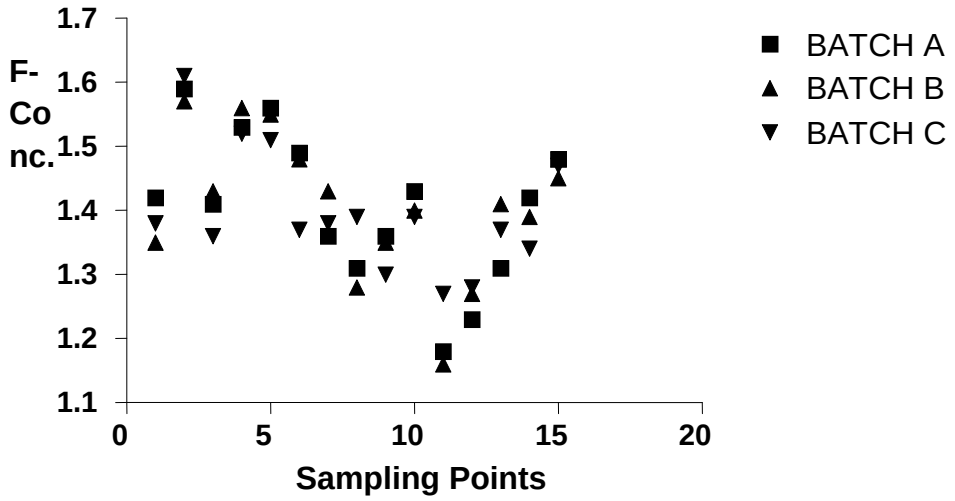
The colorimetric SPADNS METHOD was used in the determination of fluoride concentrations in the water samples, using the programmed spectrophotometer. The procedure and reagent system consisted of the approved EPA method 4500-F-D for fluoride. Determination was achieved at 570 nm wavelength by measuring the absorbance of an initial complex between zirconium ion and the dye, Trisodium 2-(4-sulfophenylazo)-1, 8-dihydroxynaphthalene-3, 6-disulfonate (SPADNS) and the subsequent bleaching of the complex due to reaction with fluoride ion. Detection limit range 0.00-2.00ppm was considered.

Results

Table 2: Concentration of Fluoride

Sample Location	Fluoride Conc.(Mean±SEM)
SP1	1.38±0.02
SP2	1.59±0.01
SP3	1.40±0.02
SP4	1.54±0.01
SP5	1.54±0.02
SP6	1.45±0.04
SP7	1.39±0.02
SP8	1.62±0.03
SP9	1.34±0.02
SP10	1.41±0.01
SP11	1.20±0.03
SP12	1.26±0.02
SP13	1.56±0.02
SP14	1.38±0.02
SP15	1.46±0.01

Chart Presentation of the of the Results



The chart above shows comparatively the varying concentration of fluoride in each sampling point and its variation from the subsequent batch at the same point.

Discussion

The results presented in this report shows that fluoride is present in all the selected boreholes in varying concentration with many of the results just slightly below the upper limit threshold concentration of World Health Organization (WHO) value of 1.5 mg/l (1.5 ppm). The World Health Organization (WHO) guidelines of 1984 suggested that in areas with warm climate the optimal fluoride in drinking water should remain at 1 mg/l (1 ppm), while in cooler climate it could go up to 1.2 mg/l (1.2 ppm)

The concentration of fluoride in the samples SP2, SP4, SP5, SP8 and SP13 were slightly high, above the value recommended by WHO (1984) with values ranging from 1.52-1.67 mg/l. this may cause dental fluorosis which is characterized by discolored, brownish, blackened, or chalky white teeth which is a clear indication of over exposure to fluoride during childhood when the teeth were developing. These effect are not apparent if the teeth were already grown prior to to the fluoride over exposure hence an adult may not show sign of dental flourosis does not mean his fluoride intake is within the safe limit. The major manifestation resulting from chronic ingestion of excessive amounts of fluoride is dental fluorosis. Only children up to approximately eight years old can be affected, because the condition occurs during tooth formation and before teeth first appear through the gums. In mild cases, mottling consists of small opaque paper-white areas scattered irregularly over the tooth surface. In severe mottling, discrete deep brown to black stained pits give the tooth a corroded appearance.

The concentration of fluoride in the samples SP1, SP3, SP6, SP7, SP9, SP10, SP11, SP12, SP14 and SP15 with a concentration range from (1.20-1.46 mg/l) were below the WHO recommended value. Fluoride is effective in the prevention of dental caries if taken in the optimal amount coupled with proper dieting as calcium deficiency increases fluoride retention in the body. Low concentrations provide protection against dental caries, especially in children. The pre- and post-eruptive protective effects of fluoride (involving the incorporation of fluoride into the matrix of the tooth during its formation, the development of shallower tooth grooves, which are consequently less prone to decay, and surface contact with enamel) increase with concentration up to about 2 mg of fluoride per litre of drinking-water; the minimum concentration of fluoride in drinking-water required to produce it is approximately 0.5 mg/l.

Recommendations

The levels of fluoride especially in some of the samples could directly pose risk to dental health and human health. Therefore, a clean-up procedure should be embarked on to reduce the fluoride concentration in the water by flocculation using alum (hydrate aluminium salt). Secondly, further research should be carried out on fluoride level in water during the dry season and other sources of fluoride exposure in other to actually ascertain the approximate ingestion level per day per kilogram of the residents.

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