Afropolitan Journals

ISSN: 2730-7603X www.afropolitanjournals.com

Nutritional Value and Superiority of Yellow-Flesh Cassava Tuber Product

Adegbite, B. A. and Chkere-Njoku, C.

Dept. of Agricultural Education, Osun State College of Education Ilesa, Nigeria. Dept. of Soil Science and Environment, Imo State University, Owerri.

Corresponding author: niyiadegbite974@gmail.com

Abstract

Cassava became the most important root crop in the tropical Africa, is the most advanced component of root and tuber crops production in Nigeria. More than 10 million smallholders grow cassava and over 50 million people earn their living directly or indirectly from it. Consumption of yellow gari in many households of Nigeria has become traditionally acceptable table diet because of it richness in vitamin A content that reduces the effect of vitamin A deficiency. Vitamin A deficiency has affected 20% of pregnant women, 13% of nursing mothers and 30 % children under 5 years. This study emphasized nutritional composition of a food sample (yellow eba) such as carbohydrate, protein, vitamin, minerals and a good source of energy using proximate analysis. The findings revealed that 2.1 % protein, 0.5 % fat, 0.4 % fibre contained in the sample. Almost 19.0 % carbohydrate with adequate proportion of minerals contents present for our healthy growth. The high beta-carotene (131.25±0.79 µg/g) and vitamin A (21.88±0.13 µg/g) in the sample is a reflection that yellow eba supplies appreciable and significant amount of intake of bio- available vitamin A. consuming yellow eba provides a number of desirable nutritional and health benefits such as vitamin A which reduces effects of vitamin A deficiency for human well - being. However, alternative and more favorable policy that would negate more devastating effects of the Coronavirus (COVID - 19) is expected to protect food production and food security.

Keywords: affluent, bio - fortified, calories, carotene, clones, immunity and mortality.

Introduction

Cassava has great potential as a dietary energy source for man and livestock, is likely to produce more food calories per unit area than any other lowland crops grown in Nigeria. It supplies 70 % of the total calories intakes of about 60 million people in Nigeria (*Ogbuekiri et al., 2014*). Cassava has become the most advanced component of root and tuber crop production in the country with the ability and encouragement of farmers to integrate science and technology into production. In the last decade consecutively, Nigeria has been rated as the world leading producer of cassava followed by Indonesia, Thailand and Democratic Republic of Congo (Adegbite, 2018). Assessing the potential of new clones of making various traditional foods such as *gari* and *fufu;* which are common in Central and West Africa are white and yellow types. But because of its high carotene content, *yellow gari* is more nutritious than white (Bouis, 2011). However, bio-fortified yellow cassava has great potential to alleviate vitamin A deficiency in Sub-Sahara Africa *(Egesi, et al., 2010).*

Garri is very important in an average Nigerian's every day diet due to its nutritional value, convenience and cost competitiveness. It is mainly produced from cassava tuber as a major raw material. Cassava becomes important composite flour made from tropical root and tubers for good quality bread production while reducing cost of wheat importation in Nigeria *(Ijah et al., 2014)*.

Consumption of vitamin A rich food has beneficial effects on vitamin A deficiency (VAD). This study emphasized nutritional composition of a food sample *yellow eba* such as carbohydrate, protein, vitamins, minerals and a good source of energy. Consumption of *yellow eba* will not only lower the effect of vitamin A deficiency but boost our body immunity, renews vision and reduce death mortality particularly among children and older ones. A number of studies have been carried out on the nutritional status of vulnerable groups the country to improve dietary quality and health singly and independently. According to *Mazia-Dixon et al., (2004)* nationally, 42 % of children were stunted, 25 % were underweight and 9 % were wasted. Also, in 2011/2012 from Delta state in Nigeria, the children consuming cassava as their staple food were at greater risk to inadequate dietary protein intake as well as inadequate dietary intake of Iron (Fe) and vitamin A than those in affluent families who had more options for balanced diets. Hence, in an attempt to supplement dietary status in Nigeria, the poultry sub-sector which has been able to inject over 25 % of Agricultural Gross Domestic Products (AGDP) in the Nigerian economy in 2020 should be sustained so as to continue augmenting the source of additional protein intake for average Nigerians. However, alternative and favorable policy that would negate more devastating effects of the Corona virus (COVID - 19) is expected to sustain food production and food security in Nigeria.

Statement of Research Problem

There is no doubt that cassava has become the most advanced component of root and tuber crop production in Nigeria, the ability and encouragement of farmer towards value - chain addition is not enough. Whereas, supporting value addition of this product is a sure way of empowering farm families as well as improving dietary balance system. However, there may be need for the following research questions:

- Of what importance is yellow cassava - flesh tuber to dietary balance system?
- Is consumption of *yellow eba* contributed to a healthy growth of farmers and their families?
- Of what usefulness will inclusion of *yellow eba* into dietary system in our society?

Research Objectives

The main objective of the study is to examine the nutritional value and superiority of yellow - flesh cassava tuber product, and specifically the following objectives were considered to:

- determine nutritional benefits derived from consumption of *yellow eba,*
- examine the implications of consuming yellow - flesh cassava over wellbeing of mankind,
- ascertain economic benefits derivable from the acceptance of yellow - flesh cassava tuber into the household dietary system in Nigeria.

Methodology

The processed *yellow gari* was used to prepare food sample *yellow eba* and this sample is packed in nylon and stored at normal room temperature for proximate analysis test at the Department of Food and Science Technology, Obafemi Awolowo University, Ile - Ife. The moisture fat, ash, fibre and crude protein was carried out using standard method (AOAC, 1975). The total carbohydrate was obtained from the sample while iron (Fe), calcium (Ca), potassium (P), and sodium (Na) were determined using atomic absorption spectrophotometric flame photometric method as *Fashakin et al (2006)* reported.

Moisture

Moisture content was determined by the standard method using 1 g (w_1) of the sample in a hot air-oven (Uniscope, SM 9053, England) at 105±1 °C until constant weight (w_2) was obtained. The result is expressed in percentage as in the equation i.

$$M.C = \frac{w_1 - w_2}{w_1} \times 100 \quad \text{eq.....i}$$

Note: MC = Moisture content, w_1 = mass of sample before drying (g),

w_2 = mass of sample after drying (g)

Ash

Ash content was determined by the official method using muffle furnace (Carbolite AA1100, United Kingdom). 2 g (w_3) of the sample was weighed into weighed (w_2) ashing crucible and placed in muffle furnace chamber at 700 °C for 3 hrs for the sample to turn into ashes. The crucible was removed cool and weighed (w_1) as in equation ii.

$$A.C = \frac{w_1 - w_2}{w_3} \times 100 \quad \text{eq.....ii}$$

Crude Fibre

Fibre was determined by standard using 2 g (w_3) of the sample. Surphuric acid was added at 200 ml of 1.25% (v/v) H_2SO_4 and boiled for 30 min. The content was filtered using filter paper (Whiteman No 1) and the residue on the filter paper was washed with 50-70 ml distilled water. The washed residue was transferred back into the flask containing (v/v) NaOH and boiled for 30 min. It was filtered again and the residue was put into a dish and dried for 130 °C for 2 hrs, cooled and weighed (w_1). It was later ash 550 °C for 30 min, cooled and reweighed (w_2). The difference is hereby expressed as percentage in the equation.

$$C.F = \frac{w_1 - w_2}{w_3} \times 100 \quad \text{eq.....iii}$$

Note: AC= Ash content, w_1 = mass of crucible + dried residue (g)

w_2 = mass of crucible + ash (g), w_3 = mass of sample (g)

Crude Protein

The total protein content was determined using the Kjeldahl method.[3] Ground sample 0.02 g was weighed into Kjeldahl flask, 10 milliliter concentrated sulphuric acid was added followed by one Kjeltee tablet (Kjeltee-Auto 1030 Analyzer, USA). The mixture was digested on heating rocket to obtain a clear solution. The *digestate* was cooled and made up to 75 ml with distilled water and transferred onto Kjeldahl distillation set, followed by 50 ml of 40% sodium hydroxide (NaOH). The ammonia formed in the mixture was subsequently distilled into 25 ml of 2% boric acid solution (prepared by dissolving 100 mg of methyl red in 100 ml methanol) indicator. The distillate collected was titrated with 0.05 M HCL. Black determination was carried out by excluding the sample from the above procedure. The equation is given as:

$$CP = \frac{1.401 \times M \times F \text{ (ml titrant} - \text{ml black)}}{\text{Sample weight}}$$

Note: CP = Crude protein, M = Molarity of acid used 0.05mol/dm), F = Kjeldahl factor (6.25)

Fat

Fat was also determined using Soxhlet apparatus (Sunbim, India). Approximately 5 g (w_3) of the ground sample was placed into a thimble which was placed inside Soxhlet extractor and n-hexane was pureed into a pre-weighed round bottom flask (w_2), used to extract the oil from the sample. The extraction was carried out for about 6 hrs, later the solvent was removed from the extracted oil by distillation. The oil in the flask was further dried in a hot-air oven at 90 °C for 30 min to remove residual organic solvent and moisture. The weight of content (w_1) was taken and cooled in a desecrator.

$$\text{Fat} = \frac{w_1 - w_2}{w_3} \times 100 \qquad \text{eq.....v}$$

Note: $w_{1=}$ weight of fat + oil, $w_{2=}$ weight of empty flask, $w_{3=}$ weight of sample

Carbohydrate

Carbohydrate was expressed as a percentage of the difference between the addition of other proximate chemical compounds and 100% as in the equation.

Carbohydrate = 100 – protein + crude fat + ash + fibre + moisture

Note: all experiment was conducted in trip late and the mean and standard deviation were calculated.

Beta - Carotene and Vitamin A

About 5 g of sample was placed in conical flask containing 25 cm^3 of 90% of ethanol and maintained at a 60 - 80 °C in a water bath for 20 min with periodic shaking. The extract was decanted, allowed to cool and it volume was measured by measuring cylinder and recorded as volume (V_1). The ethanol concentration of the sample was brought to 85% by adding 7.5 cm^3 of distilled water and allowed to cool in a container of ice water for 5 min. into a separate furnel, 12.5 cm^3 of petroleum ether (pet - ether) were poured and cool; ethanol extract was added to obtain homogenous mixture and allow standing until separate layers were obtained. The bottom layer runs into a beaker while the top layer was collected in 250 cm^3 conical flask. The bottom layer was returned to the separate furnel and re-extracted with some of the pet - ether for 5 min until the ethanol extract becomes fairly yellow. The entire pet - ether extract was collected into 250 cm^3 conical flask and returned into separating furnel for re-extraction with 25 cm^3 at 85% ethanol. The final extract (the clear layer) was measured and pour into sample bottle for further analysis. However, the absorbance of the extract was measured by Spectrophotometer, sample of each extract was placed in a cuvette containing pet-ether and reading was taken when the figure becomes steady. The operation was repeated three times for each sample and beta - carotene was calculated from the calibration curve of the standard. After the concentration of beta - carotene was calculated; the vitamin A (Retinol) was also calculated using this:

6µg of beta - carotene ~~1µg~~ of retinol equivalent

Results

Table 1: Proximate Analysis of *yellow eba* Prepared from *yellow gari*

Component	Calorific Value (%) Yellow Food Sample
Moisture content	77.80±1.03
Ash	0.35±0.02
Fibre	0.43±0.02
Crude protein	2.09±0.04
Fat	0.52±0.03
Carbohydrate	18.75±1.08

Table 2: Proximate Analysis of Mineral Composition of *yellow eba*

Minerals	Mineral Composition (mg/100g) Yellow Food Sample
Iron (Fe)	7.77±0.57
Calcium (Ca)	22.80±0.46
Potassium (K)	301.02±1.46
Phosphorous (P)	12.70±0.35
Sodium (Na)	283.49±2.81

Table 3: Analysis of vitamin A and beta - carotene

Contents	***yellow eba*** **(µg/g)**
Carotene	131.25±0.79
Vitamin A	21.88±0.13

Source: *Laboratory Treatment, FST, OAU, 2018*

Discussion

The findings in the Table 1 revealed that, 2.1 % protein content contained in the food sample which is an evidence that *yellow eba* is enough to contribute to the proportion of protein intake of households as a better alternative source of protein supplement at this period when egg and poultry meat become too expensive and unaffordable to many households in Nigeria. About 0.5 % of fat content and high fibre content (0.4 %) was present in the food sample. The importance of this finding is that, the presence of fat content which believed to be higher than food sample made from *white gari* has the tendency to increase palatability of the food, absorbing and retaining flavor. More importantly, presence of fibre content in a food sample facilitating *faccal* elimination that is being helpful in dealing with diverticular diseases and cancer of small intestine *(Leed et al., 1979)*. It further shown that 0.4 % of ash content which is a good sign of better amount of essential minerals contained. Though the carbohydrate (18.8 %) content may be lower when compare it to that of *white eba* but it is an indication that the food sample is rich in nutrients and could supply the useful body requirement for human physiological and psychological growth since it has been proved to be highly nutritious. The result is not contradicting the finding at (FIIRO, 2006).

The result in the Table 2 revealed that *yellow eba* contains (22.80±0.46) mg/100g calcium, (301.02±1.46) mg/100g potassium, sodium (283.49±2.81) mg/100g, and appreciable level of phosphorous (12.70±0.35). The quantity of minerals contents contained in the food sample is a reflection that, *yellow eba* is a good source of essential minerals though deficient in iron (Fe) content

(7.77±0.57) mg/100g, which justifies the finding of *Salzman et al. (2013)* who discovered that yellow tuber cassava is a good source of nutrients but generally low in Iron (Fe) and Zinc (Zn) contents. *Yellow eba* as dietary food provides a number of desirable nutritional and health benefits such as vitamin A. It is therefore observed that *gari* is a widely consumable food item in many households in Nigeria and it implies that many growing up children and women have adequately accessed these mineral nutrients cheaply.

The result in the above Table 3 revealed that (131.25±0.79 µg/g) of beta - carotene and (21.88±0.13 µg/g) of vitamin A are present in the food sample. The indication of the result is that *yellow eba* supplies appreciable and significant amount of beta - carotene required for growth if consumed. Appreciable amount of beta - carotene is a precursor to vitamin A which is a clear indication for alleviating vitamin A deficiency in Nigeria.

Conclusion

Conclusively, *yellow eba* may be deficient in most other vitamins and minerals but it contains significant amounts of dietary fibre. Yes, it could be adopted as a food - based strategy approach to enhance massive intake of vitamin A for the purpose of improving nutritional intake status of individuals and reduces micro-nutrient malnutrition in our society.

Recommendations

- Acceptance of yellow cassava cultivar by farmers will boost protein intake of household farmers
- Consumption of *yellow eba* is evidently proved to be a good and cheap source of essential mineral nutrients required for human physiological and psychological growth, it is therefore recommended to be inclusive in our dietary food balance
- Due to high dietary benefits of *yellow eba,* polices that will enhance more participation in it production should be encouraged
- Inclusion of *yellow eba* into our food - based strategy will not only increase intake of vitamin A but reduces micro - nutrient malnutrition in our society

References

Adegbite, B. A. (2018). Effects of farmers' age on arable crop production in Southwest Nigeria. Unpublished Theses. Department of Agricultural Extension and Communication Technology, Federal University of Technology Akure.

AOAC. (1975). Association of official analytical chemists. Official method of analysis 10th ed., Association of official analytical chemists. Washington DC. USA.

Bouis, H. E., Hotz, C., McClafferty, B., Meenakshi, J. V. and Pferiffer, W. H. (2011). Bio-fortification: A new tool to reduce micronutrient malnutrition. *Food Nutr. Bull. 32: S 31-40.*

Egesi, C. N., Olojede, A. O., Okogbenin, E., Parkes, E and Kulakow, P. (2014). Naming, registration and official release of three new pro - vitamin A Cassava varieties in Nigeria. Annual Report Umudike, 2014: 1 - 7.

FIIRO. (2006). Cassava production, processing and utilization in Nigeria. Oshodi, Nigeria. Federal Institute of Industrial Research. 183-189.

Fashakin, J. B., Ilori, M. O. and Olarewaju, I. (2006). Cost and quality optimization of a complementary diet from plant protein and corn flour using a computer aided programming model. *Nigerian Food Journal. 9:123-126.*

Ijah, U. J. J., Auta, H. S., Aduloju, M. O. and Aransiola, S. A. (2014). Microbiological, nutritional and sensory quality of bread production from wheat and potato flour blends. *International Journal of Food and Science. 2 (1)*

Leeds, A. A., Bolster, N. R., Andrew, R. and Trustwell, A. R. (1979). Meal viscocity, gestic emptying the glucose absorption in rat. Proceedings of the Nutrition Society of Nigeria. 24th May. 44pp.

Maziya-Dixon,B. B., Akinyele, I. O., Sanusi, R. A., Ogunlana, T. E., Nokoe, S. K and Harris, E. W. (2004). Vitamin A deficiency is prevalent in children less than 5 years in Nigeria. Journal of Nutrition 136 (8) 2255-2261

Ogbuekiri, H., Egesi, C. N., Onyeka, J., Njoku, D. N., Edoh, N., Chimaobi, I., Okoro, M. and Udoka, P. (2014). Evaluation of total Carotene content, dry matter content and fresh root yield on selected high yellow root cassava genotypes at Umudike. Annual Report of National Root and Tuber Crops Research Institute. 15 - 18.

Salzman, A., Birol, B., Bouis, H. E., Boy, E., DeMoura, F. F. and Islam,Y. (2013). Bio-fortification: Byness towards a non-nurishing future. *Global Food Security. 2: 9-17*.

Gegios, A., Amthor, R., Maziya-Dioxn, B., Egesi, C., Mallowa, S., Nungo, R. (2010). Children consuming cassava as a staple food are at risk for inadequate Zinc, Iron and Vitamin A intake. *Plant Foods Hum Nutr. 65:1 64-70*.