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ESTIMATION OF VANADIUM IN SELECTED LEAVES FROM AKURE, NIGERIA BY ATOMIC ABSORPTION SPECTROPHOTOMETRY.

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ABSTRACT
Estimation of the levels of vanadium in selected leaves from Akure, Nigeria was performed by atomic absorption spectrophotometry after dry ashing the samples. The highest mean level (9.92mgkg-1) of vanadium was recoded in *Coloaxia esculentum*, 1.24mgkg-1 was recorded for *Tectona grandis, mangifera indica, Aealypha ciliata, Discorea rotundata and Vernomia amygdaline*, while ND was recorded for *Manihot palmate* and *Psidium guajava*. The results showed that there were variations (CV = 54.17%) in the levels of vanadium in all the leaves analyzed and the levels were high compared to WHO commendations for some foods (mollusks, crustaceans, fish and mammals). Efforts to reduce eating high levels of it in leaves should be ensured by using different processing methods before consumption by animals and humans.

KEYWORDS: Vanadium, leaves, WHO standard, exposure, processing methods

INTRODUCTION

The nutrient amounts of leafy vegetables vary a great deal, depending on the type of plant and growing conditions. This variability must be fully appreciated and recoveries wherever the relative merits of one vegetable over another are considered. Leaves are for different purposes namely as food source, add colour, flavour, moisture and different textures to food, used as wrappers for other foods, useful in food preparations and storage, food processing in a medicine and as protein source and preserved food supply (Bailey 1992). Leaves supply vitamins, especially vitamin A, B, C & E and some minerals.

Minerals are essential nutrients to both man and animals. They are major constituents of body thirds, and tissues and serves as electrolytes concerned with the maintanance of osmotic pressure, acid-base balance membrane permeability, muscle irritability and oxygen transport. They are found in enzymes and hormone systems, forming the integral and specific components of metalloenzymes on less specific activator of these enzymes (Reddy and Love 1999). Minerals are divided as essential and non-essential minerals (Anhwange *et al* 2005), out of the non-essential mineral is vanadium.

A normal diet typically provides about 10-30 micrograms of vanadium per day. Although there is currently no RDA established, this amount appears to be adequate for must healthy adults. Vanadium is thought to play a role in metabolism of carbohydrates and may have functions in cholesterol and blood lipid metabolism (Goldfine *et al* 2000). Vanadium is not contained in many multi-vitamin/mineral supplements. It is though, however, that man obtains enough vanadium from this diets. For those individuals concerned with maintaining blood glucose levels-such as diabetics or people with hypoglycemia (low blood sugar) a vanadium supplement may be beneficial some body building and diabetic dietary supplements contain vanadium at milligrams levels-when dietary needs are likely to be only in microgram amounts (1000times lower)(Clarkson and Rawson, 1999).

Bioaccumulation of vanadium by animals, plants and human hair, soil, natural water, fish, foods and sediments have been determined and reported by different authors (Hairland and Harden-Williams (1994), Martin and Saco (1995), Minelli *et al* (2000), Tham *et al* (2001), Beg *et al*, (2001), Al-saleh

and Shinwari (2002), Poledniok and Buhl (2003), Michibata *et al* (2003) and Awofolu (2004). In realization of the beneficial effect of this element in human nutrition, this study reports the levels in selected leaf samples obtained in Akure, Nigeria. It is hoped that this study would contribute to nutrition data.

Table 1: common names, local names and botanical names of samples analyzed

S/N	Common Names	Local Names (Y)	Botanical Names
1	Teak	-	*Tectona grandis*
2	Lemon	-	*Citrus limon*
3	Mango	Mangoro	*Mangifera indica*
4	Copper leaf	-	*Acalypha ciliata*
5	False vervain	-	*Stachytarpheta cayennesis*
6	Cotton	Owu	*Gossypium hirsitum*
7	Plum	-	*Spondia mombin*
8	Plantain	Ogede agbagba	Musa paradiaca
9	Water leaf	-	*Talinum triangulare*
10	Pawpaw	Ibepe	*Carica papaya*
11	Ocimum	-	*Ocimum gratissimum*
12	Fluted pumpkin	Ugwu(I)	*Telfaira occidentalis*
13	Drum stick	-	*Moringa oligofera*
14	Grape	Osan	*Citrus paradis*
15	Yam (white)	Isu funfun	*Dioscorea rotuodata*
16	Sweet cassava	Ege	*Manihot palmats*
17	Bitter leaf	Ewuro	*Vernonia amygdalina*
18	Guava	-	*Psidium guajava*
19	Cocoyam	Koko	*Colocaxiz escutenta*
20	Sand paper	-	*Ficus exasperata*
21	Neam	Dongoyaro	*Azadirachta indica*
22	Pepper	Atarodo	*Capsicum annum* ‘
23	Coconut	Agbon	*Coco nucifera*
24	Asprillia	-	*Asprillia africana*
25	Palm tree	Ope	*Elaeis guineensis*
26	Lime	Osan were	*Citrus autifolia*
27	Cowpea	Ewa	*Vigna unguiculata*
28	Sugar cane	Ireke	*Saccharum officinarum*
29	Flann boyant	-	*Delonix regia*
30	Orange	Osan	*Citrus sinensis*
31	Draw leaf	Ewedu	*Cochorus olitorus*
32	Maize	Agbado	*Zea mays*
33	Kolanut	Obi	*Cola nitida*
34	Masquerate tree	-	*Plyalthia pendula*
35	Wild oil nut	Lapalapa	*Jatropha curcas*
36	Okro	Ila	*Hibiscus esculentum*
37	Gliricidia	Agummaniye	*Gliricidia sepium*
38	Rubber	-	*Hevea brasiltensis*
39	Cocoa	Koko	*Theobroma cacao*
40	Chromdaenae	-	*Chromolacnea odorate*

Y-Yoruba name, I-Ibo name

MATERIALS AND METHODS

Sample collection and preparation

The leaf samples (Table 1) were collected at federal college of Agriculture, Akure campus, Ondo State, Nigeria in March, 2005. They were identified at the Horticultural section of the college. They

were cleaned to remove diet, washed in distilled water, oven dried at 60^0C for 4h, ground with mortal and pestle, sieved with a mesh of aperture 425µm and stored prior to analysis.

Table 2: Levels ($mgkg^{-1}$) of vanadium in samples analyzed.

S/N	Sample	Values
1	*Tectona grandis*	1.24
2	*Citrus limon*	2.48
3	*Mangefera indica*	1.24
4	*Acalypha ciliata*	1.24
5	*Stachytarpheta cayennesis*	2.48
6	*Gossypium hirsitum*	1.34
7	*Spondia mombin*	1.28
8	*Musa paradisiala*	3.72
9	*Talinum triangulare*	2.48
10	*Carica papaya*	3.72
11	*Ocimum gratissimum*	4.96
12	*Telfaira occidentalis*	2.48
13	*Moringa oligofera*	3.72
14	*Citrus paradis*	1.66
15	*Dioscorea rotunolata*	1.24
16	*Manihot palmats*	ND
17	*Vernonia amygdahina*	1.24
18	*Psidium guajava*	ND
19	*Colocaxiz escutenta*	9.92
20	*ficus exasperata*	4.96
21	*Azadirachta indica*	3.72
22	*Capsicum annum ‘*	3.72
23	*Coco nucifera*	6.20
24	*Asprillia africana*	4.96
25	*Elaeis guineensis*	2.48
26	*Citrus autifolia*	3.72
27	*Vigna unguiculeta*	4.96
28	*Saccharum officinarum*	2.48
29	*Delonix regia*	2.48
30	*Citrus sinensis*	*3.*72
31	*Cochorus olitorus*	4.96
32	*Zea mays*	3.72
33	*Cola nitida*	1.52
34	*Plyalthia pendula*	2.48
35	*Jatropha cureas*	4.96
36	*Hibliscus esculentum*	2.48
37	*Gliricidia sepium*	4.96
38	*Hevea brasiltensis*	4.96
39	*Theobroma cacao*	7.44
40	*Chromolacnea odorate*	3.72
	Mean	3.47
	Standard Error	1.88
	Coefficient of variation	54.17

Mineral Determination

Each sample (0.5g) was dry ashed in a muffle furnace with a temperature 550^0C for 3h. the ashed sample was dissolved in a little quantity of 2M HCl, filtered and made up to $50cm^3$ using 2M HCl.

The vanadium content was determined using Pye Unicam atomic absorption spectrophotometer using manufacture's specifications. Determinations were in triplicate. Statistical analysis was performed using SPSS for widows 10.0.

RESULTS AND DISCUSSION

Table 2 depicts the mean ($mgkg^{-1}$) levels of vanadium in the samples analyzed. From the results obtained mean was $13.47mgkg^{-1}$, confinement of variation was 54.17% meaning that high variations existed among the samples Psidium guajava and manihot palmate produced no results (ND*), Tectona gradis Mangifera indica, Acalypha ciliata, Discorea rotundata and Vernonia amygdalina* gave $1.24mgkg^{-1}$ while *colocaxia esulenta* produced the highest value (9.92mgkg-1). The differences in the results may be due to meterological conditions since some of the areas are located in open areas that are subjected to windy conditions. Vanadium enters the environment from natural sources and from buring of fuel oils. It stays in the air, water and soil for a long time, it combines with other elements and particles and sticks to soil sediments.

Results from other research studies revealed the followings: Awofolu (2004) reported between 0.02-$0.27mgg^{-1}$ for plantain, maize and yam tuber, Anhwange *et al* (2005) reported $0.519\text{-}0.769mgg^{-1}$ and in Food Data Chart (2007), the followings were recoded readishes 79, Dill 14, wheat grains 0.6-2, liver 0.2-1, fish 0.2-1, meat 0.2-1, carrots 0.01, peas $0.01mg100g^{-1}$. Wardlaw (1999) reported shellfish, mushrooms and grain products as good for sources of vanadium. Geographical origin, soil content of vanadium and analytical methods employed by different author may be the factors that have been responsible either directly or indirectly for variations observed in comparison with our results.

Vanadium atom is an essential component of some enzymes particularly the vanadium nitrogenase used by some nitrogen fixing micro orgasms, vanadium is essential to ascidians or sea squirts in vanadium chromagens proteins. The concentration of vanadium, in their blood is more than 100 times higher than the concentration of vanadium in the seawater around them. Rats and chickens are also known to require vanadium in very small amounts and deficiencies result in reduced growth and impaired reproduction (Kreider 1999).

In Japan vanadium (V) oxide (V205) is marketed as a good mineral health supplement naturally occurs in drinking water. The source of this drinking water is mainly the slopes of mount Fiji. The water's vanadium pentoxide content ranges from about $80mgL^{-1}$ to $130mgL^{-1}$, it is marketed as being effective against diabetes, eczema and obesity (Wikipedia)

Exposure to high levels of vanadium can cause harmful health effects. The major effects from breathing high levels of vanadium are on the lungs, throat and eyes. Workers who breathed it for short and long periods sometimes had lung irritation, coughing, wheezing, chest pain, runny nose, and a sore throat. These effects stopped soon after they stopped breathing the contaminated air. Similar effects have been observed in animal studies. No other significant health effects of vanadium have been found in people (Clarkson and Rawson, 1999). Animals that ingested very large doses have died. Lower, but still high levels of vanadium in the water of pregnant animals resulted in minor birth defects some animals that breathed or ingested vanadium over a long term had minor kidney and liver changes (Morgan and El-Tawal, 2003)

Vanadium compounds are not regard as serous hazard however the uptake by human manually takes places through foodstuffs. Other health effects of uptake are: cardiac and vascular disease, inflammation of stomach and intestines, damage to the nervous system, bleeding and throat pains, weakening, sickness and headaches, dizziness and behavioral changes. The health hazards are dependent on its oxidation state (Nielsen, 1996).

According to WHO (1988) report, 0.7, 0.4, 0.4 and $0.14mgkg^{-1}$ were specified for molluscs, crustaceans, mammals and fish respectively. An elevated amount could result in people consuming

the analyzed foods depending on the rate of elimination through the kidney and the quantity of the food taken.

CONCLUSION

Generally, the results presented in Table 1 revealed that presence of vanadium in most of the leaves analyzed. It was observed that the values obtained were higher than the recommended values for molluscs, crustaceans, mammals and fish by WHO. It would be advisable to subject the leaves to different processing methods before consumption.

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