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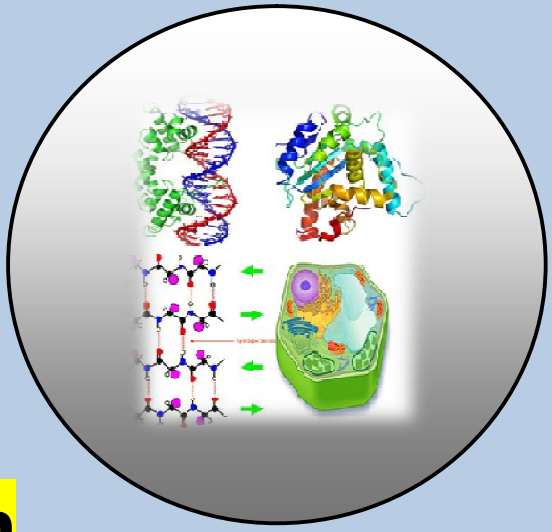

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RESEARCH PAPER

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Determination of the Heavy Metal and Moisture Contents of Some Samples of Red Palm Oil Sold in Awka Metropolis, Nigeria

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ABSTRACT

This study assessed the heavy metal and moisture contents of some palm oil samples sold in Awka metropolis, Nigeria. Wet digestion using an acid mixture of $HNO_3/HCLO_3/H_2SO_4$ was employed for the heavy metal analysis. The filtrates were analyzed using Atomic Absorption Spectrophotometer (AAS).The results of the study showed that the heavy metal mean values for arsenic were 0.340-1.448, mercury 1.052 – 1.453, lead 0.018 - 0.493, cadmium 0.050 – 0.114, Nickel 0.091-1.313.The average moisture contents were 2.83, 4.24, 1.060, 0.070 and 0.00 for samples A, B, C, D and E respectively. The results of the study showed that heavy metal content of the oil samples fell below the 0ral Component Limit (OCL) as stipulated by USP. United State Pharmacopea (USP) stipulated an OCL of 1.5ppm. 1.5ppm, 1ppm, 0.5ppm, and 25ppm for arsenic, mercury, lead, cadmium, and nickel. Except for sample E, the moisture content of all the samples were higher than the 0.29% limit set by Standard Organization of Nigeria (SON). High moisture content of palm oil makes the oil to be unstable and prone to microbial attack. So consumption of these palm oils may pose little risk to human health in terms of their moisture contents but they are safe for consumption with respect to their heavy metal contents.

Keywords: Heavy metals, Moisture, Palm oil, Awka metropolis, and Nigeria.

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INTRODUCTION

Palm oil has been part of human diet for more than 500 years. For generations, it has been revered as both a nutritious food and a valuable medicine. However, care should be taken to evaluate the purity and safety of this nutritional and medicinal agent to the human system (Adepoju, et al; 2012). Although red palm oil remain vital in human nutrition and medicinal treatment, they are concerns about its contamination by toxic elements such as heavy metals and the potential risk such contamination could pose to the consumers. The moisture content of palm oil plays a role in the quality of palm oil.

Heavy metals could have access into red palm oil during planting, harvesting, processing, packaging, storage or sale of product (Ohimain, et al; 2012). The presence of these toxic metals may appear harmless in minute quantities, however their accumulation overtime carries potential health risk to human who regularly consume red palm oil contaminated with toxic metals (Ferner, 2001). Lead is a highly poisonous metal affecting almost every organ and system in the body, mostly the nervous system. Lead has been shown many times to permanently reduce the cognitive capacity of children at extremely low levels of

Exposure (Golub, 2005). Nickel is relatively non toxic metal, but prolonged exposure results in respiratory tract neoplasia and dermatitis (Chatterjea and Shinde, 2007). Cadmium ion contributes to renal tubular toxicity while accumulating in the cortex of the kidney (Jarup et al., 2000). Acute mercury poisoning occurs in 3 phases. In the first 1–3 days, flu-like symptoms appear, followed by severe pulmonary toxicity and then gingivostomatitis, tremor, memory loss, depression, insomnia, and shyness (Clarkson,2002) Renal tubule damage is a hallmark of cadmium toxicity and is reflected in increased concentrations of biomarkers such as β2-microglobulin. Glomerular damage may follow with corresponding increased levels of albumin and transferring (Bernard, 2004).

MATERIAL AND METHOD

Sample Procurement

The five oil samples viz. Eke Awka Market, Ekeagba Isuaniocha Market, Nkwo Mgbakwu Market, eke Nibo Market and Afor Nise Market used for the study were bought from open markets in Awka metropolis, Anambra State.

Treatment of Samples

Sample Digestion for Heavy Metals

2g of the oil was weighed into a digestion flask.20ml of acid mixture containing $HNO_3/HCLO_3/H_2SO_4$ in the ratio of 2:2:1 was added to the flask.. The flask was heated at 250^0Ctill a clear digest is obtained (1 hour 30minutes). The digest was diluted with 40ml mark of distilled water and shaken vigorously. Then the digest was centrifuged at 5000rev/min for 6minutes and then filtered with whatman No I filter paper and the filtrates were obtained. Then 10ml of the filtrates was used for the analysis using atomic absorption spectrometer (AAS) (FS 240 AAS, Agilent technologies, USA)

METHODS

Heavy Metal Content Determination

The method of APHA (1995) was used for the heavy metal analysis.

Moisture Content Determination

The method of Aletor, et al (1990) was used for moisture content analysis.

RESULTS

The results of the heavy metal analysis are as shown in table 1.

Table 1. Heavy Metal Contents(Mean values).

Parameters (ppm)	Samples	A	B	C	D	E
Arsenic		0.340	0.784	0.00	0.00	1.448
Mercury		1.453	1.052	1.313	0.00	0.00
Lead		0.018	0.089	0.244	0.493	0.455
Cadmium		0.114	0.075	0.077	0.060	0.050
Nickel		1.313	0.274	0.230	0.934	0.091

The results of the moisture content are as shown in table 2.

Table 2. Moisture Content.

Sample	Average moisture content (%)
A	2.83
B	4.24
C	1.06
D	0.70
E	0.00

DISCUSSION

The results of the study shows that the heavy metal mean values of the samples for arsenic were 0.340-1.448, mercury 1.052 – 1.453, lead 0.018 - 0.493, cadmium 0.050 – 0.114, Nickel 0.091-1.313.The average moisture contents were 2.83, 4.24, 1.060, 0.070 and 0.00 for samples A, B, C, D and E respectively. The results of the study showed that heavy metal contents of the oil samples fell below the 0ral Component Limit(OCL) as stipulated by USP. United State Pharmacopea(USP) stipulated an OCL of 1.5ppm. 1.5ppm, 1ppm, 0.5ppm, and 25ppm for arsenic, mercury, lead, cadmium, and nickel.The results of heavy metal analysis agrees with the results of a similar study by Adepoju et al. (2012) who reported that the results of the heavy metal analysis of some samples of edible red palm oil sold in Lagos, Nigeria fell below the OCL set by USP.

Heavy metals could have access into red palm oil during planting, harvesting, processing, packaging, storage or sale of product (Ohimain, et al; 2012).

The presence of these toxic metals may appear harmless in minute quantities, however their accumulation overtime carries potential health risk to human who regularly consume red palm oil contaminated with toxic metals (Ferner, 2001). Lead is a highly poisonous metal affecting almost every organ and system in the body, mostly the nervous system. Lead has been shown many times to permanently reduce the cognitive capacity of children at extremely low levels of exposure (Golub, 2005). Nickel is relatively non toxic metal, but prolonged exposure results in respiratory tract neoplasia and dermatitis (Chatterjea and Shinde, 2007). Cadmium ion contributes to renal tubular toxicity while accumulating in the cortex of the kidned (Jarup et al., 2000). Acute mercury poisoning occurs in 3 phases. In the first 1–3 days, flu-like symptoms appear, followed by severe pulmonary toxicity and then gingivostomatitis, tremor, memory loss, emotional lability, depression, insomnia, and shyness (Clarkson, 2002) Renal tubule damage is a hallmark of cadmium toxicity and is reflected in increased concentrations of biomarkers such as β2-microglobulin. Glomerular damage may follow with corresponding increased levels of albumin and transferring (Bernard, 2004).

The moisture content of all the samples except sample B were lower than the value reported by Okechalu (2011). Except for sample E, the moisture content of all the samples were higher than the 0.29% limit set by Standard Organization of Nigeria (SON) (2000).High moisture content of palm oil can accelerate rancidity. Pearson (1976) reported that oxidative and ketone rancidity are encouraged and accelerated by heat, light, moisture and traces of certain metals such as iron, nickel, copper.

CONCLUSION

Heavy metal contents of the sample were acceptable when compared with the OCL set by USP. But the moisture contents of about 80% of the samples were on the high side when compared with the guideline set by SON. So consumption of these palm oils may pose little risk to human health in terms of their moisture content considering the fact that high moisture contents encourages rancidity. There is need for regulatory bodies to monitor the quality of these palm oils.

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