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DETERMINATION OF TRACE METALS IN *Moringa oleifera* (DRUMSTICK) IN KAZAURE TOWNSHIP, JIGAWA STATE OF NIGERIA

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ABSTRACT
The levels of trace metals were determined in the *Moringa oleifera* (drumstick). The leave, bark and root part samples of *Moringa oleifera*, located in Kazaure local government area of Jigawa state, Nigeria were analyzed for trace metals using atomic absorption spectrophotometer(AAS). Generally, the plant accumulate metals in the order Fe > Pb > Cr > Cd. The root samples concentrated the highest level of all the metals. The result revealed the accumulated amount of trace metals in leave sample as 0.053mg/kg(Cr), 0.160mg/kg(Pb), 0.573mg/kg(Fe) and 0.035mg/kg(Cd), in the bark sample as 0.199mg/kg(Cr), 0.293mg/kg(Pb), 3.244mg/kg(Fe) and 0.187mg/kg(Cd) and in the root sample as 0.355mg/kg(Cr), 0.393mg/kg(Pb), 10.374mg/kg(Fe) and 0.259mg/kg(Cd). The range of metal concentration determined in *Moringa oleifera* as a whole is Cr (0.05 – 0.35mg/kg), Pb (0.16 – 0.39 mg/kg), Fe (0.57 – 10.37 mg/kg), and Cd (0.04 – 0.26 mg/kg). The relative high concentration of the lead over chromium is attributable to vehicular emission experienced in the studied area. Levels of metals in the *Moringa oleifera* sample were generally below the WHO and FAO maximum permissive limits. The values so detected in this study are within safe levels, hence the consumption of *Moringa oleifera* amidst the inhabitant of Kazaure poses no immediate health hazards.

INTRODUCTION
The harmful effect of trace metals has been, for many decades, a global challenge. Historical cases of catastrophic and endemic exposures of heavy metals abound in literature. The concentrations of heavy metals in continental waters are controlled by atmospheric precipitations and the weathering process on soils and bed rocks (Nwadozie, 1998). During the last two centuries, heavy metals released by human activities have superimposed new patterns of metal distribution on those occurring naturally (Chou et al 2000). As a result of increasing anthropogenic activities, the heavy metal pollution of soil, water and atmosphere represents a growing environmental problem affecting food quality and human health (Anwar et al 1998). Heavy metals may enter the food chain as a result of the up take by edible plants, thus the determination of heavy metals in environmental sample is very important (Booth et al 1988). The interaction between metals and solid phase of soil water and air within and above soil depends on a variety of chemical factors and determination of the heavy metal transport and fate absorption of metals from soil determinant that limits mobility in soils (Kadashi 2008). Heavy metals from soil enter plants primarily through the roots system. In general, plant root are the most important site for uptake of chemicals from soil (Bhauger et al 2003). According to Alloway et al (1993), uncontrolled incineration can lead to anomalous high concentrations of Pb and Cd in agricultural soils. Although heavy metals can

be immobilized in the soil, they are not biodegradable and thereby undergo ecological cycle within the food web (Nurnbeg 1984). There is a growing amount of evidence indicating accelerated transport of metals in soils amended with biosolids (Al Wabel et al 2002). Many trace metals especially Cd, Cu, Pb, Sn and Zn are dispersed in the soil in leachate from both surface waste dumps and land fills (Udom et al 2004). The present study assesses the level of trace metals lead, chromium, iron, and cadmium accumulation in root, leaves and bark of Drum stick (*Moringa oleifera)*, in Kazaure Local Government area of Jigawa state, of Nigeria in to establish their safety for human consumption.

MATERIALS AND METHODS

Sample collection and treatment

The samples of *Moringa oleifera* leaves, bark and root were randomly collected from a farmyard in Kazaure township. The representative samples were air dried in the laboratory, and then placed in an oven to complete the drying at a temperature of about 150^0C. The dried samples were crushed into powdered form and sieved to obtain finest powder. One gram of finely grounded sample was accurately weighed into a pure clean crucible. The samples were ashed in a furnace at a temperature of about 500^0C for ten minutes. 10mls of concentrated HCl and HNO_3 in ratio 1:1 was added to each ashed sample, in a beaker. The beaker was placed on a hot plate to warm for 45 minutes for complete digestion. The digested sample were filtered into separate volumetric flask of $100cm^3$ capacity and made up to the mark using distilled water. The various flasks were labeled leaves, bark and root, and kept aside for instrumental analysis. The digests were analyzed using the Buck model 210VGP flame Atomic Absorption Spectrophotometer. The instrument was calibrated with analytical grade standard metal solutions. Blanks were also determined to ascertain the contribution of reagents to metal levels. Instrument calibration and blank determination were carried out at intervals of two samples.

RESULTS

Table 1: Mean concentrations (mg/kg) of trace metals in the various parts of *Moringa oleifera*

Metals samples	Cr (mg/kg)	Pb (mg/kg)	Fe (mg/kg)	Cd (mg/kg)
Leave sample	0.053 ±0.02	0.160 ±0.02	0.573 ± 0.20	0.035 ±0.01
Bark sample	0.199 ±0.05	0.293 ±0.24	3.244 ± 1.00	0.187 ± 0.03
Root sample	0.355 ± 0.10	0.393 ± 0.05	10.374 ± 2.50	0.259 ± 0.03

Table 2: Range of trace metals in the whole plant, *Moringa oleifera* compared with maximum permissive limits.

Metals	Cr	Pb	Fe	Cd
Whole plant	0.05 – 0.35	0.16 – 0.39	0.57-10.37	0.04 – 0.26
FAO Max. Limits	2.5	0.5	450	0.5
WHO max limits	2.3	1.5	425	0.2

NS means not stated**.**

DISCUSSION

Table 1 shows the mean concentrations of trace metals in mg/kg in various samples parts of *Moringa oleifera.* The order of trace metal burden in the leave sample is Fe> Pb>Cr>Cd, while that of bark sample and root sample follows the same trend, as shown in Table 1. The root samples concentrated more of the trace metals than leaves and bark samples. This may be due to the closeness of the root to the soil. The increased concentration of lead may be attributable to the vehicular emission due to the heavy trafficking of vehicles in the vicinity of the sampled area. According to Fowotade (2005), similar trend in the burden of heavy metals was reported in the leaves and bark of neem tree, (*Azadirachta indica*), in Katsina Metropolis. Concentration of metals reported in water leaf (*Talinum triangulare*), Cd 0.003 mg/kg, Cr, 0.050 mg/kg and Pb 0.206 mg/kg also corroborates the result in the present study (Oti et al 2011). Table 2 shows the trace metal burden in the entire *Moringa oleifera* plant. These compared to the FAO and WHO standard shows that the limit reported in this study is below the level that can be hazardous to the consumers of the plant.

CONCLUSION

The results obtained in this study show that trace metals burdens in the leaves, bark and root of drumstick, *Moringa oleifera* samples were generally below the WHO and FAO permissive level and hence pose no consumption risk, to the inhabitant and animals of kazaure. However continuous monitoring of the study area by environmental protection agencies at federal and state level is recommended.

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