ASSESSMENT OF SOME HEAVY METALS IN BUSHMEAT SOLD ALONG MAJOR HIGHWAYS IN OYO STATE

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ABSTRACT

Some heavy metals in smoked bush meat sold along major highways in Oyo State were evaluated using standard analytical methods. The major highways identified and used as study were Ibadan-Ife, Ibadan-Oyo/Ogbomosho and Abeokuta-Iseyin respectively. Heavy metals determined were Cadmium (Cd), Lead (Pb), Iron (Fe), Copper (Cu), Zinc (Zn), Chromium (Cr), Magnesium (Mg), Tin (Ti) and Aluminium (Al). The results showed varying amounts of these heavy metals widely distributed within the bush meat samples, showing significant differences ($P \leq 0.05$). All the metals evaluated were compared with standards stipulated by various regulatory bodies, such as FAO/WHO (Food and Agricultural Organization, WHO (World Health Organisation), FEPA (Federal Environmental Protection Agency of Nigeria) and ANZFA (Australia-New Zealand Food Authority) for their permissible levels. The Zinc, which ranged from 20mg/kg to 38.65 m/kg for the three bush meat samples was found to be above recommended permissible level by WHO. WHO had recommended 15mg for adult and 5mg for children. The study had shown that high level of Zinc from the study areas is detrimental to the health of the consumers and should therefore be a matter of concern since excess zinc is harmful to the body systems.

Keywords: Bush-meat, Assessment, Heavy Metals, Highways

INTRODUCTION

Bush-meat, also known as game meat has enormous potential for meat production and its vital source of protein for African rural people (Fonweban & Njwe, 1990, Adelakun et al., 2020). Meat refers to animal tissues used as food, mostly skeletal muscles and associated fat but it may also refer to organs, including lungs, livers, skin, brains, bone marrow, kidneys and a variety of other internal organs as well as blood (Emelue & Idaewor, 2018; Hammer, 1987).Any meat from wild animal is called bush-meat and it could be consumed fresh, smoked, salted or sun dried. Smoked bush meat, however, is the final product most widespread and readily available in the rural, sub-urban and urban markets in most African settings (Emulue & Idaewor, 2018; Ntiamoa-Baudu, 1997; Onadeko, 2004). Bush-meat consumption in Africa has increased due to factors such as food insecurity, demographic changes, cultural practices, taste preferences and perceived medicinal value (Ahovanse et al., 2023; Dell et al., 2020; Chabi-Boni et al., 2019; Katani et al.).

The demand for bush meat has been met through hunting from the wild by the use of guns, cutlasses, chase dogs, baiting with chemicals and bush burning (Oduro & Kankan, 2002; Adelakun et al., 2020).

Heavy metals are any metal that is potentially toxic and has a specific gravity greater than 5.0. Vanadiuym (V), Cadmium (cd), Mercury (Hg), Lead (Pb), Copper (Cu),

Iron (Fe), Cobalt (Co), Manganese (Mn) and Zink (Zn) are the most important (Jaishankar et al., 2014; Raeeszadah et al. (2021). These metals can accumulate in the tissues of the human body, animals, and plants and their main problem is that they are not metabolized by biological systems (Jaishankar et al., 2021).

Hunting practices such as use of guns and baits used for killing wild animals could be a great threat to human life due to the presence of harmful chemicals or heavy metals such as Lead (Pb), Cadmium (Cd) Manganese (Mn), Iron (Fe), Zinc (Zn) and Copper (Cu) etc. (Hunlet et al., 2009, Adelakun et al., 2020). Toxic substances in meat tissues can be caused by a variety of sources including animal drugs, pesticides, feed and other agricultural or industrial chemical substances (Khalafalla et al., 2011; Adelakun et al., 2020).Raeeszadeh et al., (2021) studied the determination of some heavy metals concentration in species animal meat (sheep, beef, turkey and ostrich) and carcinogenic health risk assessment in Kurdistan Provice, Western Iran while Adelakun et al (2020) reported the heavy metals in bush meat from New-Bussa and its environs, Nigeria. Okoro et al (2015) researched on the Lead (Pb) and Cadmium (Cd) levels in fresh and smoked-dried grass cutter (*Thryonomys Swinderianus Teniminck*) meat while Hamoda et al. (2018) gave detail reports on assessment of heavy metal concentration in fish meat of wild and farmed Nile Tilapia (Oreochromis Niloticus), Egypt. Instances of heavy metal contamination in meat products during processing have also been reported by various authors (Akan et al., 2010, Harlia and Balia, 2010). However, the aims of this present research work are to determine heavy metal contamination of bush meat sold along some major highways in Oyo State and provide information on the potential hazard effects of these toxic metals on human health.

MATERIALS AND METHODS

Smoked bush meats were purchased along three (3) major highways in Oyo State. The highways used were Ibadan-life, Ibadan – Oyo/Ogbomoso and Abeokuta – Iseyin respectively. The vehicular traffic along these major highways are very high. Three (3) different types of smoked bush meat (Squirrel, Hyena and Pouch rat) were put in Ziplock bags, properly labelled and transported to the laboratories of the Department of Food Science and Technology, Federal Polytechnic, Ilaro, Ogun State for further processing and analysis. Reagents and chemical used were of analytical grades.

Analytical Procedures:

Samples of Smoked bush meats (Squirrel, hyena and pouch rats) were digested according to method described by Akan et al (2012) and reported by Adelakun et al (2020). Determination of, Cd, Pb, Fe, Cu, Zn, Cr, Mg, Ti and Al were read directly on each final solution using Perkin-Elmer A Analyst 300 Atomic Absorption spectroscopy (AAS).

Statistical Analysis

Data obtained were subjected to one-way analysis of variance (ANOVA) to find out the significant differences in heavy metal

concentration of the smoked bush meats. Duncan Multiple Range Test (DMRT) was used to separate means with Statistical Package for Social Sciences (SPSS).

RESULTS

Table 1: Heavy Metal Concentration in Bush Meat Sample from Highways Sold Along Highways in Oyo State, southern Nigeria

Sample	Cd	Pb	Fe	Cu	Zn	Cr	Mg	Ti	Al
Squirrel	0.0115±0.00^{c}	0.0071±0.00^{b}	0.0564±0.00^{b}	0.0085±0.00^{a}	38.65±0.00^{a}	0.009±0.00^{a}	0.037±0.00^{a}	0.048±0.00^{a}	0.025±0.00^{c}
Hyena	0.0170±0.00^{b}	0.0050±0.00^{c}	0.0338±0.00^{c}	0.0060±0.00^{b}	37.96±0.01^{a}	0.009±0.00^{a}	0.034±0.00^{b}	0.046±0.00^{b}	0.028±0.00^{b}
Pouch Rat	0.0188±0.00^{a}	0.0077±0.00^{a}	0.0745±0.00^{a}	0.0058±0.00^{b}	0.20±0.00^{b}	0.004±0.00^{b}	0.002±0.00^{c}	0.004±0.00^{c}	0.0045±0.00^{a}

Values are mean ± Standard Deviation. Means in the same column with different superscript letters are significantly ($p>0.05$) different.

DISCUSSION

The result of heavy metal concentrations in the three smoked meat samples are as shown in Table 1. The metals evaluated viz. Cadmium, Lead, Iron, Copper, Zinc, Cranium, Tin and aluminum have significant differences ($p \leq 0.05$) among the treated samples. Lead ranged from o.0071mg/kg to 0.0077mg/kg; for the three samples, showing significant differences ($p \leq 0.05$). Lead has been shown to play a role in the development of other cancers, such as testicular cancer, bladder cancer, pancreatic cancer as well as cancer of the gall bladder (Adelakun et al., 2020). The Pb concentrations in all the three smoked bush meat samples were lower than the permissible limit (1mg/kg) set by the Australia – New Zealand Food Authority (ANTFA, 2001; Okoro et al., 2015). Pb levels in the smoked bush meat were also lower than 1mg/kg reported (Galadima and Garba, 2011; Okoro et al., 2015), and approved by the Federal Environmental Protection Agency of Nigeria (FEPA).

Cadmium (Cd) levels in all the three samples are 0.0115mg/kg, 0.0170mg/kg and 0.0188mg/kg for Squirrel, Hyena and Pouch rat respectively. Cd is toxic virtually to every system in the normal body. According to literature, Cadmium is cumulative poison and could be exceptionally toxic. (Orebiyi et al., 2010, Duralet et al., 2007; Adelakun et al., 2020). Cd obtained in this present work existed in low concentrations in all the three samples. Cd is primarily toxic to Kidney, especially to proximal tubular cells and may catalyze diabetes-induced effects on Kidneys. The Cd levels are below the permissible limit (0.5mg/kg) stated in meat and liver (FAO/WHO, 2000).

Iron levels in the smoked meat samples varied from 0.0338mg/kg to 0.0745mg/kg. High intakes of iron or high body iron burden may increase the risk of colorectal cancer, cardiovascular Disease (CVD), infection, neurodegenerative disorders and inflammatory conditions (Thompson et al., 2001; World Cancer Research, 2007; Geissler and Singh, 2011; Usman et al., 2022). The iron levels are below the permissible level stipulated by WHO (0.3mg/kg). Iron is also regarded as one of the essential elements for humans. Approximately 3000 to 5000mg of iron exists in the human body (Landis and Yu, 1995; Adelakun et al., 2020). It was also reported that as long as the quantity of Iron in the environmental is not too large, it may not be harmful to the human body (Adelakun et al., 2020).

As shown in Table 1, Copper (Cu) ranged from 0.0058mg/kg to 0.0085mg/kg for the three sample evaluated. Some forms of human activity such as the application of agricultural fertilizers, industrial waste water disposal, release copper directly into the soil. The copper released into the environment eventually end up in the soils or surface waters (Solidum et al., 2013; Adelakun et al., 2020). Bush bulk is herbivorous animals, feeding on roots, tubers, grass, grains of cereals etc. These animals (bush meat) consumed bits of the soil on roots and tubers while digging for food. (Adelakun et al., 2020). Copper obtained in this work is also below the permissible level according to WHO standard.

The Zinc values for Squirrel, hyena and pouch rat are 38.65mg/kg; 37.96mg/kg and 20mg/kg respectively, with Squirrel having the highest value and pouch rat having the lowest value. Zinc is a necessary heavy metal that is present in the cells of many organism as a key component of various enzymes. It is critical for cell division, collagen formation and a healthy immune system (Yirgu, 2011). However, excessive Zinc levels are detrimental to human health (WHO, 2011). Zinc is an essential cofactor element for several enzymatic reactions in human body and therefore needed in the human diet (Linnik & Zubenko, 2000). Its deficiency as well as excesses can be harmful (Orebiyi et al., 2010, Adelakun et al., 2020). The normal daily requirement for zinc is 15mg for adult and 5mg for children (Adelakun et al., 2020). Therefore, the levels of Zinc in all the samples were above WHO recommended level.

The concentration of Chromium in the smoked bush meat samples ranged from 0.004mg/kg, showing significant differences ($p \leq 0.05$) among samples. Chromium has been designated as non-essential heavy metal. However, the International Agency for research in cancer in 2012 (IARC) declared that foods containing Chromium were harmful to human health. Liver, kidney, vascular, and nerve tissue damage can result from prolonged exposure to Chromium. All the values obtained in this present work are below the allowable limit of 1mg/kg stipulated by WHO (2004).

The magnesium levels for the three smoked bush meat samples are 0.037mg/kg; 0.034mg/kg and 0l002mg/kg while that of Tin (Ti) are 0.048mg/kg, 0.046mg/kg and 0.004mg/kg respectively for Squirrel, hyena and pouch rat. Both magnesium and tin occurred at low levels that could not pose any harmful threats to the consumers.

CONCLUSION

It is evident from this present work that smoked bush meat sold along the major highways in Oyo State contained heavy metals at reasonably level that may not constitute hazard to human health. It is possible for some of these bush meat vendors to be observing serious hygienic procedures during processing of their products coupled with the fact that further contaminations are prevented by adequate covering of their produce from dust, air, exhaust of moving vehicles etc.

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