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Investigating the nutrient composition and anti-nutritional factors of 'Akidi' (*Vigna unguiculata unguiculata*)

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Abstract: *The chemical and anti-nutritional composition of a locally grown, underutilized legume 'Akidi'(Vigna unguiculata unguiculata) was investigated, with the aim of creating awareness on its nutritional importance, diversifying food choice and increasing household food security. 'Akidi' seed was procured from a local farmer from Nsukka in Enugu State, Nigeria. Dehulling and boiling were the two treatments applied. The samples were analyzed for proximate, mineral and anti nutritional compositions. The result revealed no difference in the protein content of whole and dehulled samples (22.8%), while boiling slightly reduced the protein content to 18.3%. Highest moisture of 12.4% was observed with the boiled sample. Crude fiber content of 'akidi 'was 2.2%, 1.3% and 1.2% for raw, boiled and dehulled samples, respectively. The anti nutritional factors (phytate, oxalate and tannin) contents of 'akidi' were minimal except saponnin which was found to be 4.80% for whole sample and was reduced to 3.6 and 3.0 % on dehulled and boiled samples, respectively. The analysis also revealed that 'akidi' seed contains low magnesium, potassium and sodium but rich in calcium and iron. Iron content of 14.6 mg, 13.1 mg, and 11.4 mg were obtained for whole, boiled and dehulled samples, respectively. Processing enhanced the carbohydrate and energy content of 'akidi'. Carbohydrate content increased from 59.7 % for whole 'akidi' to 62.6 % and 65.2 % for dehulled and boiled, respectively. While energy contents of 344 cal, 357 cal and 349 cal were obtained for whole, dehulled and boiled samples. 'Akidi' seed was low in anti nutritional factors and can serve as good sources of protein, energy and iron when adequately consumed.*
Keywords: *'Akidi', proximate, anti-nutrient, dehulling, boiling*

I. Introduction

Legumes constitute the second largest family of seed plant and contain about 600 generation with 11,000 species [1]. Legume seeds are important item in our diets, rich in calories, protein and some other nutrients. Common bean (Phaseolus vulgaris L.) is a traditional food in the human diet, as it is low in fat and rich in proteins, vitamins, complex carbohydrates, and minerals. In addition to contributing nutritional requirements, consumption of dry beans has been linked to reduced risk of heart disease [2], and cancer [3].

However, legumes such as soybean and groundnut are very rich in oil, their oil content is about 3% of the total weight [4]. Oil seed legumes are good source of oil used for household cooking and industrial processes, residues procured after oil extraction is rich in protein and can serve as animal feed [5].

Furthermore, Lentil seeds are used as commercial starch for textile and printing industries likewise starch from chickpea used in manufacturing of plywood [6]. According to the same source, black gram seed contains a substance that is used in food processing industry as emulsifiers and stabilizers for foams. Legume shells, especially peanut shell is used as fuel, filler for fertilizers, mulch for growing polishing steel and aluminum insulation for building [1].

Food legumes are indispensable to vegetarians and health conscious people prohibited from excessive intake of animal proteins. In addition to its numerous uses, legumes like lupins and seaweeds are found in patent medicines, stems and leaves of some legumes like cowpea have high concentration of malaic, malonic, citric and oxalic acids that are used in medicine [7]. Legumes contains appreciable amount of important minerals such as calcium and iron [8]. The calcium content ranges from 58 to 287 mg/100g while the iron content is about 2.5 to 10.5 mg/100g [9].

Food legumes contain anti-nutritional components (lectin/haemagglutanin, saponnin, tannin, phytate, polyphenol, oxalates etc), which hinders the body from digesting the nutrients in pulses. These toxins cause food poisoning to human beings and animals [10]. According to Olusanya [3], legumes contain some toxic components such as anti-trypsin factors which impair the digestion of proteins and hence prevent its efficient utilization. Fortunately many of these toxic components are destroyed by heat [3].

Recently, there is urgent need to eradicate extreme poverty and hunger by the year 2015 as the goal number one of the Millennium Development Goals (MDGs), in view of the present situation it is necessary that healthy foods are made available on peoples table. Protein –Energy Malnutrition (PEM) in developing countries and among vegetarians has not aborted; poverty and low income among majority of the population especially in developing countries like Nigeria have prevented the consumption of adequate diet rich in animal proteins.

Legumes remain the major and sometimes the only source of protein for the majority of the population in Nigeria [11]. Obviously, there are some well-known legumes (cowpea, soybean, pigeon pea, common bean, oil bean seed, etc) which are already in existence, identifying some lesser-known food legumes that will help for diversification in food choice will be most appropriate in alleviating protein –energy malnutrition among children and women (the most vulnerable). It is observed that some lesser known food legumes are not well utilized due to prejudice and some social and cultural taboos linked to their consumption. As a matter of fact, directing research towards identifying and evaluating the nutrient content of these foods will help create awareness on the nutritional importance of some of these foods, improve their utilization and consumption thereby boosting household food security. The present research work is therefore designed to investigate the nutrient (proximate, anti-nutrients and mineral) compositions of a locally cultivated food legume 'Akidi' (Vigna unguiculata unguiculata).

II. Materials and methods

1.2.1 Collection of samples:

Akidi seed was procured from a local farmer in Nsukka, Enugu state. Seeds were carefully picked, cleaned and shared into three equal portions. One portion was soaked for 15 minutes, manually removed the seed coat, dried at 60^0C for 24 hrs and then ground to fine powder, the second portion was washed boiled to softness, dried at 60^0C for 24 hrs, while third portion was ground to fine powder wholly. The different flour samples were stored separately in an air tight container for analysis.

1.2.2 Chemical analysis

Moisture content of the samples was determined by air oven method (Gallenkamp). The protein content of the samples was analyzed using Kjeldahl method as described by Onwuka [1]; crude lipid was determined using soxhelt extraction method; ash content was determined by heating the sample in a muffle furnace at 550oc for 4 hrs; crude fibre content was determined using Saura-Calixto et al methods [13], The gross energy of sample materials was estimated according to the methods of Osborne and Voogt [14].

1.2.3 Determination of mineral content

Potassium and sodium were determined by digesting the ash of the 'akidi' with phechloric acid and nitric acid, readings were taken on Jenway digital flame spectronic 20 [15]. Calcium, magnesium and iron were determined spectrometrically by using buck 200 atomic absorption spectrometer [16], and compared with absorption of standards of these minerals.

1.2.4 Determination of anti-nutrients

Phytate was determined using the method of Griffith and Thomas [17]by titration with ferric chloride solution. Oxalate was determined by extraction with water for about three hours and standard solutions of oxalic acid was prepared and read on spectrophotometer (spectronic 20) at 420 mn. Tannin content was determined by extracting the husk with a mixture of acetone and acetic acid for five hours, measured its absorbance and comparing the absorbance of the extract with the absorbance of standard solutions of tannic acid at 500 nm on spectronic 20 [18]. Saponnin was determined spectrophotometrically and the absorbance read at 380 nm on a spectrophotometer and compared with absorption of standard saponnin solutions at 380 nm [19].

III. Results and discussion

The proximate composition of the different 'akidi' flour samples is presented in Table 1. The result revealed that the protein content of 'akidi' was 22.8% for both whole and dehulled, while boiling reduced the protein content to 18.3%. Highest moisture was observed in boiled sample while lowest moisture content was observed with dehulled sample probably due to the treatment applied when drying, Fat content of 'akidi' was found to be slightly lower in whole sample (1.5%) than in the processed samples (1.7%), may be due to the utensils used in processing. Fiber content was reduced on processing from 2.2 % for whole to 1.3% and 1.2% for dehulled and boiled, respectively. 'Akidi' seed was found to be low in magnesium, potassium, sodium and calcium but contains appreciable amount of iron (14.6).

The result of the proximate composition of whole, boiled and dehuled 'akidi'(Vigna unguiculata unguiculata) in comparison with some other legumes is presented in Table 2. From the Table It was observed that 'akidi' contain the same protein and fat level with pigeon pea [7]and mungbean [20]. The iron contained in 'akidi' seed was found to be higher than that contained in pigeon pea, soybean, groundnut, and cowpea as reported by Golpalan et al, [7] as well as mungbean based on the findings of Agugo and Onimawo [20].

The level of anti-nutritional factors present in 'Akidi' (Vigna unguiculata unguiculata) is presented in Table 3. Except for the saponnin value which was moderately high, the level of the anti- nutritional factors was low and cannot constitute any hazard to other nutrients from other sources. However, consumption of food rich in saponnin helps to bind both cholesterol and bile salt that are naturally released into the gastro-intestinal tract [GIT], again saponnin minimizes the absorption of cholesterol from food into the blood stream [21]. There was slight reduction in values obtained in dehulled sample, showing that removal of seed coat of 'akidi' leads to reduction in anti- nutrients.

Figure 1. underutilized akidi seed

Table 1. Proximate composition of 'Akidi' samples

Samples	Moist (%)	Pro (%)	Fat (%)	Fibre (%)	Ash (%)	CHO (%)	Food energy (g/cal)	Calcium (mg)	Magn. (mg)	Pota. (mg)	Sodium (mg)	Iron (mg)
A	11.8	22.8	1.5	2.2	2.0	59.7	344	15	0.4	0.6	0.3	14.6
B	10.7	22.8	1.7	1.3	0.9	62.6	357	12	0.5	0.5	0.2	13.1
C	12.4	18.3	1.7	1.2	1.2	65.2	349	13	0.5	0.5	0.3	11.4

A – Whole 'akidi' flour, B- dehulled 'akidi' flour, C - Boiled 'akidi' flour

Table 2. Proximate composition of 'Akidi' in comparison with other legumes

Legumes	Moist (%)	Pro (%)	Fat (%)	Fibre (%)	Ash (%)	CHO (%)	Food energy (g/cal)	Calcium (mg)	Magn. (mg)	Pota. (mg)	Sodiu m (mg)	Iron (mg)
Akidi	11.8	22.8	1.5	2.2	2.0	59.7	344	15	0.4	0.6	0.3	**14.6**
#Pigeon pea	11.5	22.3	1.7	7.8	-	57.6	339	73	-	-	-	2.3
#Soybean	8.1	43.2	19.5	3.7	-	19.5	4.30	240	-	-	-	10.4
#Groundnut	8.4	25.4	40.1	6.0	-	26.1	585	90	-	-	-	2.5
#Cowpea	12.4	24.1	1.0	5.0	-	54.5	345	77	-	-	-	8.6
*Mungbean	9.30	22.9	1.45	8.95	3.43	63.38	347	130	-	-	-	4.23

Golpalan et al (2002), *Agugo and Onimawo (2009)

Table 3. Anti-nutritional composition of 'Akidi' Samples

Anti nutrients	A	B	C
Phytate	0.2	0.3	0.1
Oxalate	2.4	2.1	1.8
Saponin	4.8	3.2	3.4
Tannin	0.7	0.4	0.6

A – Whole 'akidi' flour, B- dehulled 'akidi' flour, C - Boiled 'akidi' flour

IV. Conclusion

The present research work revealed that 'Akidi' seed is low in anti nutritional factors and can serve as good sources of protein, energy and iron when adequately consumed, as it contains appreciable amount of these nutrients.

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