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Determination of Heavy Metal Concentrations of Locally – Grounded Snuff Products Sold in Different Markets in Yenagoa

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Abstract:-Snuff is a tobacco product which contains the chemical stimulant, nicotine. It is a product made from grounded tobacco leaves and is an example of smokeless tobacco. Snuff is tobacco in the form of powder that can be inhaled or placed against the gums. This research reports the results of the concentrations of heavy metal ions in locally-grounded snuff products sold in different markets in Yenagoa, Bayelsa State, Nigeria. The snuff samples were analyzed for heavy metal concentrations using Flame Atomic Absorption Spectrophotometer. The mean metal concentrations in all the markets were1.604 ± 1.264ppm, 0.352 ± 0.203ppm, 0.187 ± 0.106ppm, 1.188 ± 0.872ppm and 2.150 ± 0.468 ppm for Pb, Cd, Cu, Ni and Cr respectively. The metal concentration levels in different markets were Pb>Ni>Cr>Cd>Cu for Opolo market, Cr>Pb>Ni>Cd>Cu for Kpansia market, Cr>Pb>Ni>Cd>Cu for Swali market and Pb>Cr>Ni>Cd>Cu for Tombia market.The resulting levels of the metals were compared to the World Health Organization (WHO) permissible limits and all the metal ions were above the provisional tolerable intake limits except copper ion. The results of this study indicate that the snuff products contain heavy metals which are toxic to the users.The findings can be used to raise public awareness about the safety and health effects of snuff, which is clearly a source of oral exposure to toxic heavy metals.

Keywords:-*Snuff, heavy metal, Yenagoa, health effects, WHO*

I. INTRODUCTION

Tobacco is a product prepared from the leaves of the tobacco plant by curing them. The plant is part of the genus Nicotiana and of the solanaceae (night Shade) family. Nicotianatabacumis the cultivated tobacco plant most commonly used to make commercial tobacco products. The tobacco plant (Nicotianatabacum) is widely known for its leaves, which are smoked, chewed, or sniffed for various effects. It is well documented that the key addictive component of tobacco products is the chemical nicotine [3-(1-methyl- 2-pyrrolidinyl)-pyridine, $C_{10}H_{14}N_2$] (Atrens, D. M. 2001), and is very harmful to humans.

Dry tobacco leaves are mainly used for smoking in cigarettes, cigars, pipe tobacco and flavored shisha tobacco. They can also be consumed as snuff, chewing tobacco, dipping tobacco and snus. The tobacco plant can be grown economically from 50° Northern to 40° Southern latitude. Tobacco in Nigeria has a long history. It has proved pleasure to millions of adults who have chosen to smoke and to those who prefer to either chew it or inhale it as snuff. Local snuff is called Ifienya in Izon, Utaba in Igbo and Taba in Yoruba in Nigeria, and it is mostly patronized by the elderly ones in the society.The consumption or sniffing of snuff has been a source of concern to the whole world because of its toxic effect on humans. Nigeria just like other developing and developed nations are major consumers of snuff and tobacco products. However, smokeless tobacco products are classified under foods for regulatory purposes (Odangowei, I. O.*et al.*, 2018).

To a small extent, heavy metals enter the body through food, drinking water and air. As trace elements, some heavy metals are essential to human body. However, at higher concentrations, they can lead to poisoning. Heavy metals are dangerous because they tend to bioacummulate. Tobacco contains over 19 known carcinogens and at least 30 metallic compounds, comprising heavy metals (IARC, 1987; IARC, 1993; IARC, 2006). Harmful effects on human health are associated with exposure to the heavy metals such as lead (Pb), cadmium (Cd), chromium (Cr), copper (Co) and nickel (Ni). These metals have been extensively studied (Lars, 2003) and their effects on human health have been regularly reviewed by international bodies, such as the World Health Organization (WHO). These heavy metals are found in the atmosphere as well as many man-made sources, and they do not have any metabolic function, as such, in the body (Fergusson, J. E. 1990).

Snuff is known to cause gum cancer, osteoporosis, and rheumatism. Studies have reported effects such as oral cancer,

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leukoplakia, immune dysfunction, periodontal diseases, decreased sperm viability, and perinatal mortality (Hannan, M. A. et al., 1986; Allard, W.F.et al., 1999; Alsanosy, R.M. 2014; Makrami, R. M.et al., 2015). The toxicity of some metals found in tobacco has also been reported. The role of copper (Cu) in submucous fibrosis in vitro has been shown earlier (Trivedy,C. et al., 2001) and it was noticed that Cu in snuff may be responsible for the fibrosis in mouth cavities. Early symptoms of chronic Cu poisoning include precancerous oral lesions (leukoplakia-small white patches) and sores in the mouth or tongue, followed by oral submucous fibrosis and difficulty in opening the mouth fully.Cu may cause free radical-induced lung injury. Lead is particularly dangerous for the younger age group, as chronic exposure resulting in the lowering of the IQ and its poisoning effect on the brain may not be reversible (IARC, 2006; Raghunath, R. et al., 1997; Khandekar, R. N. 1984).Pb levels have been associated with elevated blood pressure (ATSDR, 2007). Excessive doses of Cd are known to cause lung and bone damage, and increased blood pressure(IARC, 1993) and causation of cardiovascular disease(IPCS, 1992; ATSDR, 1997; Jarup, L.et al., 1998). Cd in smokeless tobacco has been shown to be associated with arterial disease (Navas-Acien, A.et al, 2004; Pappas, R. S.et al., 2008). Nickelcauses dermatitis and oral allergic sensitizations (Ruegger, M. S. 1995; Kelleher, P. et al., 2000). Oral allergic contact dermatitis is known to be caused by Cr(VI) (Moller, D. R.et al., 1986). Toxic metals in tobacco products are either from the tobacco leaves or as contaminants introduced during either the pre-harvesting treatment (e.g. from fertilizers and pesticides) or from the post-harvest additives (e.g. from preservatives) (Iskander, F. Y.1986). The objective of this study is to determine the concentrations of heavy metal ion in locally grounded snuff products sold in different markets in Yenagoa, Bayelsa State, Nigeria.

II. MATERIALS AND METHODS

A. Study Area

The study area (Yenagoa), is the State Capital Territory of Bayelsa State. It is a wet land located on the southernmost part of Nigeria. It has a deltaic landmass, and characterized by shallow aquifer with several networks of creek and creeklets. Residents of this homogenous Ijaw city are lovers of commerce. Every day, including Sunday, is a market day in some communities in the metropolis**.**It has a well-organized and mapped out market called Swali market and other smaller community markets.

B. Collection of Samples

Four (4) different samples of locally- grounded snuff were obtained from different markets in Yenagoa, Bayelsa State namely; Kpansia, Opolo, Swali and Tombia Markets. The samples were collected in sterile sample bottles and conveyed to the chemistry Laboratory of the Niger Delta University, Wilberforce Island Bayelsa State for heavy metal analysis.

C. Sample Analysis

The heavy metal concentrations were determined using Flame Atomic Absorption Spectrophotometer. Appropriate quality assurance procedures and precautions were taken to ensure reliability of results. Samples were carefully handled to avoid cross-contamination.All chemicals used were of analytical grade; all plastic-and-glassware were washed, rinsed severally with tap water, and then soaked in 5% HNO_3 solution for a minimum of 24 hours. They were rinsed severally with deionized water before use. Blank samples of deionised water were run to calculate the limits of detection and limits of quantification. Blank procedural reagent samples were also used to subtract the results of all tested metal standards and samples injected into the flame atomic Adsorption spectrophotometer and the results were calibrated.

III. RESULTS

Snuff Samples	Heavy Metal concentration (ppm)				
	Pb	Cd	Cu	Ni	Cr
Opolo Market	1.264	0.282	0.145	0.974	0.468
Kpansia Market	1.604	0.255	0.106	0.955	2.150
Swali Market	1.444	0.352	0.186	1.188	2.133
Tombia Market	1.306	0.203	0.187	0.872	0.932
WHO Standard	0.3	0.1	2	0.02	0.05

Table 1.The mean heavy metal concentrations of Snuff products sold in different markets in Yenagoa.

- Abbreviations: WHO= World Health Organization, ppm= part per million.

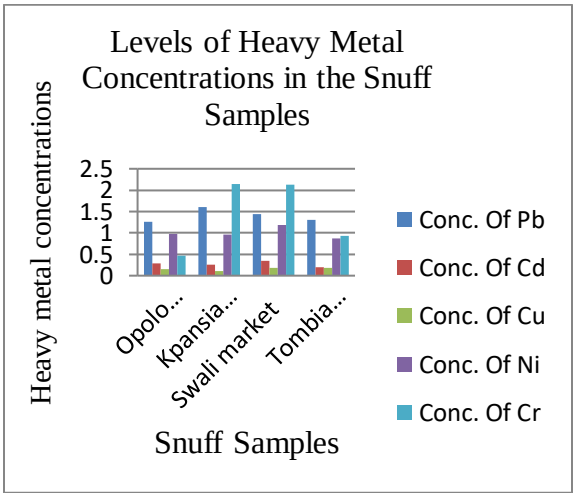

Fig.1:- Levels of heavy metal concentrations in the snuff samples

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IV. DISCUSSION

Detectable levels of lead, cadmium, copper, nickel and chromium were analyzed in locally-grounded snuff samples. The average metal concentrations in the different market samples reported were 1.604 ± 1.264ppm, 0.352 ± 0.203ppm, 0.187 ± 0.106ppm, 1.188 ± 0.872ppm and 2.150 ± 0.468 ppm for Pb, Cd, Cu, Ni and Cr respectively (table 1). The highest metal concentration levels in different markets followed the order Pb>Ni>Cr>Cd>Cu for Opolo market, Cr>Pb>Ni>Cd>Cu for Kpansia market, Cr>Pb>Ni>Cd>Cu for Swali market and Pb>Cr>Ni>Cd>Cu for Tombia market (figure 1). These findings are in agreement with previous studies (Chiba, M. and Masironi, R. 1992; Bhisey, R. A. 2012).

From the result it shows that lead was highest in Opolo and Tombia markets and is higher than World Health Organization (WHO) permissible limits as shown in Table 1. The retention of Pb in the body leads to an increased blood Pb level, thereby impacting the hematic and immune system. Lead is particularly dangerous for the younger age group, as chronic exposure resulting in the lowering of the IQ and its poisoning effect on the brain may not be reversible (IARC, 2006; Raghunath, R. *et al*., 1997; Khandekar, R. N. 1984). Pb levels have been associated with elevated blood pressure (ATSDR, 2007).

Cadmium concentrations from the result was found higher that the WHO permissible level in all markets. Excessive doses of Cd are known to cause lung and bone damage, and increased blood pressure (IARC, 1993) and causation of cardiovascular disease (IPCS, 1992; ATSDR, 1997; Jarup, L.*et al*., 1998). Cd in smokeless tobacco has been shown to be associated with arterial disease (Navas-Acien, A.*et al*, 2004; Pappas, R.S.*et al*., 2008). The following oral exposure of Cd is likely to depend on physiological status, such as age and levels of Fe, Ca, and Zn stored in the body. It is possible that the source of metals may be due to the addition of various ingredients. Certain spices, such as mint, saffron, etc., used in the flavoring of snuff might also contribute to the heavy metal content (Pappas, R.S. *et al.*, 2008).

Copper is an essential and beneficial element in human metabolism. A safe and adequate range of intake was established in 1980 for copper with a range of 2 to 3 mg/day (Turnlund, J. R. 1988). The Cu levels were found to be below the WHO permissible limits in all markets.Chromium levels from the results shows highest in Kpansia and Swali markets and was higher than the WHO permissible limits. Oral allergic contact dermatitis is known to be caused by Cr(VI) (Moller, D. R. *et al*., 1986).Nickel levels from the results are higher than WHO permissible limits. Ni causes dermatitis and oral allergic sensitizations (Ruegger, M.S. 1995; Kelleher, P. et al., 2000). Toxic metals in tobacco products are either from the tobacco leaves or as contaminants introduced during either the pre-harvesting treatment (e.g. from fertilizers and pesticides) or from the post-harvest additives (e.g. from preservatives) (Iskander, F. Y. 1986). General toxicity and carcinogenicity are characteristic of heavy metals. Because of their high toxicity, Cd, Cr, and Pb are ranked among the foremost metals of public health concern (Tchounwou, P.B. et al., 2014).

V. CONCLUSION

This study shows that the snuff samples contain heavy metals above permissible limits prescribed by the World Health Organization which constitute a significant contributor of heavy metal intake in the consumers.The present work has demonstrated the need of establishing a national regulatory framework for the levels of trace metals in the product (snuff). It is hoped that these results could serve as a guide in decision making and formulation of policies on the local production/preparation and consumption of snuff. There is also need for further studies to ascertain other toxic metals in snuff products and to evaluate the potential risk to human.

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