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PROXIMATE ANALYSIS OF THREE DIFFERENT VARIETIES OF BAMBARA NUT *vigna subterranean* SOLD IN DAMATURU

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Abstract

Bambara nut [vigna subterranean] is an indigenous Nigerian crop that is grown across the country and by extension cultivated by subsistence farmers throughout sub-Saharan Africa. Research findings indicate that the crop has nutritional and agronomic potential, but it remains scientifically neglected. The aim of this research is to evaluate the proximate

Keywords

Nutrient, Proximate, Malnutrition, Weaning, Legume Cereal,

INTRODUCTION

Bambara nut (*Vigna subterranean L,.Thouars*) is an indigenous Nigerian crop that is grown across the country (Adebowale *et al.*, 2013) though Bambara nut is grown extensively in Nigeria (Adebowale and lawan, 2013) it is one of the underutilized legumes in the country. Nigeria produced over 100,000 metric tons yearly, *(Asiedu, 2013).* In North Eastern Nigeria, Bambara nut is the third most important legumes after peanut and cowpea *(*Adebowale *et al ., 2013).* The cultivars had distinct color differences ranging from cream through brown, maroon to black, with variations in the seeds sizes and seeds coat

composition of three different varieties of Bambara nut [white, black and red]. Soxlet extraction method was used to determine the fat contents and the following results were obtained; white has [7.02%], black [5.79%],and red [3.22%]fats respectively. Kjeldahl method were also used to determine the protein content and the following results were obtained; white [19.05%], black [18.32%], and red [3.20%] respectively. It is recommended that, based on this analysis the white variety should be planted because it has more nutritive value than the other varieties of Bambara nut. It is also recommended that further studies should be carried out on the effect of fermentation, which reduces anti-nutrient in legumes.

thickness. Bambara nut seeds makes balanced food as it contains sufficient quantities of carbohydrate, protein and fats with relatively high proportion of lysine and methionine as percentage of the protein, despite it nutrient composition, it is nutritional superior to many legumes and is the preferred crop for many local people (*Brought and. Azam-Ali,2011*).

Bambara nut is a rich source of protein (20-25%) and its seeds are valued for their nutritional and economic importance, it contains about 60% carbohydrate. Its protein is reported to be higher in the essential amino acids methionine than other grain legumes and contains 6-12% oil when is half of peanuts. The gross energy value of Bambara nut is greater than that of other common pulses such as cowpea and pigeon pea *(FAO, 2010*). Legumes are nutritious foods and substitute for animal protein arises from the knowledge of the functional properties of the seed flour and other products. In Africa, mal nutrition is prevalent due to lack of sufficient animal protein, hence the search for alternative sources of protein from lesser-known legumes in lieu of expensive and scarce animal protein (*Adebowale and Lawal, 2013*).

Madamba (2012) reported good indications of the possible use of food of plant origin to overcome the problem of shortage of foods of animal origin. Therefore, the use of legume seeds may be the beginning of a series of formulations which lead to a substantial drop in dependency of animal

sources for nutritious foods. Unfortunately, legume seeds contained anti nutritional factors like enzyme inhibitors, phytates, oxalates, saponins and polyphenolic compounds, all of which limit their utilization (Liener, 2011). Although, remarkable improvement in the nutritive value and quality of legume seeds have been achieved through dehulling, heat treatment, germination, fermentation, soaking and partial hydrolysis of proteolytic enzyme (Basu *et al.,* 2012). As part of the efforts made to solve the problem of low protein intake in Nigeria, nutritionists have advocated increase consumption of food legumes, such as *Vigna unguiculata* and *Glycine max* in campaign.

In North Eastern of Nigeria freshly harvested pods or seeds are cooked shelled and eaten as snacks (Ijarotimi and Esho, 2014) or milled into nutritious flour used for preparation of acceptable shelf stable food products such as extruded "moin moin "analogue, called "Okpo" which is very popular among the Igbo tribe of the Eastern Nigeria (Ijarotimi, 2014) but cannot be keep for more than 12hours. Since Bambara nut is very nutritious and of economic importance, it could be utilized in the development of more acceptable shelf stable food products such as extruded snacks. Presently, the common consumed traditional snacks are produced by germination, frying, roasting, boiling, baking, drying-These include snacks such as akara, okpa, dodo, dodo-ikire, moinmoin, cassava chips, tapioca, Massa, melon cake, etc. (Liener, 2010).

Some of the traditional snacks are unhygienic ally produced and package and not shelf stable, keeping only for few hours or days at ambient temperature. So, Bambara nut could be utilized in the production of more shelf stable, hygienically processed, well packaged and acceptable product such as extruded snacks. Formulation and development of nutrious weaning food from local readily available raw material have received a lot of attention in many developing countries (FAO. 2012).

There are many plants that produce their reserve food in form of oil; these plants store their food either in seed or in their fruits. These seeds or fruits may be edible or non-edible (Basu, 2011). Some of them are useful in many aspects, example: in production of soap, or cosmetics, some are essentially grown for human consumption. The seed that contain oils are called oil seed. Fats and oils have found their ways into almost all the activities of

man. The main sources of these fats and oils have always been from animals and plants. While fats are obtained from animals like fishes etc. The oil from plants and animals are collectively called "fixed oils", while the oils from plants are more precisely referred to vegetable oil, and can be isolated from plants like the oil palm, olive, soya bean, cotton, groundnut, coconut, Bambara etc. There are also, the essential or ethereal oil which are volatile and found in some plants (Thours, 2012).

Previously, the only oil and fats used by man were those obtained from animals. Experiments to find suitable alternatives to animal oil and fats were made in 19th century when population of Europe was expanding so rapidly that there were insufficient animal oils and fats to meet the growing demand. Biological seeds contain oil and more research works are carried out on them. Fats and oils are essential for good health. These oils can be utilized as edible fats, for salad, cooking oil, margarine and confectionary purpose (Paul *et. al* 2008) Presently in Nigeria, Industries depend on palm oil, groundnut oil and beni-seed oil for vegetable cooking oil, soaps, cream and margarine manufacture. There is need to provide other sources of oil for these productions such as from Bambara nut seed (Duke *et al*., 2011).

Mal nutrition has become a major health problem in the developing countries and has contributed to infant mortality, poor physical and intellectual development in infant and lower resistance to diseases (Begemann, 2012) Weaning food plays a vital role in the growth, development and mental health of children. During this period children need nutritionally balanced, calorie-dense supplemented food in addition to mother milk (Brink and Belay, 2014). The quality and quantity of nutrient present in volume of milk, produced by healthy lactating mothers has been found to be adequate in meeting the baby's nutrient and energy requirement for the first six months of life .As the child's need for nutrients increases there is need to provide another complementary weaning food of high biological value to supplement the breast milk. The occurrence of protein energy mal nutrition among children of North Eastern of Nigeria is as a result of the quality of the weaning foods consumed as these weaning foods mainly mono cereals, starch, roots and tubers. Weaning food for infants in developing countries requires proteins, energy, vitamins and minerals (FAO. 2010). These can only be obtained by combining the local

foods available such as cereal and legumes as composite weaning foods, which will have high nutrient density. This has been suggested by the integrated child development scheme (ICDS) to combat mal nutrition among mothers and children of low socio-economic groups.

Cereals are deficient in lysine and tryptophan but have sufficient sulphur containing amino acids which are limited in legumes, while legumes are rich in lysine, supplementation of cereals with legumes‟ is beneficial as the nutritive value of the final product is improved (Ijarotimi, 2014). With the potential of Bambara nut not being used as a snack, it can also be used in preparation of weaning food, and then it is important to screen the various varieties of Bambara nut for the proximate composition.

The aim of this research is to determine the proximate analysis of three different varieties of Bambara nut sold in Damaturu, such as: protein content, crude fat, ash contents, moisture, crude fibre and carbohydrate.

Vigna subterranea (also known by its common names: Bambara nut, Bambara bean, Congo goober, earth pea, ground-bean, or hog-peanut is a member of the family Fabaceae (Lineman, 2012). The plant originated in West Africa (the Bambara people are found in southern Mali, Guinea, Burkina Faso and Senegal). Vigna subterranea ripens its pods underground, much like the peanut (also called a groundnut). They can be eaten fresh or boiled after drying (Adebowale and Lawal, 2013). Scientific classification Kingdom: Plantae, (unranked): Angiosperms, (unranked): Eudicots, (unranked):,Rosids, Order: Fabales, Family: Fabaceae, Genus: Vigna, Species: V. subterranean.

VARIETIES

The crop is indigenous to Sub-Sahara Africa and there has been limited research into developing new varieties so all varieties are considered to be traditional. They appear in colors of black, white, cream, brown, red and mottled. Other varieties from Burkina Faso are also grown (Amadou *et al., 2010*). Several varieties are recognized in Africa differing in the shape of the leaves and the size, hardness and the color of the seeds. The greatest variation is found in Togo and Zambia (Barimalaa and Anoghalu, 2013). No cultivars of Bambara groundnut have been named, but genotypes are distinguished on the basis of seed attributes (color, size, hardness) and

plant form (bushy or spreading). Sometimes names are based on the location where the seed was collected (Doku and Kakari, 2011)

Nutritional value.

Bambara nut seeds contain 63% carbohydrate, 19% protein, and 6.5% fat, *(Linnemann, 2012)* the gross energy value of Bambara nut seed is greater than that of other common pulses such as cowpea, lentil (lens esculenta) and pigeon pea (cajanus cajan) *(FAO, 2012)* Dekock provide the following nutritional breakdown: carbohydrate 54.5-69.3%, protein 17-24%, and fat 5.3-7.8%. Bambara nut is a good source of fibre, calcium, iron and potassium. The red seeds could be useful in areas where iron deficiency is a problem, as the cream seeds. Often, it is the cream white seed. Bambara nut which are more sought after and command up to a 10% premium in Ghana *(Goli et al, 2012)*. Bambara nut has the potential to provide a balanced diet in areas where animal protein is scarce and or expensive and where the cultivation of other legume is risk due to low rain fall. Bambara nut compares favorable in nutritional status with other well-known and highly commercialized because information on nutrients contents and anti-nutritional factors was presented in a paper from Nigeria on the nutritional effects three traditional processing methods *(Ijarotimi and Esho, 2014)*. Fermentation improved the mineral composition, but had little effect on the amino acid contents and decreased the anti-nutritional factors, Oxalate, tannic acid, phytic acid and trypsin.

Table: 1 Nutritional status of Bambara compared to other common legumes.

Nutrients	Banbaranut	Soyabean	cowpea	Chickpea
Calories	390	416	333	364
Protein %	21.8	36.5	23.6	19.3
FAT %	6.6	19.9	0.8	6.0
CHO %	61.9	30.2	60.0	60.6

Source: (Ijarotimi and Esho, 2014)

CHEMICALS AND REAGENTS.

All chemicals and reagents used were of analytical grade. Petroleum ether, copper 11 sulfate, sodium hydroxide, hydrogen chloride 1.25% sulphuric acid, boric acid, 1.25%sodium sulphate

SAMPLES COLLECTION

Bambara nut red, black and white (*vigna subterranean*) were obtained from Damaturu Yobe state of Nigeria. The Bambara nut seeds were selected, cleaned and sorted to remove all foreign materials such as dust, dirty, and immature seed. The varieties selected are white, black and red typed for the Bambaranut.

Determination of moisture content.

Sample was weighed, evaporated and oven dried for about 3hrs and weighed again. The difference between the weight of the sample before and after drying is taken as the ratio of the weight of sample taken before drying and expressed as percentage of the whole sample.

Ash content determination(Using crucible and muffle furnace).

Organic components of a food sample were not stable at high temperature while inorganic components (such as metals) are and as such the latter are left behind after a strong heating. Therefore, the ash content estimates the amount of mineral elements present in the sample.

Determination of fat content(Using soxlet extractor).

In this method, the sample was treated with concentrated HCl and heated on a boiling water bath to hydrolyze the sample for about 30minus after the hydrolysis was completed, the fat would be extracted using diethyl ether and determined. Ethanol is also added to precipitate all polar components out to aid extraction.

Crude protein determination(Using kjeldahl apparatus).

When the sample was neutralized with a standard alkali and the formaldehyde was added, the added formaldehyde binds to the free amino group of the proteins to form methyl derivatives which increase the titratable acidity of the neutralized sample and the alkali used to reach the end point was stoichiometrically proportional to the protein content.

RESULTS AND DISCUSSION :

Table 2: shows the results of proximate analysis of three different varieties of Bambara nut

Sample ID	Fat (%)	Protein (%)	Moisture (%)	Fibre (%)	Ash (%)	Carbohydrate (%)
White	7.02	19.05	6.05	5.21	4.18	58.49
Black	5.79	18.32	5.83	5.08	3.85	61.13
Red	3.22	3.20	6.17	4.94	3.94	78.53
Methods	Soxhlet	Kjeldahl	Oven-Drying	Furnace	Furnace	Difference

The result shows that Bambara nut has great potential for incorporation into various human foods where it could provide useful plant protein, fat, fibre and carbohydrate. Considering result of Bambara nut, in fat, the white variety contain the higher value (7.02%) than the other varieties as shown in table 2, likewise value for protein, crude fibre and ash content, showed the white variety had higher value (19.05, 5.21 and 4.18%) compared to other varieties. Indeed, in moisture content, the red variety had higher moisture content with 6.17%.

The high protein content of 19.05%, 18.32%, 3.20% of the three samples suggests that it could be used in the management of protein deficiency cases such as in Kwashiorkor. Bambara nut crude fat is very high compared to most legumes *(Ijarotimi, 2014)*.

CONCLUSION AND RECOMMENDATION.

Base on this study, Bambara nut may be used by people with diabetes and obesity, by virtue of its protein, and fibre contents. The relatively high carbohydrate content may not have significant effect due to the fibre content, which can weaken the absorption of sugar, reduces its (sugar) response and increase insulin sensitivity. The results of this study indicate that the Bambara nut is rich in proteins, fats and carbohydrates and are therefore inexpensive source of macronutrients which can be used in

intervention programme aimed at alleviating protein-energy malnutrition. The finding may therefore change the neglecting attitude toward Bambara nut to improve production, utilization and industrialization

RECOMMENDATIONS.

Based on this study, the following recommendations were made;

- It is recommended that, based on the analysis,the white variety should be planted because it has more nutritive value than the other varieties.
- Further studies on cultivation of the Bambara nut for commercial purpose should be undertaken since the plant grown well in arid conditions such as large scales cultivation in the face of climate changes will enhance food availability.
- It is recommended that further studies should be carried out on the effect of fermentation, which reduces anti-nutrient in legumes.

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