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Nutritional analysis of *Manihot esculentus* Crantz tubers. A potential biomaterial in food processing.

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Abstract

The *M. esculentus* Crantz tuber was subjected to nutritional assessment using standard methods. The outcome of the proximate analysis revealed moisture content, ash, crude protein, crude fat, crude fiber and carbohydrate to be10.2 ± 0.20%, 0.40 ± 0.10%, 8.12 ± 0.10%, 1.17 ± 0.15%, 1.20 ± 0.26% and 79.80 ± 0.61% respectively and elemental content were as follows as Calcium, magnesium sodium, potassium, Manganese, iron and zinc to be 521.1±0.10mg/g,376.1±0.10 mg/g,2.51±0.00mg/g, 526.1±0.10mg/g , 1.851±0.00 mg/g, 9.77±0.00 mg/g and 2.71±0.00mg/g respectively.

Keywords: *Manihot esculentus* Crantz tuber, elemental content, proximate content

1. Introduction

Cassava (*Manihot esculentus Crantz*) tuber also known as manioc, mandioca, yucca, is the most important food in terms of dietary carbohydrates. Many households eat cassava daily in various forms (Okechukwu and Okoye, 2010) .Today it is a staple food and animal feed in tropical and subtropical Africa Asia and Latin America with an estimated total cultivated area greater than 13 million hectares of which more than 70% is in Africa and Asia (El-sharkawy,2003). Approximately 500 million people depend on it as major carbohydrate (energy) source, in part of the country because it yields more energy per hectare than other major crops. Cassava tuber is grown in areas where mineral and vitamins deficiencies are widespread, especially in Africa. A marginal nutrient status increase the risk of mortality, improving the nutritional valve of cassava could alleviate some aspects of hidden hunger, that is subclinical nutrient deficiencies without overt clinical signs of malnutrition. The relationship between hidden hunger and food insecurity has been relieved elsewhere (Tanumihardjo et al.,2007).

The problem here is that a lot of cassava tubers in our farm are not utilized, billions of dollars is been lost to this annually. Literature has revealed that they are widely used in food and pharmaceuticals but out of them only few tubers are reported for their nutritional and other applications. Evidently, there are not sufficient studies that scientifically confirm the nutritional importance of this tuber (Oteiza etal. ,2004).The objective of this research is to determine the proximate and elemental Content of the cassava tuber in order to amplify the possibilities of the tuber's applications in food and pharmaceuticals. Also to empower local farmers as market would be available for the supply of this natural product. This will generate employment and boost the economy.

Result of this research is likely to highlight the proximate and elemental content of the tubers. It is also likely to establish a scientific base and set pace for starch technology research so as to establish present and future natural product materials of better efficacy for starch based industries (Hurley, 1976)

2. Materials and Methods

The chemicals used in study are of analytical grade

2.1 Method of extraction

The tubers of *Manihot esculentus* Crantz *tubers* were purchased from Chobaoo market, Jos, Plateau State, Nigeria and was identified and authenticated by plant scientist of the Department of Plant Sciences, University of Jos, Nigeria. The *M. esculentus* Crantz tuber was thoroughly washed and all foreign material removed. The tuber was peeled, weighed and peeled. The tuber was pulverized using a blender. Enough quantity of water was added to the pulp which will then pass through an 180um sieve. The filtrate was allowed to settle and 0.1N sodium hydroxide was added to separate the starch as well as to neutralize the prevailing slight acidity (AOAC, 1999).

2.2 Proximate analysis

Moisture, ash, crude protein, crude fat, crude fiber, carbohydrate content was determined respectively using standard procedures of the Association of Official Analytical Chemists (AOAC, 1999).

2.2.1 Determination of Moisture

The moisture content of the starch was determined according to (AOAC, 1999) method. 2g of the starch samples was accurately weighed into evaporating dish and dried in an oven at 80^{o}C for 3hours.The samples were cooled in desiccators and weighed. The process of heating, cooling and weighing was repeated after every 30 mins interval until a constant weight was obtained. The moisture content was then calculated as follows;

$$\% \text{ moisture} = \frac{W1-W2}{W1-W0} \times \frac{100}{1}$$

Where:

W0 = Weight of Petri dish in grams
W1 = Weight of Petri dish in grams and sample before drying.
W2 = Weight of Petri dish in grams and sample after drying

2.2.2 Determination of Ash content

The ash content of the samples was determined by using (AOAC,1990) methods. About 2g of the sample was weighed into crucible in triplicate. The sample was placed in the muffle furnace at 500^{o}C until a light grey ash was observed and constant weight obtained. The sample was cooled in desiccators to avoid adsorption of moisture and weighed. The ash content was calculated as follow:

$$\% \text{ Ash content} = \frac{W1-W2}{W} \times \frac{100}{1}$$

Where

W2 = Weight of sample and the crucible before ashing
W1 = Weight of sample and crucible After ashing
W = Weight of sample

2.2.3 Determination of crude protein:

0.5g of the sample was weight and was heated at low temperature for digestion to NaOH and 5ml of $Na_2S_2O_3$ antibumbing agent were added, after which the component was diluted into 10mlof Boric acid and put in a Kjeldhal flask and was allowed to digest till a clear solution was obtained. The solution was prepared and make up in a 50ml volumetric flask. The Sample was then distilled in the Markham steel distillation and the solution gotten was titrated with 0.02N HCL solution.

$$\% \text{ Crude protein} = \frac{M \times T \times 0.014 \times V_1 \times 100}{W \times V2}$$

2.2.4 Determination of crude fat

Fat content was determined using the method described by (AOAC, 1990). 2g of the starch sample was weighed and wrapped in a cellulose filtered paper. It was then placed in the extraction thimble. Fat extraction unit was cleaned, dried in an oven and cooled in the desiccators before weighing. Petroleum ether (250ml) was measured into the flask and the fat extracted with solvent. After extraction, the solvent was evaporated by drying in the oven. The flask and the content were then cooled in desiccators and weighed. The fat content was calculated as follows:

$$\% \text{ fat content} = \frac{X-Y}{Z} \times \frac{100}{1}$$

Where:

X=Weight of fat + flask.
Y=Weight of flask.
Z= Weight of sample.

2.2.5 Determination of crude fibre

2g of the sample was taken and boiled for 30minutes with 1:25% H_2SO_4. It was fitered and re-boiled for another 30minutes with 1:25% NaOH Solution. The

Sample was filtered with water, HCL, Methylated Spirit. It was then dried in the hot air over to dry (AOAC, 1990).

$$\% \text{ of crude fibre} = \frac{W1 - W2}{W0} \times \frac{100}{1}$$

Where:

W1 = Weight of dried sample + dish
W2 = Weight of dish.
W0 = Weight of initial sample

2.2.6 Determination of carbohydrate content:

100 - (% crude protein + %Crude fat + %Crude Fibre + % ash).

2.3 Elemental analysis

2.3.1 Ash Sample Preparation

Five grams (5g) of an oven dried sample were weighed into a crucible. The crucible was then placed in a hot furnace and ashed at 600^{o}C for 3 hours. The furnace was cooled to about 120^{o}C.The crucible was then removed and placed in a desiccators for 1 hour to cool before weighing .The process was repeated until a constant weight was obtained.

2.4.2 Elemental Determination of the ashed samples:

The ashed sample (0.5g) were weighed and transferred into the digestion tube.5ml of each of distilled water, concentrated trioxonitrate (V) acid (HNO_3) and perchloric acid ($HCLO_4$) were added and the content mixed. The tube was placed into the digestion block inside a fume cupboard and the temperature control of the digester was set at 150ºC and digested for 90 minutes. The temperature was then increases to 230ºC and digested for another 30minutes (While fuming stage). The digester temperature was reduced back to150ºC and followed by the addition of 1ml of hydrochloric acid to the tubes within a few minutes.

Table 1**: Nutritional Analysis of *Manihot esculentus* Crantz tubers.**

Parameter	Result
Moisture content (%)	10.2 ± 0.20
Ash content (%)	0.40 ± 0.10
Crude protein (%)	8.12 ±0.10
Crude fat (%)	1.17 ± 0.15
Crude fiber (%)	1.20 ± 0.26
Carbohydrate (%)	79.80 ± 0.61
Calcium (mg/100g)	521.1 ± 0.10
Magnesium (mg/100g)	376.1 ± 0.10
Sodium (mg/100g)	2.51 ± 0.00
Potassium (mg/100g)	526.1 ± 0.10
Manganese (mg/100g)	1.851 ± 0.00
Iron (mg/100g)	9.77 ± 0.00
Zinc (mg/100g)	2.71 ± 0.00

N=3, mean ± SD.

Results and Discussion

Elemental analysis of the tubers revealed the content of calcium, magnesium sodium, Potassium, manganese, cobalt, iron and zinc to be 521.1±0.10mg/g,376.1±0.10 mg/g, 2.511±0.00Mg/g, 526.1±0.10mg/g , 1.851±0.00 mg/g, 9.77±0.00 mg/g and 2.71±0.00mg/g respectively. The Results also showed that *M. esculentus* Crantz tuber had moisture content, ash, Crude protein, Crude fat, crude fiber and carbohydrate to be 10.2±0.20%, 0.40±0.10 %, 8.12±0.10%, 1.17±0.15%, 1.20±0.26% respectively. The result compared favorably with the Standard and FAO/WHO reference. The M. *esculentus* Crantz tuber is highly recommendable for use in food industries, as emulsifier in food processing and food additives. The tuber is very rich in calcium (521.1±0.01 mg/100g of dry matter). Generally, humans and other vertebrates require relatively large qualities of calcium for construction and maintenance of bone, blood clothing and nerve transmission. The recommended daily allowance for an adult is 800mg, its absence may result in stunted growth, rickets, osteoporosis, convulsions (Murray et al., 2000).The tubers contained 376.1±0.10mg/100g of magnesium. The high level of the element shows that the tubers could provide an alternative source of magnesium in diets. Magnesium is required in large quantities by the body for the activation of enzymes involved in protein synthesis. The RDA (Recommended dietary allowance) is 420 mg/day for men and 320 mg/day for women. Other sources of magnesium are whole grams, green leafy vegetable. Possible outcomes of deficiency are growth-failure, behavioral disturbances weakness and

spasms (Murray et al., 2000).Also, the tubers contained 2.51±0.00 mg/100g of sodium. The sample is very rich in sodium, the body requires in a large quantity in other to maintain acid-base balance osmotic balance between cells and interstitial fluid and nerve function. The recommended daily allowance of sodium is 115-7500 mg/kg for infants, 324-975mg/kg for children and 1100-3300mg/kg for adults. (Murray et al., 2000). Its absence causes muscle cramps, mental apathy and reduced appetite. Potassium content of the tuber was 526.1±0.10 mg/100g. The high level of this nutrient shows that the tuber could provide alternative source of potassium in a large quantity for the maintenance of acid-base balance, body water balance and nerve function. The recommended daily allowance for an adult in good health is 2500 mg. Its absence may result in muscular weakness, paralysis. Other sources of potassium are meat, milk, and many fruits. (Ikewuchi and Ikewuchi,2009).The tuber contained 1.851±0.00mg/100g of manganese. The tuber has a low level content of the mineral. The body requires in a minute quantity for the activation of various enzymes, including the one required for urea formation, no deficiency for human has been reported. Other sources of manganese are egg yolk, whole grain and green vegetable (Hurley, 1976).The tuber contain 9.77±0.00mg/100g of Iron .It is a trace element needed by the body as it constituent of hemoglobin and enzymes involved in energy metabolism in iron transport is functions as essential component of enzymes involved in biological oxidation. (Zago and oteiza, 2001).The recommended daily allowance for an adult in goods health is 10mg/100g and its deficiency causes anemia and reduced resistance to infection. Other Sources of iron includes: eggs, meat, legumes, whole grains and green leafy vegetable. The tubers contain 2.71±0.00mg/100g of Zinc. It has no unpaired electron when in the state Zn+ preventing its participation in redox reactions. Zn has been recognized to act as an antioxidant by replacing metals that are active in catalyzing free radical reactions such as Fe (Oteiza et al .,2004;Zago and Oteiza, 2001).

References

AOAC (1990).methods of Analysis of the Association of official Analytical chemist, Washington D.C, 14th Ed, method 14004.

AOAC(1999).Association of official analyst Chemists, official Methods of analyst .13th ed. Horwitz,W.(EN) Benjamin franklin station. Asngton D.C16 ;96-99.

El-Sharkawy M.A.(2003).Cassava biology and physiology plant mol. Biol. 53:621-41.

Hurley L.S.,(1976)Manganese and other trace Elements.In: Present Knowledge in Nutrition.(Nutrition Reviews).56-62.

Murray R.K.Granner D.K. Mayes. P.A. Rodwell V.W. (2000) Biochemistry 25thvedtion.McGraw- Hil, Health Profession Division, USA(14),314-320.

Oteiza.P. Mackezie G.G. Verstraeten S.V.(2004). Metals in Neurodgeneration: Involvement of oxidant and oxidant sensitive Transcription factor mol. Aspect med. 25, 103-115.

Okechukwu D.E and Okoye I.C.(2010).Evaluation of Soaking time on the Cyanide content of Abachasilices 34thAnnual Conference and General meeting Nigeria Institute of Food Science and Technology (NIFST). Port-Harcourt pg 136-137.

Raquel D.S,Jaciral,Celio R.S. (2009)Cashew tree *(Anacardium occidental.L.)* exudates gum: a appli. Biochem 35, 45-53.

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