Available online at http://www.journalijdr.com

IJDR

ISSN: 2230-9926

International Journal of Development Research
Vol. 08, Issue, 10, pp. 23780-23783, October, 2018

ORIGINAL RESEARCH ARTICLE

OPEN ACCESS

EVALUATION OF THE HEAVY METAL CONTENT OF UGU LEAF (*TELFARIA OCCIDENTALIS*) COLLECTED FROM EKE OKIGWE MARKET, IMO STATE, NIGERIA

[1]Amah A.K., *[2]Ogbodo, E.C., [3]Timothy, C.O., [3]Iheukwumere, C.B., [3]Mbanaso, E.L., [3]Akunneh-Wariso, C.C., [1]Ejiofor, D.C., [4]Amaechi, I.P., [5]Njoku, C.M. and [3]Okhiai, O.

[1]Department of Human Physiology, College of Medicine, Imo State University, Owerri, Nigeria
[2]Department of Medical Laboratory Science, Faculty of Health Sciences, Nnamdi Azikiwe University, Nnewi, Nigeria
[3]Department of Human Physiology, College of Medicine, Abia State University, Uturu, Nigeria
[4]Department of Science Laboratory Technology, College of Health and Management Technology, Aba, Nigeria
[5]Department of Chemical Pathology, Faculty of Medicine, Nnamdi Azikiwe University, Nnewi, Nigeria

ARTICLE INFO

Article History:

Received 08th July, 2018
Received in revised form
15th August, 2018
Accepted 06th September, 2018
Published online 30th October, 2018

Key Words:

Heavy metals, *Telfaria occidentalis,*
Ugu, Atomic Absorption Spectrophotometer, WHO, Eke Okigwe Market, Nigeria.

ABSTRACT

This study evaluated the heavy metal content of ugu leaf (*Telfaria occidentalis*) collected from Eke Okigwe Market in Imo State, South Eastern Nigeria. The heavy metals including Mercury (Hg), Cadmium (Cd), Manganese (Mn) and Lead (Pb) were analyzed using Atomic Absorption Spectrophotometer (AAS). The results revealed a significantly higher concentrations of Hg, Cd and Mn in *T. occidentalis* leaf beyond the World Health Organization (WHO) allowable limits of 0.001, 0.003 and 0.1435 mg/100g for Hg, Cd and Mn respectively ($P<0.05$). However, lead was not detected in the vegetable. The nutritional implication of these high levels of Mercury, cadmium as well as manganese in this vegetable is that consumers may be prone to heavy metals toxicity as a result of regular consumption. Hence, adequate care should be taken in the consumption of this vegetable so as to avoid bioaccumulation of these heavy metals and subsequently, its deleterious effects.

Citation: Amah A.K., Ogbodo, E.C., Timothy, C.O., Iheukwumere *et al.* 2018. “Evaluation of the heavy metal content of ugu leaf (telfaria occidentalis) collected fromeke okigwe market, Imo State, Nigeria”, *International Journal of Development Research*, 8, (10), 23780-23783.

INTRODUCTION

Heavy metals are natural components of the earth’s crust and they can enter the food cycles through a variety of chemical and geochemical processes (Tinsley, 1979). Heavy metals refer to the inorganic element mostly metals which may be present in food usually in amount well below 50mg/day and have some toxicological or nutritional value or significance. Leafy vegetables are widely used for culinary purposes; they are used to increase the quality of soups and also for their dietary purposes (Sobukola *et al*., 2007).They are very important protective food and useful for the maintenance of health, prevention and treatment of various diseases (D’mello, 2003). However, these vegetables contain both essential and toxic (heavy) metals over a wide range of concentration (Radwan and Salama, 2006) because they may be contaminated with heavy metals due to the environment where they are growing (Duffus, 2002).

***Corresponding author:** *Ogbodo, E.C.,*
Department of Medical Laboratory Science, Faculty of Health Sciences, Nnamdi Azikiwe University, Nnewi, Nigeria

From the point of food analysis, heavy metal content of leafy vegetable sample is the concentration of heavy metals that are contained in leafy vegetables. These leafy vegetables are consumable and the continuous intake of them may imply continuous intake of some heavy metals that are contained in them. *Telfaira occidentalis* is one of such leafy vegetables of great importance. *Telfaira occidentalis* belongs to the family of Curcubitaceae with botanical name known as *Telfairia occidentalis* (Odiaka and Odiaka, 2011) and It is commonly known as Ugu in Igbo, iroko or aporoko in Yoruba, ubong in Efik/Ibibio, mfang ubre in Oron, umee in Urhobo, and umeke in Edo (Kayode and Kayode, 2011). It occurs in the forest zone of west and central Africa, mostly in Benin, Nigeria and Cameroon and is believed to have originated in south-east Nigeria and was distributed by the Igbos who had cultivated it for centuries (Dike, 2010; Kayode and Kayode, 2011).It is widely cultivated because of its palatable and nutritious leaves which are used mainly as vegetables. Because of its affordability, availability and the mineral elements it contains, it has become a popular vegetable consumed more than other vegetables in the population diet (Nwosu *et al*., 2012). *Telfaira* *occidentalis* leaf have been reported to contain minerals such as iron, potassium, sodium, phosphorus, calcium and magnesium as well as antioxidants vitamins such as thiamine, riboflavin and ascorbic acid and phytochemicals like phenols (Fasuyi, 2006; Kayoede *et al*., 2009). *Telfaria occidentalis* leaves has hypolipidemic effect and may be useful in hypercholestolemia (Eseyin *et al.,* 2005), antidiabetic effect (Aderibigbe *et al*., 1999; Eseyin *et al*., 2010), hepatoprotective effect (Oboh *et al*., 2006) and has the potential to regenerate testicular damage and also increases spermatogenesis (Nwangwa *et al*., 2007). It possess antioxidant properties (Yang *et al*., 2002; Oboh *et al*., 2004; Nwanna and Oboh, 2007) and has been found to protect and ameliorate oxidative brain and liver damage induced by malnutrition in rats (Kayode *et al*., 2010). It has also been reported to boots blood level and beat diabetes (Alade, 2000). However, the bioaccumulation of heavy metals in this vegetable may result in the formation of heavy metals overload which predisposes the consumers to potential hazardous effects regardless of the natural healing function of the body no matter how many good health supplements one takes (Lane*et al*., 2005). Therefore, this study evaluated the heavy metal content of ugu leaf (*Telfaria occidentalis*) collected from Eke Okigwe Market in Imo State, South Eastern Nigeria.

MATERIALS AND METHODS

Study area and sample collection: The samples of *Telfaria occidentalis* were randomly collected from Eke Okigwe Market, Imo State, Nigeria.

Pre-treatment of samples: The collected vegetable samples were washed thrice with distilled water to remove dust particles. Thereafter, the leaves were dried and ground into a fine powder and stored in polyethylene bags, until used for acid digestion.

Sample preparation: 1g of each sample was weighed into a 50ml of hydrogen perioxide (H_2O_2) and 5ml of perchloric acid ($HClO_4$). The entire content was heated in an oven at a temperature of 95 degree centigrade until a clear solution was observed in the beaker. Thereafter, the digest was filtered with What man No. 42filter paper into a 250ml volumetric flask. Two 5ml portions of distilled water were used to rinse the beaker and content filtered into a 250ml volumetric flask. The filtrate was allowed to cool to room temperature before dilution was made to 250ml mark with distilled water. The digest was analyzed for Hg (mercury), Cd (cadmium), Mn (manganese) and Pb (lead) on buck scientific 210vgp atomic absorption spectrophotometer.

Sample analysis: The atomic absorption spectrophotometric (ASS) method was used for the analysis. Buck scientific 210vgp atomic absorption spectrophotometer was used for the quantification of metal ions. The instrument was set up according to the manufacturer's instruction and allowed to equilibrate for about 15 minutes. It was then flushed to zero readings with distilled water, depending on the element being ionized for, the appropriate hollow cathode lamp was put in place and monochrometer was adjusted at the appropriate wavelength. The standard solutions of the test element were first aspirated into the instrument and thereafter, their respective absorbances were recorded. The readings were aspirated into the instrument one after the other; three consecutive times and their absorbance were recorded. The respective composition of samples with respect to the test element was calculated with the formulae while statistical method employed was the student t-test.

$$Emg/100g = 100/W \times N/10^3 \times D$$

W = Weight of the sample used; M = concentration in ppm derived from standard curve, E = the test element and D = dilution factor.

RESULTS

The heavy metal contents of leafy vegetable, *Telfaria occidentalis* (ugu) is shown in the table 1. *Telfaria occidentalis* has higher level of manganese, 1.525±0.002 mg/100g and a very lower level of mercury, 0.0055±0.001 mg/100g compared to other heavy metals. It was observed that compared with WHO allowable concentration limits of 0.001 mg/100g, 0.003 mg/100g, and 0.1435 mg/100g for mercury, cadmium and manganese respectively (WHO, 1996), the concentrations of mercury, 0.0055±0.001 mg/100g, cadmium, 0.0075±0.001 and manganese, 1.525±0.002 mg/100g detected in the sample was significantly higher ($p<0.05$). However, lead was not detected in the vegetable.

Table 1. Heavy metal content of *T. occidentalis*(mg/100g)

Metals	Mean ±SD
Mercury	0.0055±0.001
Cadmium	0.0075±0.001
Manganese	1.525±0.002
Lead	---------------

*Values are triplicate determinations; ----- = NOT detected; $p<0.05$ is statistically significant.

DISCUSSION

In this study, the mean concentration of mercury detected in the *T. occidentalis* leaf sample was significantly higher compared with WHO allowable concentration limit (WHO, 1996). This finding suggest that consumers of *T. occidentalis* may be latently exposed to mercury toxicity, resulting from mercury contamination of the environment (Rao and Purohit, 2011) due to indiscriminate disposal of industrial effluents (Gowd *et al*., 2010). This may lead to damage to and alteration of the function of the bio-membranes, ultimately resulting in the development of different pathological processes (Bharathi *et al.,* 2012). Also, mercury causes permanent damage to the kidneys (ATSDR, 1999) and manifests its central nervous system toxicity by generating high levels of reactive oxygen species (ROS) and oxidative stress (ATSDR, 1999; Xu *et al*., 2012; Vanithasri and Jagadeesan, 2013), thus altering the functions of the brain (Rao and Purohit, 2011) and this is of immense importance especially in children who consume this leaf vegetable. The present study revealed a significantly increased mean concentration of cadmium in the *T. occidentalis* sample in comparison with WHO allowable concentration limit. This may imply that consumers of *Telfaria occidentalis* might be exposed to cadmium toxicity because cadmium can accumulate in the body thereby affecting various enzymes (Manahan, 2003) and resulting in a number of deleterious outcomes including lungs and prostate cancer, metal fume fever and renal dysfunction (Jarup, 1998). This finding is in contrast with previous similar studies which had earlier reported none detectable level of cadmium in *T.*

occidentalis (Ikhajiagbe *et al*., 2013; Oladebeye, 2017). This disparity may be attributed to the difference in the prevailing environmental conditions in which the studies were conducted. Furthermore, the detected concentration of manganese (1.525±0.002 mg/100g) in *T. occidentalis* sample was significantly higher than WHO permissible level. This implies that consumers of *T. occidentalis* may be prone to the bioaccumulation of manganese. Over exposure to manganese leads to oxidative stress and causes hazardous effects on the lungs and brains (Jarup, 2003; Bouchard *et al.,* 2010). This is in consonance with the finding of Oladebeye, (2017) who recorded a value of between 793.33-1635.37 mg/kg in their previous study. However, in this present study, lead was not detected in *T. occidentalis* leaf. This implies that the mean concentration of lead present in the vegetable is within permissible limit and hence consumers of the vegetable may not be exposed to lead poisoning. Our finding is in keeping with previous similar studies (Ladipo and Doherty, 2011; Doherty *et al*., 2012; Oladebeye, 2017).

Conclusion

In this study, heavy metals such Mercury, cadmium and manganese were detected in *T. occidentalis* leaf beyond the World Health Organization permissible limits while lead was not detected in the vegetable. The nutritional implication of these high levels of Mercury, cadmium as well as manganese in this vegetable is that consumers may be prone to heavy metals toxicity as a result of regular consumption. Hence, adequate care should be taken in the consumption of this vegetable so as to avoid bioaccumulation of these heavy metals and subsequently, its deleterious effects.

REFERENCES

Aderibigbe, A., Lawal, B., Oluwagbemi, J. 1999. The antihyperglycaemic effect of *Telfairia occidentalis* in mice. *African Journal of Medicine and Medical Sciences*; 28: 115-171.

Agency for Toxic Substances and Disease Registry (ASTDR). Public Health Statement: Strontium. Retrieved September, 2018.

Alada, A.R.A. 2000. The hematological effects of *Telfaria occidentalis* diet preparation. *African Journal of Biomedical Research*; 3:185-186.

Bharathi, E., Jagadeesan, G., Manivasagam, T. 2012. Influence of s-allyl cysteine against mercuric chloride induced nephrotoxicity in albino rats. *Journal of Chemistry and Pharmaceutical Research*; 4(3):1470-1474.

Bouchard, M., Sebastian, S., Benoit, B., Melissa, L., Marie-Eve, B., Therese, B., Elyse, L., David, C.B., Donna, M. 2010. Intellectual impairment in school age children. *Environmental Health Perspectives*; 119(1):138-143.

D' Mellon, J.P.F. 2003. Food safety, contamination and toxins. CABI Publishing, Wallingford, Oxon, UK, Cambridge, M.A. Pp. 480.

Dike, M.C. 2010. Proximate, phytochemical and nutrient compositions of some fruits, seeds and leaves of some plant species at Umudike, Nigeria. *Journal of Agriculture and Biological Science*; 5: 7-16.

Doherty, V. F., Sogbanmu, T. O., Kanife, U. C., Wright, O. 2012. Heavy metals in vegetables collected from selected farm and market sites in Lagos, Nigeria. *Global Advanced Research Journal of Environmental Science and Toxicology*; 1(6):137-142.

Duffus, J.H. 2002. Heavy metals, a meaningless term. *Pure and Applied Chemistry*; 741(5):793-803.

Eseyin OA, Ebong P, Eyong EU, Umoh E, Agboke H. 2010. Hypoglycaemic activity of ethyl acetate fraction of the leaf extract of Telfairia occidentalis. *Turkish Journal of Pharmaceutical Science*; 23(3): 341-343.

Eseyin, O.A., Ebong, P., Eyong, U.E., Umoh, E., Attih, E. 2010. Comparative hypoglycaemic effects of ethanolic and aqueous extracts of the leaf and seed of *Telfairia occidentalis*. *Turkish Journal of Pharmaceutical Science*; 7 (1): 29-34.

Eseyin, O.A., Igboasoiyi, A.C., Oforah, E., Mbagwutt, Umoh, E., Ekpe, J.F. 2005. Studies of the effects of alcohol extract of *Telfaria occidentalis* on alloxan-induced diabetic rats. Global *Journal of Pure and Applied Science*; 11:85-87.

Fasuyi, A.O. 2006. Nutritional potentials of some tropical vegetable leaf meals: chemical characterization and functional properties. *African Journal of Biotechnology*; 5:49-53.

Gowd, S.S., Reddy, M.R.M., Govil, P.K. 2010. Assessment of heavy metal contamination in soil at Jajmau (Kanpur) and Unnao Industrial areas of the Ganga plain, Uttar Pradesh, India. *Journal of Hazardous materials*;174:113-121.

Goyer, R.A. 1995. Nutrition and metal toxicity. *American Journal of Clinical Nutrition*; 61:32-40.

Ikhajiagbe, B., Odigie, U.E., Oghogho, J.I., Omoregbee, O. 2013. Heavy metal contents and microbial flora of fresh leaves of fluted pumpkin (*Telfaira occidentalis*), collected from road-side open markets in Benin Metropolis, Midwestern, Nigeria. *International Journal of Biotechnology*; 2 (2): 52 – 58.

Jarup, L. 1998. Health effects of cadmium exposure: a review of the literature and a risk estimate. *Scandinavian Journal of Work, Environment and Health;* 24:11-51.

Jarup, L. 2003. Hazards of heavy metal contamination. *British Medical Bulletin*; 68: 167–182.

Kayode, A.A., Kayode, O.T. 2011. Some medicinal values of *Telfairia occidentalis*: A review. *American Journal of Biochemistryand Molecular Biology*; 1:30 – 38.

Kayode, A.A.A., Kayode, O.T., Odetoh, A.A. 2010. *Telfaria occidentalis* ameliorates oxidative brain damage in malnourished rats. *International Journal of Biology and Chemistry*; 4:10-18.

Kayode, O.T., Kayode, A.A., Odetola, A.A. 2009. Therapeutic effect of *Telfairia occidentalis* ameliorates oxidative brain damage in malnourished rats. *International Journal of Biology and Chemistry*; 4: 10-18.

Ladipo, M.K., Doherty, V.F. 2011. Heavy metal levels in vegetables from selected markets in Lagos, Nigeria. *African Journal of Food Science and Technology*; Pp. 018-021.

Lane, T.W., Sacto, M.A., George, G.N., Pickering, I.J., Prince, R.C., Morel, F.M. 2005. Biochemistry: a cadmium enzymes from marine diations. *Nature*; 435(70):38-42.

Manahan, S.E. 2003. Toxicological Chemistry and Biochemistry, CRC Press, Limited Liability Company (LLC), 3rd edition.

Nwangwa, E.K., Mordi, J., Ebuye, O.A., Ojieh, A.E. 2007. Testicular regenerative effects induced by the extracts of Telfaria occidentalis in rats. *Caderno de Pesquisa Serie Biologia*; 19:27-35.

Nwanna, E.E., Oboh, G. 2007. Antioxidant and hepatoprotective properties of polyphenol extracts from *Telfaria occidentalis* (Fluted pumpkin) leaves on acetaminophen induced liver damage. *Pakistan Journal of Biological Science*; 10:2682-2687.

Nwosu, C.S., Onyeneke, R.U., Okoli, V.B. 2012. Socioeconomic determinant of fluted pumpkin leaf (*Telfairia occidentalis*) production in Ezinihitte Mbaise LGA of Imo State, Nigeria. *Agriculture Research Journal*; 6:355 – 361.

Oboh, G. 2006. Tropical green leafy vegetables prevent garlic induced hepatotoxicity in the rat. *Journal of Medicinal food*; 9(4): 545-551.

Oboh, G., Akindahunsi, A.A. 2004. Change in the ascorbic acid, total phenol and antioxidant activity of sun-dried commonly consumed green leafy vegetables in Nigeria. *Nutrition and Health*; 18:29-36.

Odiaka, N. I., Odiaka, E. C. 2011. Gold mine in indigenous vegetables: The case of fluted pumpkin (*Telfairia occidentalis* Hook. F.) for economic growth. *Acta Horticuturae*; 911:279–284.

Oladebeye, A.O. 2017. Assessment of Heavy Metals In Nigerian Vegetables and Soils in Owo and Edo Axes Using X-Ray Fluorescence (Xrf) Technique. A research project submitted to the Department of Chemical Sciences, College of Natural and Applied Sciences, Achievers University, Owo, Ondo State in partial fulfilment of the requirements for the award of Bachelor of Science (B.Sc Honours) in Industrial Chemistry.

Radwan, M.A., Salama, A.K. 2006. Market basket survey for some heavy metals in Egyptian fruits and vegetables food. *Chemistry and Toxicology*; 44:1273-1278.

Rao, M., Purohit, A. 2011. Neuroprotection by Melatonin on Mercury Induced Toxicity in the Rat Brain. *Pharmacology and Pharmacy*; 2: 375-385.

Sobukola, O.P., Dairo, O.U., Sanni, L.O., Odunewu, A.L., Fafiolu, B.O. 2007. Thin layer drying process of some leafy vegetables under open sun. *Food Science and Technology Intervention*; 13(1):35-40.

Tinsley, I.J. 1979. Chemical concepts of pollutants behavior J. Willey and Sons Inc. NY. Pp. 8.

Vanithasri, V., Jagadeesan, G. 2013. Comparative beneficial effect of n-acetylcysteine and gallic acid on antioxidant and acetyl choline status of mercury intoxicated rats. *International Journal of Phytopharmacology*; 4(5):293-300.

WHO 1996. Guideline for food and drinking water quality, health criteria and other supporting information. 2nd Edition, WHO Geneva. Pp. 217.

Xu, F., Farkas, S., Kortbeek, S., Zhang, F.X., Chen, L., Zamponi, G.W., Syed, N.I. 2012. Mercury-induced toxicity of rat cortical neurons is mediated through N-methyl-D Aspartate receptors. *Molecular Brain*; 5: 30.

Yang, J.H., Lin, H.C., May, J.L. 2002. Antioxidant properties of several commercial mushrooms. *Food Chemistry*; 77:229-235.

****