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Research article

Assessment of some Heavy Metals Levels in Palm Wine from some Oil-Producing Communities in Rivers State of Nigeria

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Abstract

The levels of some heavy metals such as Cadmium (Cd), Lead (Pb) and Zinc (Zn) in palm wine from two oil-producing communities of Yeghe and Abonchia in Rivers State of Nigeria have been determined using atomic absorption spectrophotometer (AAS). The average cadmium, lead and zinc levels in palm wine from Yeghe were 0.034, 0.135 and 8.067 mg/kg respectively while those from Abonchia were 0.020, 0.412 and 6.682 mg/kg respectively. The corresponding Cadmium, Lead and Zinc levels from the non-oil producing community of Odiemerenyi were 0.0036, 0.017 and 3.648 mg/kg respectively. When the values of these heavy metals are compared with the values from palm wine obtained from the non-oil producing community, there were significant differences which are also higher than the WHO permissible levels for each of these metals. However, the values from the non oil producing community (control) are comparable with the WHO standard.

Key words: Heavy metals, oil palm (Elaeis quineense) palm wine

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INTRODUCTION

There is a slow and silent epidemic of environmental metal poisoning globally from the ever increasing amount of metals being introduced to the biosphere (Alloway, 1990). Pollution by heavy metals occurs largely from industrial, domestic and agricultural wastes as well as from combustion of fossil fuels by automobiles and industries (Duffus, 2002). In many third world countries and Nigeria in particular, domestic wastes and wastes from small

scale industries are deposited in refuse dumps whose composition varies from site to site. Many of the sites contain significant amount of ash which resulted from burning of the dung from time to time. The process of oxidation and corrosion makes the metals soluble and leach into the soil from where they are picked up by growing plants thereby entering the food chain. Also, in the course of oil exploration and exploitation, several oil spillages had occurred in several villages within Rivers State that have resulted in pollution of the rivers, seas and soils by heavy metals such as cadmium, zinc and lead (Agbogidi *et al.,* 2005).

Cadmium remains a source of concern for industrial workers and people living in polluted areas (Setchi and Khandelwal, 2006). By far the most salient toxicological property of cadmium is its exceptional long half life in human body and its ability to disrupt a number of biological systems (Nordberg *et al.,* 2007).

Lead is a highly poisonous metal that affects almost every organ in the body especially the nervous system. High levels of lead exposure may cause miscarriages in women and reduce fertility in men. Though a micro nutrient, high levels of zinc in the body can cause damage to the pancreas and other health problems such as cramp.

Palm wine which is a popular traditional alcoholic beverage is a sweet effervescent drink consumed by over ten million people in West Africa (FAD, 1998). It is obtained from the sap of the oil palm *Elaeis quineense* and raphia palm by tapping the top of the trunk. It is a rich nutrient medium containing sugar, proteins, amino acids, alcohols and minerals (Ezeagu and Fafunso, 2003). It also contains a dense population of yeasts (Basir and Maduagwu, 1978) and since there is no additive (Obire, 2005), Doctors and Optometrists recommend it for patients with eye problems. When palm wine is allowed to stand, fermentation takes place, the sugar is converted to ethanol and subsequently to ethanoic acid resulting in loss of sweetness, short shelf life and decreased acceptability. Since palm wine is a popular drink in Rivers State, it becomes expedient to determine the levels of these heavy metals above in palm wine obtained from oil palm (*Elaeis quineense*) with a view to comparing with the values given by the World Health Organization (WHO) and ascertaining their safety and suitability for consumption.

Materials and methods

Site selection

Palm wine samples from oil palm *Elaeis quineense* were collected from three different communities in Yeghe, Abonchia and Odiemerenyi. The first two communities which are 15km away from each other are oil producing while the third is a non oil producing community and located about 12km from Abonchia. Samples were collected from their locations of about 100 metres distance in each community.

Methodology

Palm wine samples were collected with 150ml sterile bottles from different locations in two oil producing communities of Yeghe and Abonchia. A third sample was also taken from different locations in a non-oil producing community Odiemerenyi as a control.

20ml portion of each fresh sample collected was put into a 100ml conical flask and 10ml of conc. $HN0_3$ was added and heated on a heating mantle to digest in a fume cupboard until the volume reduced to about 10ml. On cooling, 15ml of distilled water was added to make it up to 25ml and then filtered using Whatman No. 1 filter paper. The filtrate was submitted for analysis of Cd, Zn and Pb using Atomic Absorption Spectrophotometer (AAS).

Result

Table 1: Concentration of Cd, Pb and Zn at different locations

Community	S/N	Location	Mean Cd * Conc. mg/kg	Mean Pb * Conc. mg/kg	Mean Zn * Conc. mg/kg
Yeghe Oil producing	1. 2. 3.	Era Legbara Gio Gbomu Zormene	0.041 0.022 0.039	0.202 0.073 0.132	8.280 7.602 8.322
Abonchia Oil producing	1. 2. 3.	Keewin Osa Dump Beach Bee	0.015 0.015 0.030	0.335 0.492 0.411	6.588 6.349 7.109
Odiemerenyi non-oil producing	1. 2. 3.	Beach A Beach B Beach C	0.004 0.003 0.0038	0.018 0.019 0.016	3.800 3.612 3.531

* Mean values are taken from 3 sets for each location

Discussions

The two communities under consideration and both oil producing which have attracted allied small and medium sized industries to the communities. The third community is non oil producing and served as a control. Conscious of the health hazards and the implications of high levels of these heavy metals to the ecosystem, the World Health Organization (WHO) established acceptable standards that are allowable for each of these heavy metals.

Examination of the results in table 1 shows that the cadmium levels in palm wine from Yeghe community were significantly higher in all three locations i.e. 0.041, 0.022 and 0.039 mg/kg than the three locations in Odiemerenyi the control community where the values were 0.004, 0.003 and 0.0038 mg/kg. Similarly, the cadmium level in palm wine from Abonchia community were also higher in all three locations i.e. 0.015, 0.015 and 0.300 mg/kg than the control community Odiemerenyi.

The average cadmium level of the three locations in Yeghe was 0.034 mg/kg and that of Abonchia was 0.020 mg/kg while the average value in the control Odiemerenyi was 0.0036 mg/kg. Comparison of these values indicates that the cadmium levels in Yeghe and Abonchia communities were higher by 0.034 and 0,0164 mg/kg respectively than the control Odiemerenyi which was 0.036 mg/kg The World Health Organization (WHO) permissible limit for cadmium is 0.003 mg/kg (WHO, 2006). This implies that the cadmium levels in palm wine from Yeghe and Abonchia were higher than the limit allowed by WHO.

The lead levels in palm wine from Yeghe in the three locations were 0.202, 0.073 and 0.132 mg/kg which gave an average of 0.135 mg/kg. The corresponding levels in Abonchia were 0.335, 0.492 and 0.411 mg/kg with an average of 0.412 mg/kg. These levels were much higher than the values obtained from the control community Odiemerenyi which were 0.018, 0.019 and 0.016 mg/kg and averaged 0.017 mg/kg. The permissible lead limit by (WHO) is 0.010 mg/kg which means that palm wine from both Yeghe and Abonchia communities contain lead in excess of the permissible limit by 0.125 and 0.402 mg.kg respectively.

The last heavy metal zinc gave high values of 8.280, 7.602 and 8.322 mg/kg with an average of 8.067 at the three locations in Yeghe and 6.588, 6,349 and 7.109 mg/kg with an average of 6.682 mg/kg in Abonchia. The control community Odiemerenyi had values of 3.800, 3.612 and 3.531 mg/kg with an average of 3.648 mg/kg at the three locations. Again, a comparison of the average value of 8.067 mg/kg from Yeghe and 6.682 mg/kg from Abonchia with the (WHO) standard of 3-5 mg/kg shows an obvious high level of zinc in palm wine from Yeghe and Abonchia by about 5.067 and 3.682 mg/kg respectively.

The control community with an average of 3.648mg/kg is comparable with the WHO standard of 3-5 mg/kg. From the results above, the levels of these three heavy metals cadmium, lead and zinc in palm wine from the two oil producing communities of Yeghe and Abonchia were appreciably higher than the levels in the control community. This may be a consequence of oil spillage that had occurred and other anthropogenic activities associated with allied industries (Klaassen, 2001) around those areas. The high cadmium and lead levels should be a concern since these metals are very toxic and hazardous to health. While cadmium is known as one of the carcinogenic heavy metals, records show that lead toxicity leads to kidney and brain damage and also recognized as potential enzyme inhibitor in man and animal biochemical system.

Conclusion

The results of the levels of heavy metals present in palm wine from oil palm in the two oil producing communities of Rivers State are overwhelmingly higher than the control community. Since palm wine is a common and popular alcoholic drink. Many people from these communities stand the risk of the hazards associated with bioaccumulation of these heavy metals.

Recommendation

As all the six locations in the two oil producing communities show similar trend in their heavy metal levels, we can without fear of equivocation recommend that caution should be applied in the consumption of palm wine especially from oil producing areas.

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