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NUTRITIONAL AND ANTINUTRITIONAL ANALYSES OF *HURA CREPITANS* SEEDS CULTIVATED IN SOKOTO NORTH L.G.A, NORTH-WESTERN NIGERIA.

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ABSTRACT

The proximate, minerals constituents and anti-nutritional factors of Hura crepitans seeds were evaluated. The results of the proximate analysis showed that 3.13%, 4.00%, 7.83%, 33.17%, 17.30%, 8.17%, 29.53% were the percentage composition of moisture, ash, crude lipid, crude protein, fibre and carbohydrate respectively. The calorific value was obtained to be 485.85±7.22 kJ/kg. The anti-nutritional analysis showed that phytate had the highest concentration of 20.28±0.90 while oxalate has the lowest concentration of 0.017±0.15 mg/100g dry weight respectively. The mineral analysis of Hura crepitans seed also indicates that K has the highest value of 238.33 mg/100g dry weight while Cd with a value 0.71±0.01 mg/100g dry weight has the least. The result shows that the H. crepitans seeds if properly utilized can serve as good source of minerals.

Keywords: Anti-nutritional, Hura crepitans, Proximate, Mineral, Nutritional

INTRODUCTION

In Nigeria, wild fruits are commonly consumed by both rural and urban dwellers especially during dry season when most cultivated fruits are scarcely available. Wild and semi wild food (fruits) resources are frequently consumed in rural communities as alternative sources of essential nutrient supply to the body (Muhammad *et al.*, 2015). There are more than 30,000 edible plant foods used by humans with only about 30% of them supplying over 90% of the body dietary need (Hassan *et al.*, 2011). While they may be eaten raw, cooked alone or part of sauce preparations, irrespective of the mode of consumption, they are not only beneficial nutritionally, but are relatively cheap to procure (Hassan *et al.*, 2011). In order to face the problem of under nutrition and malnutrition brought about as a result of ever increasing global population growth rate, fruits can be utilized for their good source of nutrients and food supplements (Angeline *et al.*, 2015) since they well known for their excellent source of nutrients such as minerals (Anuradha *et al.*, 2013). Mineral elements though usually form a small portion of the total composition of most plant materials and of total body weight; they are nevertheless of great physiological importance particularly in the body metabolism where they play a vital role in general well-being as well as in the cure of diseases (Underwood, 1977; Prasad, 1993). Some mineral elements remain chelated with organic ligands and make them bioavailable to the body system (Choudhury and Garg, 2007). Determination of mineral elements in plants is very important since the quality of many foods and medicines depends upon the content and type of minerals (Bahadur *et al.*, 2011). In this way, not only must the absolute amounts of minerals be estimated in the edible portions of foods, but these minerals must also be in forms that are bioavailable for organisms. In recent years, scientists and nutritionists have started believing in the therapeutic role of metals in human health (Udayakumar and Begum, 2004). Some plants contain significant amount of minerals, the presence and quantity depend on plant family, history and phytochemical properties of the plant (Houghton, 2007).

Hura crepitans Linn. is a 90–130 feet high tropical plant belonging to the family Euphorbiacea. *H. crepitans* is often planted in towns and villages as a shade tree. It has short, densely crowned spines on the trunk and branches with a long stalked leaves 5–20 cm long, 5–15 cm broad, ovate, shortly and abruptly acuminate, and dark green in colour with closely parallel pinnate nerves. The purple flower spikes and large fluted flattened fruits are highly distinctive. The tree flowers usually at the beginning of and again at the end of rainy season. The capsule splits explosively, releasing one flattened circular seed about 18 mm across from each chamber (Fowomola and Akindahunsi, 2007). The medicinal value of fruits from wild plants lies in the presence of a variety of phytochemical and elemental composition, hence the need to continuously investigate the phytoconstituents, elemental and vitamin components present in the medicinal plant to assess their nutritional values.

The present study is aimed at investigating the levels of antinutrients and nutrients present in *H. crepitans* Linn seed.

MATERIALS AND METHODS

Sample Collection

The fresh and matured sample of *Hura crepitans* fruits were collected randomly from *Hura crepitans* trees behind College of Nursing, Sokoto South Local Government Area of Sokoto State Nigeria. The samples were transported to the laboratory in clean polythene bag and was identified by a taxonomist in the Department of Botany, Faculty of Science Usmanu Danfodiyo University Sokoto Nigeria were a herbarium specimen was deposited and voucher number UDUH /ANS /0142 issued.

Sample Preparation

The *Hura* plant fruits were broken manually to obtain the seeds. The seeds were washed with distilled water to remove the contaminants. They were dried under the sun for five days. Good and matured seeds were manually selected and grounded into powder using mortar and pestle. The powered seeds sample was stored in an air tight plastic bag until use.

Proximate Analysis: The standard method of the Association of Analytical Chemists (AOAC, 1990) was used for the determination of ash, moisture, crude protein, crude lipid and crude fibre contents. The method described by Hassan *et al*., 2008 was used to determine the available carbohydrate and energy value (in kJ/kg)

Anti-nutritional Analysis: The method ~~of~~ described by Ola and Oboh (2000) was adopted for the determination of phytate. The methods described by AOAC (1990), Krishna and Ranjhan (1980), IITA (1988) and Allen *et al*., (1974) were used to determine the levels of hydrocyanic acid, oxalate, nitrate and tannins respectively.

Minerals Analysis: 2 g of the dried sample was digested with 24 cm^3 mixture of nitric acid /perchloric acid in the ratio 12:4. The minerals Ca, Mg, Ni, Cd, Cu and Zn were determined using atomic absorption spectrophotometry, Na and K using atomic emission spectrometry (AOAC, 1990), while phosphorus was determined by the molybdenum blue colorimetric method (James, 1995).

Statistical Analysis

The data were expressed as Mean ± SEM and analyzed using one way analysis of variance (ANOVA), followed by Dunnett-t post-hoc test. Values of $p \leq 0.05$ were considered statistically significant.

RESULTS

Tables 1, 2 and 3 shows the proximate composition and energy content, concentration of some minerals and that of selected antinutrient parameters assayed in the *H. crepitans* seed respectively.

Table 1: Proximate Parameters of *H. crepitans* Seeds

Proximate Parameters	Content (mg/100 g DW) ± SEM
Moisture	3.13±0.67
Ash	5.42±0.60
Crude lipid	3.50±0.58
Crude protein	12.42±0.18
Carbohydrate	75.19±0.32
Fibre	1.57±0.28
Calorific	381.94±7.22

Each value is the mean ± SEM of triplicate determinations. DW = dry weight

Table 2: Some Mineral Contents of *H. crepitans* Seeds

Minerals	Composition (mg/100 g)
Potassium	238.33±0.80
Sodium	71.67±0.83
Calcium	0.37±0.17
Magnesium	0.95±0.29
Phosphorus	4.33±0.10
Zinc	12.35±0.48
Copper	4.87±0.29
Potassium	238.33±0.80
Sodium	71.67±0.83
Calcium	0.37±0.17
Iron	27.22±0.56
Cadmium	0.71±0.01
Nickel	2.23±0.68

Each value is the mean ±SEM of triplicate determinations

Table 3: Anti – nutritional Analysis of *H. crepitans* Seeds

Parameter	Concentration (mg/100g DW)
Nitrate	0.255±0.09
Cyanide	0.18±0.06
Tannin	0.43±0.24
Phytate	20.28±0.49
Oxalate	0.017±0.15

Data are mean ± SEM of triplicate determination, DW = dry weight

DISCUSSIONS

The results of the proximate parameters (Table 1) showed that *H. crepitans* seed has an appreciable level of the proximate parameters investigated. This low moisture content obtained from the seeds showed that the seeds are not prone to microbial damage; therefore, it can be stored for a long period of time without any spoilage (Hassan *et al.,* 2005). Intake of crude fibre has a beneficial physiological role in reducing the incidence of colon cancer. Crude fibre in human diet as reduces cholesterol level, risk of coronary heart diseases, colon and breast cancer and hypertension. It also enhances glucose tolerance and increases insulin sensitivity (Muhammad *et al*., 2015). Fibre content in diet also reduces mineral, protein and carbohydrate bioavailability by hindering their hydrolytic break down (Hassan *et al*., 2005). The carbohydrate content was high hence is could serve as a rich energy source in diets.

The results of the analyzed minerals represented in Table 2 shows that *H. crepitans* seeds is rich in potassium (238.33 mg/100 g sample) and sodium (71.67 mg/100 g sample). Both minerals play a vital role in active transport across the cell membrane, and they are required for maintenance of osmotic balance (Hassan *et al*., 2005; Muhammad *et al.,* 2015). While magnesium activates enzymatic system responsible for calcium metabolisms in the bone and in the nerves electrical potential, iron is utilized in the body for the transportation of oxygen to the tissues and plays a role in melanin formation. Iron is also an important element in the diet for pregnant women, nursing mother, infants and elderly people to prevent anaemia and other related diseases (Muhammad *et al.,* 2015). Copper is known for its role in haemoglobin formation and its contribution to iron and energy metabolism (Hassan *et al.,* 2005). Zinc on the other hand plays a significant role in gene expression, regulation of cellular growth and participates as a co-factor of enzyme responsible for carbohydrate, protein and nucleic acid metabolism and its deficiency is associated with growth retardation (Muhammad *et al.,* 2015).

The concentration of tannin was found to be 0.43 mg/100g (Table 3). Tannins are aromatic compounds containing phenolic groups. They interact with salivary proteins and glycoproteins in the mouth and render the tissues astringent to taste (Howes, 1953). Astringency gives tannin medicinal value in preventing diarrhea and dysentery and for controlling hemorrhage (Sollman, 1957; Jones, 1965). Furthermore, tannins protect plants against dehydration, rotting, and damage by animals and pathogens. When they are polymerized, an insoluble protective barrier is formed that prevents microbial attack (Stumpf and Conn, 1981). Therefore tannins can be applied to wounds as protective coating. The concentration of phytate was found to be 20.28 mg/100g. Savage *et al*., (1964) reported that phytate depressed the growth of chicks fed with phytate-casein diet by forming complex with zinc, thereby making the latter unavailable. It has been reported that phytate formed a complex with protein by the actions of cations, usually calcium, zinc, or magnesium, which act as a bridge between the negatively charged protein carboxyl groups and the former (Omosaiye and Cheryan, 1979). The phytate composition of the sample might not pose any health hazard when compared to a phytate diet of 10-60 mg/g which if consumed over a long period of time that has been reported to decrease bioavailability of minerals in monogastric animals (Thompson, 1993). The concentration of Hydrocyanic acid in the seed is 0.18 mg/100g this shows that the level of the acid in the sample is within the acceptable range for human consumption. Only plants with more than 200 mg of hydrocyanic acid equivalent per 100 mg fresh weight are considered dangerous (Betancur-Ancona *et al*., 2008). Consumption of high levels of Cyanide is associated with a serious health problem, a neurological disease known as Tropical Ataxis Neurophathy (TAN) was linked to consumption of high level of cyanide in cassava based diet (Hassan and Umar, 2008). The report of Chen *et al*., (1934) showed that the minimum lethal dose of hydrogen cyanide taken by mouth to be between 0.5 mg and 3.5 mg/kg of body weight. Other symptoms of hydrogen cyanide include peripheral numbness, light-headedness, mental confusion, stupor, cyanosis, and convulsion were reported by survivors (Halstrom and Moller, 1945). The concentration of oxalate found in the seed is 0.017 mg/100g which is not high to pose any health risk. Oxalate forms a complex with calcium, thereby making it unavailable when fed into animals, and so high oxalate diets can increase the risk of renal calcium absorption and has been implicated as a source of kidney stone (Osagie and Eka, 1998; Chai and Liebman, 2004). The concentration of nitrate in the seed is 0.255 mg/100 g. These values are within the acceptable daily intake of 3.7 mg/kg body weight. Higher concentration of nitrate in the food can lead to methemoglobianaemia a disease known to reduce the ability of red blood cells to carry oxygen (Kim-Shapiro *et al*., 2005).

CONCLUSION

It can be concluded that the seeds of *H. crepitans* is a good source of important minerals to animal and human through dieting especially K, Na, Fe and P. The anti-nutrient analysis indicates that the seeds are relatively safe for human consumption.

Generally, results and findings from this research agreed favourably with those of other wild plants recommended as food supplement in literature. The information obtained from this analysis would therefore serve as a guide for the possible utilization of *H. crepitans* seeds by animal feed manufacturers, public health authorities, and other food regulatory bodies.

Contribution of Authors

This work was carried out in collaboration with the authors. Authors LG and AM supervised and co-supervised the work as well as designed the experimental protocol. Author MA performed the laboratory work and literature search. Authors SA and BM participated in the results interpretation. Finally authors KJ and C managed the statistical analysis of the study. All authors read and approved the final manuscript.

Conflict of interest

We declare that we have no conflict of interest

REFERENCES

Allen, E.S., Grimshaw, H.M., Parkinson, J.A. and Quarmby, C. (1974). *Chemical Analysis of Ecologyical Materials*. Blackwell Scientific Publication, London. pp 52-62.

Angeline, M. C. H. and Krishnakumari, S. (2015). Analysis of Mineral Elements, Proximate and Nutritive value in *Citrullus vulgaris Schrad* (Watermelon) seed extracts. The *Pharma Innovation Journal,* 4(8):7-11.

Anuradha, V., Praveena, A., Sanjayan, K.P. (2013). Nutritive analysis of fresh and dry fruits of *Morinda tinctoria*. *Int. J Curr Microbiol App Sci*, 2(3):65-74.

AOAC, (1990). Official methods of analysis, 14^{th} Edition Association of Analytical Chemists, Washington DC. pp 1112-1114.

Bahadur, A., Chaudhry, Z., Jan, G., Danish, M., Rehman, A. and Ahmad, R. (2011). Nutritional and elemental analyses of some selected fodder species used in traditional medicine. *Afri. J Pharm Pharmacol,* 5:1157-1161.

Betancur-Ancona, D., Gallegos-Tintore, S., Ddelgado-Herrera, A., Perez- Flores, V., Ruelas, A. C. and Luis Chel-Guerrero, L (2008). Some Physicochemical and Anti-nutritional Properties of Raw Flours and Protein Isolates From *Mucunapruriens* (velvet bean) and *Canavaliaensiformis* (jack bean). *International Journal of Food Science and Technology*, 43: 816-823.

Chai, W. and Liebman, M. (2004). Assessment of Oxalate Absorption from Almonds and Black Beans With and Without the Use of an Extrinsic Label. 172: 953-957.

Chen, K.K., Rose, C.L. and Cloves, G.H.A. (1934). Comparative values of several antidotes in cyanide poisoning. *Am J Med Sci,* 188:767-781.

Choudhury, R.P. and Garg, A.N. (2007). Variation in essential, trace and toxic elemental contents in *Murraya koenigii* – A spice and medicinal herb from different Indian states. *Food Chem*, 104:1454-1463.

Fowomola, M.A. and Akindahunsi, A.A. (2007). Nutritional Quality of Sandbox Tree (*Hura crepitans* Linn.). *Journal of Medicinal Food*, 10(1):159–164.

Halstrom, F. and Moller, K.D. (1945). Content of cyanide in human organs from cases of poisoning with cyanide taken by mouth with contribution to toxicology cyanides. *Acta Pharmacol Toxicol,* 1:118–128.

Hassan, L.G., Bagudo, B. U., Aliero, A.A., Umar, K.J., Abubakar, L. and Sani, N.A. (2011). Evaluation of Nutrient and Antinutrient Content of *Parkia biglobosa* L. Flower. *Nigerian Journal of Basic and Applied Sciences,* 19 (1):76-80.

Hassan, L.G. and Umar, K.J. (2008). Nutritional Value of *Solanum americanum L. Electronic Journal of Food and Plant Chemistry,* 3(1):14-17.

Hassan, L.G., Umar, K.J. and Usman, A. (2005). Nutrient Content of the Leaves of *Tribulus terrestris*. *Journal of Tropical Bioscience,* 5(2):77-82.

Houghton, P. (2007). Use of medicinal plants in CNS disorders. In Yanniv Z. and U. Bachrach (Eds.). Handbook of Medicinal Plants. India, Harworth Press. pp. 234.

Howes, F.N. (1953). Vegetable Tannin Materials, Butterworth, London.

IITA, (1988). Selected Methods for Soil Plant Analysis (Manual Series No.1). International Institute for Tropical Agriculture, Ibadan Nigeria. pp. 55-56.

James, C.A. (1995). Analytical Chemistry of Food. Chapman and Hill, London. pp. 21-32.

Krishna, G. and Ranjhan, S.K. (1980). Laboratory Manual for Nutrition Research. Vikas Publishing House PVT ltd, Gaziabad India. pp. 76-89.

Jones, L. (1965). Veterinary Pharmacology and Therapeutics, 3rd ed., Iowa State University Press, Ames.

Kim-Shapiro, D. B., Gladwin, M. T., Patel, R. P., and Hogg, N. (2005). Role of Nitrite in Haemoglobin-Mediated Hypoxic Vasodilation. *Journal of Inorganic Biochemistry,* 99 (1):237-246

Muhammad, S., Umar, K.J., Sani, N. A. and Muhammad, S. (2015). Evaluation of Nutritional and Antinutritional Profile of Ginger bread plum (*Neocarya Macrophtlla*) Seed Kernel. *International Journal of Science and Technology,* 4:361 -367.

Obiajulu, C.B.O. and Uwaoma, A.O. (2012). Comparative Study of the Physicochemical Characterisation of Some Oil as Potential Feedstock for Biodiesel Production. *International Journal of Advances in Engineering and Technology,* **8(3)**:261-271.

Ola, F.L. and Oboh, G. (2000). Food Value of two Nigerian Edible Mushrooms (*Termitomycetes stratus* and *Termitomycetes robustus*). *The Journal of Technoscience,* 4:1-3.

Omosaiye, O. and Cheryan, M. (1979). Low-phytate, full-fat soy protein products by ultra filtration of aqueous extracts of whole soybeans. *Cereal Chem,* 56:58-62.

Osagie, A.U. and Eka, O.U. (1998). Antinutritional factors (oxalate). In: Nutritional Quality of Plant Foods. Post Harvest Unit, University of Benin, Benin City, Nigeria. pp. 233-234.

Prasad, A.S. (1993). Essential and Toxic Elements in Human Health and Disease: An Update. Wiley-Liss. New York.

Savage, J.E., Yohe, J.M., Pickett, E.E. and O'Dell, B.L. (1964). Zinc metabolism in the growing chicks. Tissue concentration and effect of phytate on absorption. *Poultry Sci,* 43:420–426.

Sollman, T.A. (1957). Manual of Pharmacology, 8th ed., W.B. Saunders, Philadelphia.

Stumpf, P.K. and Conn, E.E: (1981). Secondary plant products. In: The Biochemistry of Plant (Conn EE, ed.), Academic Press, New York. pp. 33–40.

Thompson, L. U. (1993). Potential Health Benefits and Problems Associated With Anti Nutrients in Foods. *International Journal of Food Resources*, 26:131-149.

Udayakumar, R. and Begum, V.H. (2004). Elemental analysis of Medicinal Plants used in controlling infectious diseases. *Hamdard Medicus,* 67:35-36.

Underwood, E.J. (1977). *Trace Elements in Human and Animal Nutrition*. 3rd Edn. Academic Press. New York.