Vitamins and Mineral composition of *Sorghum vulgare* leaf-sheath, *Eremomastax polysperma* and *Brillantaisia owariensis*

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Abstract

This study estimated the vitamins and minerals content present in *Sorghum vulgare* leaf-sheath, *Eremomastax polysperma* and *Brillantaisia owariensis* leaves. The vitamin content was analysed using spectrophotometric method while minerals was determined, using atomic absorption spectrophotometric method. The vitamin C, vitamin E and vitamin D contents of *Brillantaisia owariensis* (59.961mg/100g; 10.370mg/100g; 20.254mg/100g) was higher than *Sorghum vulgare* leaf-sheath (52.975mg/100g; 10.188mg/100g; 14.400mg/100g) and *Eremomastax polysperma* (54.89mg/100g; 10.224mg/100g; 1.584mg/100g) respectively. Vitamin A concentration of *Eremomastax polysperma* (1.074mg/100g) was higher than *Brillantaisia owariensis* (0.224mg/100g) and *Sorghum vulgare* leaf-sheath (0.85mg/100g); while *Sorghum vulgare* leaf-sheath had a vitamin B_6 concentration (222.50mg/100g) that was higher than *Brillantaisia owariensis* (120.00mg/100g) and *Eremomastax polysperma* (90.00mg/100g) leaves. The mineral contents showed the concentration of iron to be highest in all the plants; 32.317 µg/g in *Sorghum vulgare* leaf sheath, 35.202 µg/g in *Brillantaisia owariensis*, and 29.258 µg/g in *Eremomastax polysperma*. The manganese concentration of *Brillantaisia owariensis* (5.860 µg/g) was higher than *Sorghum vulgare* (5.547 µg/g) and *Eremomastax polysperma* (0.067 µg/g). The results obtained suggests that *Sorghum vulgare* leaf-sheath, *Eremomastax polysperma* and *Brillantaisia owariensis* leaves have appreciable amount of vitamins and minerals, which could aid in the general well-being of humans.

Key words: vitamins , minerals, plants

1.0 Introduction

Vitamins are organic compounds that are needed in small amounts to promote and regulate body processes necessary for growth, reproduction and the general health maintenance. Vitamins can be fat soluble (vitamin A, D, E and K) or water soluble (vitamin C and vitamin B-complex). Vitamin A is needed for cellular differentiation, vision and has antioxidant properties. Vitamin D together with parathyroid and calcitonin, helps in maintaining calcium and phosphorous metabolism in the body fluids and tissues. Vitamin E has

antioxidant function and Vitamin K has coagulation function (Ravisankar *et.al.,* 2015). Vitamin C is needed in the synthesis and maintenance of collagen needed for synthesis of neurotransmitter, hormones, bile acids and carnitine and also has antioxidant function. Vitamin B_1(thiamine) is needed for glucose metabolism; vitamin B_2 (Riboflavin) helps to release energy from foods, promotes good vision, and healthy skin. Vitamin B_3(niacin) is involved in energy production, normal enzyme function, digestion, promoting normal appetite, healthy skin, and nerves. Vitamin B_6(pyridoxine, pyridoxal or pyridoxamine) aids in protein metabolism and red blood cell formation. It is also involved in the body's production of chemicals such as insulin and haemoglobin. Vitamin B_{12} (also known as cobalamin), aids in the building of genetic material, production of normal red blood cells, and maintenance of the nervous system (Bellows and Moore, 2012).

Minerals are inorganic chemical elements required by living organisms in smaller amounts. Minerals are essential for bone strength (calcium, phosphorus), electrolytes (Na^+, K^+ and Cl^-); ATP processing (magnesium); found in proteins (sulphur) (Srilakshmi, 2008); antioxidant (selenium) and stimulate the immune system (zinc) (Soetan *et al.,* 2010).

Eremomastax polysperma and *Brillantaisia owariensis* belongs to the acanthaceae family. *E. polysperma* is common in Southern Nigeria (Uyoh *et al.,* 2014) and used to treat anaemia and internal heat (Mboso *et. al.,* 2014). *B. patula* a synonym of *B. owariensis* is a shrubby herbs, found in Nigeria, Toga, West Cameroon and across Uganda and Angola. The leaves are used for rheumatism treatment, the decoction is taken to ease child birth, menstrual pain and stomach ache (Faparusi *et. al.*, 2012).

Sorghum vulgare is of the poaceae family. The extracts of sorghum have a strong chemoprotective potential, anti-inflammatory properties, hepatoprotective and hematopoietic effects (Benson *et. al.,* 2013).

Therefore, this study was undertaken to assess the level of vitamins and selected minerals present in *Sorghum vulgare* leaf-sheath, *Eremomastax polysperma* and *Brillantaisia owariensis* leaves.

2. Methodology

2.1 Collection of Plant sample

The plants; *Sorghum vulgare* leaf sheath was bought from mile 3 market while *Eremomastax polysperma* and *Brillantaisia owariensis* were gotten from a farm at Rumokoro (Lat 4.88999; long 6.96922) all in Port Harcourt, Nigeria. The plants were identified with voucher numbers: UPH/V/1325(*Brillantaisia owariensis*) and UPH/V/1326 (*Sorghum vulgare* , synomyms *sorghum bicolr*) and UPH/V/1346 (*Erempmastax polysperma*) . They were dried and ground into fine powder with a blender and stored in an air tight container.

2.2 Determination of Vitamins

Vitamin C was measured spectrophotometrically at 540nm. Vitamin E (Tocopherol) was estimated by the Emmerie-Engel reaction as reported by Rosenberg (1992) and absorbance read at 520nm in a spectrophotometer. Vitamin A assay was based on the spectrophotometric estimation of the colour produced by vitamin A acetate or palmitate with trichloroacetic acid (TCA) and the absorbance was read immediately at 620nm in a spectrophotometer. Determination of vitamin B_1 and B_2 was done using spectrophotometer and absorbance read at 261nm and 242nm respectively. Vitamin B_3 (Nicotinamide) and vitamin B_6 was also assayed spectrophotometrically.

2.3 Minerals

Heavy metal analysis was conducted using Atomic Absorption Spectrophometer according to the method of APHA 1998 (American Public Health Association).

3. Results

Table 1. Vitamin contents present in *Sorghum vulgare* leaf sheath, *Brillantaisia owariensis* and *Eremomastax polysperma*

Vitamin	*Sorghum vulgare* leaf-sheath (concentration mg/100g)	*Brillantaisia owariensis* (concentration mg/100g)	*Eremomastax polysperma* (concentration mg/100g)
Vitamin A	0.854	0.224	1.076
Vitamin E	10.188	10.370	10.224
Vitamin C	52.975	59.961	54.89
Vitamin B_1	0.006	0.003	0.008
Vitamin B_2	0.024	0.028	0.016
Vitamin B_3	0.488	0.390	0.256
Vitamin B_6	222.500	120.000	90.000
Vitamin B_{12}	0.100	0.050	0.575
Vitamin D	14.400	20.256	1.584

Table 2. Mineral content of *Sorghum vulgare* leaf-sheath, *Eremomastax polysperma* and *Brillantaisia owariensis*

Parameters	concentration (µg/g)		
	Sorghum vulgare	*Brillantaisia owariensis*	*Eremomastax polysperma*
Chromium	0.066	0.091	0.00
Cobalt	0.335	0.136	0.16
Zinc	0.175	0.246	0.038
Cadmium	0.414	0.214	0.12
Lead	0.00	0.371	0.03
Copper	5.630	0.069	0.00
Iron	32.310	35.20	29.26
Manganese	5.547	5.860	0.067
Silver	0.052	0.063	0.024
Nickel	1.730	1.340	0.315

4.0 Discussion

Vitamins are a group of unrelated organic substances occurring in many foods in small amounts and necessary in trace amounts for the normal metabolic functioning of the body. Vitamin A (retinoids) is necessary for the normal functioning of the visual system, growth and development, maintenance of epithelial cellular integrity; immune function and reproduction. Vitamin D is required for calcium and phosphate homeostasis, which in turn are needed for the normal mineralization of bones, muscle contraction , nerve conduction and general cellular function in all body cells (FAO, 2004). Vitamin E acts as antioxidants either as tocopherol or tocotrienols (Srilaskshmi, 2008). Vitamin C is necessary for carnithine synthesis; neurotransmitter synthesis; collagen formation; iron metabolism, keeping the ferric iron in its ferrous form ; it has antioxidant function and used for drug detoxification (Srilaskshmi, 2008).

For vitamin B-complex, vitamin B_1 or thiamine is required for carbohydrate metabolism; Vitamin B_2 or riboflavin functions as coenzyme in many oxidation-reduction reactions; niacin (vitamin B_3) plays a vital role as coenzyme for hydrogen transfer with numerous dehydrogenases (FAO, 2004). Vitamin B_6 functions as coenzyme in the metabolism of amino acids, glycogen and sphingoids bases (FAO, 2004). While vitamin B_{12} is involved in biochemical processes essential for DNA synthesis and growth. The vitamin C content present in the plants were 52.97mg/100g, 59.9mg/100g and 54.89mg/100g for *Sorghum vulgare* leaf-sheath, *B . owariensis* and *E. polysperma* leaves respectively. The vitamin E content was 10.18mg, 10.37mg and 10.22mg for *Sorghum vulgare* leaf-sheath, *B . owariensis* and *E. polysperma* leaves respectively. The results suggest that the plants were able to meet-up some of the daily requirement of the vitamins.

Minerals are inorganic chemical elements required by living organisms in smaller amounts. Zinc a trace mineral is required for several enzyme function and plays a role in immune system. Iron functions in the transport and storage of oxygen; necessary for red blood cells formation

and serve as a cofactor of enzymes and other proteins. Cobalt is necessary for vitamin B_{12} biosynthesis. Copper is important for the maintenance of normal haemoglobin status; it's a part of many enzymes systems and also capable of binding bacterial toxins and increases antibiotic activities. Nickel is present in urease; chromium is needed for glucose metabolism; manganese needed as enzyme component in general metabolism (Srilakshmi, 2008). Cadmium and lead are toxic metals. Cadmium toxicity is associated with painful bone disorder, pulmonary, renal, hepatic, reproductive and cardiovascular dysfunction. Lead on the other-hand, induces neurologic and haematological dysfunction (Zhai *et. al.*, 2015). The maximum limit for cadmium and lead are 0.2ppm and 0.3ppm respectively (Codex-stan, 2015).

The Mineral content present in *Sorghum vulgare* leaf sheath, *Brillantaisia owariensis* and *Eremomastax polysperma* leaves is shown on Table 2. Iron had the highest concentration 32.317; 35.202, and 29.258µg/g for *Sorghum vulgare* leaf sheath, *Brillantaisia owariensis* and *Eremomastax polysperma* leaves respectively. Suggesting the plants being able to meet iron deficient needs and might be suitable for anaemia treatment. The lead and cadmium concentration for *Sorghum vulgare* leaf sheath was 0.000 and 0.414 µg/g, *Brillantaisia owariensis* leaf was 0.371 and 0.214 µg/g while *Eremomastax polysperma* was 0.032 µg/g and 0.120 µg/g respectively. This indicates that *Sorghum vulgare* leaf sheath and *Eremomastax polysperma* pose no toxic effect from lead poisoning and *Eremomastax polysperma* had no cadmium-related toxicity.

5. Conclusion

In conclusion *Sorghum vulgare* leaf sheath, *Brillantaisia owariensis* and *Eremomastax polysperma* leaves have appreciable amount of vitamins and minerals (such as iron which could help in treating anaemia) that could possibly maintain human's health generally.

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