Determination of Proximate and Mineral Compositions of White Cowpea Beans (*Vigna Unguiculata*) Collected From Markets in Minna, Nigeria

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Abstract— The proximate and mineral composition of white cowpea beans (*Vigna unguiculata*) obtained from three different markets in Minna, Nigeria, was determined in this study. White cow pea beans were collected from three markets in Minna, using simple random sampling and analyzed for proximate and elementary composition by standard procedures. The beans samples from Maikunkele had the highest moisture (6.20±0.20%), crude fiber (3.26± 0.52%) and lipid content (4.21± 0.36%).Carbohydrate content was found to be highest in sample from Kure market (62.68± 0.58%). The various samples were also found to be rich in mineral compositions. All the samples were observed to have high potassium content from the mineral analysis, with sample from Kure having the highest (741.15±0.99mg/100g). Calcium, sodium and iron were also present in appreciable quantity. Copper had the least elemental composition (0.91±0.36 to 1.02±0.43mg/100g) in all the samples. The results showed that there is a significant difference (P> 0.05) in the proximate and mineral composition of some of the cowpea beans that are found in the markets studied. The white cowpea beans in Minna are highly nutritious, hence good for human and livestock consumption.

Index Terms— cowpea beans, proximate, mineral, Bosso, Mekukele, Kure.

1 INTRODUCTION

The pertinent role played by cowpea as food substance for both man and animals cannot be overemphasized [1]. Cowpea (*Vigna unguiculata*) is a well known leguminous crop, which is one of the most important sources of protein in the diet of animals and man. It is also known to have a high nutrient content with a high dry seed protein content of 25% which is highly digestible compared to other legumes [2]. Unlike other leguminous grains such as soya beans and groundnuts which are oil-protein seeds, cowpea is starch-protein seeds and offers a wider pattern of utilization than any other legume in Africa [3], [4] and [5]. Cow pea seeds are boiled and consumed alone or combined with other foods such as rice, yam, maize and plantain. They can also be processed into paste in the preparation of various traditional foods [6].

The cow pea is one of the various species of the widely cultivated genus vigna. Four species are recognized, of which three are cultivated [7] and [8]. They are well adapted to drier region of tropic, where other food legumes do not perform well [2]. It also has the useful ability to fixe atmospheric nitrogen through it root nodules and it grows well in poor soil with more than 85% sand and less than 0.2% organic matter and low level of phosphorus.

Various studies have reported the proximate compositions of cowpeas found in different parts of the world [9]. [9] in his study on five varieties of cowpea consumed in samaru in Nigeria, reported crude protein content of 19.84±0.18%, lipid (3.46±0.05%), carbohydrate content of 60.57% and crude lipid of 2.42%. In a similar study, a moisture and crude fiber content of 5.08%, 14.15% respectively were also reported by [4]. Thus most of the values reported differ depending source and variety of the cowpea seeds used for the study. [10], had 24.13%, 4.37%, 0.97% and 56.6% as the composition of crude protein, crude fat, crude fibre and carbohydrate respectively in the proximate analysis of cow pea seeds. Similarly, [4] reported crude protein content of 17.91%.

Sequel to the indispensable use of cowpea as a nutritive food substance in human and animal diets, various researchers have explored the proximate and mineral compositions of local varieties of this grain as an alternative to other dietary food substances [7] and [12]. Due to its strategic significance in Nigeria and the world at large, research on the proximate composition and long term genetic improvement are going on within various laboratories. The accomplishment of some of these studies has been reported in various literatures [6], [7] and [13].

Inspite of the foregoing, there is scarcity of information on the proximate composition of varieties of cowpea beans seeds found and sold around Minna in Nigeria. Determination of proximate and mineral composition of white cow pea beans sold in markets in minna therefore become pertinent, hence the purpose of this present study.

MATERIALS AND METHOD

Sampling method

White coat Cowpea grains were used in this study. The cowpea beans were collected from three different markets (Mai-

kunkele, Bosso and Kure) all in Minna, using systematic random sampling. The samples were conveyed to the laboratory in a clean polythene bag.

Preparation of samples

The foreign particles present in the grains were carefully removed by method of hand picking. The various samples were ground using agate mortar. The mortar was decontaminated by washing with distilled water and soap after each sample was ground.

Proximate and Mineral Analysis

The proximate and mineral analysis was done according to Standard procedure [14]. All the chemicals used in this study were of analytical grade, unless stated otherwise. The mineral compositions were determined using atomic absorption spectrometer and flame emission spectrometer.

Determination of moisture content.

Procedure: the moisture dish was accurately weighed. Approximately 1.0g of the sample was added and then reweighed. It was then kept in vacuum oven for five hours. The dish was then removed from the oven, cooled and reweighed. This was repeated until a constant weight was obtained.

Determination of Ash Content

Procedure: 5g of the sample was accurately weighed in a crucible which had been dried. The crucible was then dried in oven at 100°C. It was then transferred to muffle furnace and temperature increased to 550±5°C. This was maintained for 8 hours until a white ash was obtained. The crucible was removed from desiccator and weighed soon after cooling.

Determination of crude protein

Procedure: the crude protein was determined using micro-Kjeldah method as described by [14].

$$\% \text{ N (wet)} = \frac{(A-B) \times 1.4007}{\text{Weigh (g) of sample}} \times 100$$

A= volume (ml) std HCl × normality of std HCl

B= volume (ml) std NaOH × normality of std NaOH

Determination of crude lipid

Procedure: this was done gravimetrically. 5g of the sample was weighed into thimble. Extraction was carried out using petroleum ether (40-60°C) for 3 hours. The extractant was distilled off and the flask reweighed.

$$\% \text{ lipid} = \frac{\text{weight of lipid}}{\text{Weight of sample}} \times 100$$

Determination of total carbohydrate.

This was done conveniently by method of difference.

Total carbohydrate= 100-(% lipid + % ash + % moist + % protein)

Mineral analysis

The sodium and potassium content of the sample were analyzed using flame photometry while the level of calcium, magnesium, iron and some other trace element were determined using Atomic absorption spectrometry.

Method of data analysis

The data obtained from the study were analyzed using both descriptive and inferential statistical procedures. This was achieved using SPSS (16.0).

RESULTS AND DISCUSION

The result of the proximate analysis is represented in the table below.

Table 1: proximate composition of white cowpea beans (*Vigna unguiculata*) obtained from three markets in Minna.

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Parameter (%)	Bosso	Maikunkele	Kure
Moisture Content	5.20±0.95^{b}	6.20±0.20^{c}	4.80 ±0.17^{a}
Crude protein	23.30±0.50^{b}	21.21± 0.18^{a}	21.42± 0.52^{a}
Crude fibre	2.80 ± 0.26^{a}	3.26± 0.52^{c}	3.10± 0.95^{b}
Lipid	3.90± 0.35^{b}	4.21± 0.36^{c}	3.50± 0.11^{a}
Total ash	3.80 ±0.36^{a}	4.12± 0.11^{b}	4.50± 0.10^{c}
Carbohydrate	61.97±0.95^{a}	60.41± 0.36^{a}	62.68±0.58^{b}

Results are expressed as mean±SD for triplicate measurements. Values on the same row with same superscript do not differ significant at P<0.05

The result of proximate analysis (table 1) showed that the white cowpea seeds from Maikunkele market had the highest moisture content (6.20±0.20%) while those from Kure market had the least (4.80±0.17%). This implies that the cow pea beans obtained from Kure market are less susceptible to spoilage by microorganisms, during storage, hence can be stored for relatively long period of time when compared to others. The value for Maikunkele market was within the range of 93.30± 0.67 reported by [2], but less than that reported by [10].

Carbohydrate content, showed a range of 60.41±0.88% to 62.68±0.03%. The sample from Kure market had the highest value (62.68±0.03%) while the least value was from Maikunkele market (60.40± 0.36%).

Crude protein analysis of the samples ranged from 21.42% to 23.30%. This implies that the protein content from the various markets did not differ significantly. The beans from Bosso market recorded the highest amount. The values obtained in this study are higher when compared to that reported [4].

The crude fiber content obtained in this study showed that beans from Maikunkele market had the highest amount of crude fiber (3.26±0.52%). Beans from Bosso market had the least (2.80±0.26%). The fiber content obtained in relation to diet is adequate. The range of values obtained is within the range of that reported by [2].

Lipids play important role in diet as important energy source, and also aid the transportation of fat soluble vitamins (A, D, E, and K). The lipid content of all the samples were generally low ranging from 3.50± 0.11% to 4.21± 0.36%, corresponding to Kure and Maikunkele market respectively.

RESULT FROM MINERAL ANALYSIS OF THE SAMPLE

Table 3: Mineral composition of white cowpea beans (Vigna unguiculata) obtained from three markets.

Mineral content(mg/100g)	Bosso	Maikunkele	Kure
Sodium	80.16± 0.69[b]	78.12± 0.85[a]	81.70± 0.22[c]
Calcium	200.10± 0.21[b]	194.12± 0.12[a]	201.61± 0.53[c]
Potassium	733.03± 0.34[a]	740.01± 0.95[b]	741.15± 0.99[a]
Magnesium	194.01± 0.93[b]	195.02± 0.10[b]	190.22± 0.27[a]
Iron	10.11± 0.9[b]	9.80± 0.10[a]	9.88± 0.95[a]
Zinc	6.40 ±0.03[b]	6.80± 0.96[c]	6.10± 0.18[a]
Copper	1.02± 0.43[b]	0.91± 0.36[a]	1.00± 0.17[b]

Results are expressed as mean±SD for triplicate measurements. Values on the same row with same superscript do not differ significant at P<0.05

The results of mineral analysis of the various samples are shown in table 3 and fig. 4 above. The results showed a very high amount of potassium in all the samples analyzed. The amount of potassium obtained from Kure market (741.15±0.99mg/100g) was higher than those from the other markets. The results also indicate that the highest amount of magnesium in all the samples of study was observed in sample from Maikunkele market. The result obtained is within the range of that reported by [1]. It is however higher than 8.67±0.38 to 14.00±0.39 mg/100g reported by [9]. It is also clear from the analysis that the concentration of sodium in all the samples ranged from78.12±0.85 mg/100g to 81.70±0.22 mg/100g with samples from Kure market having the highest. The concentration of iron in the samples ranged from 9.8±0.10 to 10.11±0.90 mg/100g.

Other elements analyzed were calcium, iron, zinc and copper. The elemental composition of calcium in all the samples ranged from 194.01±0.93 to 201.61±0.53 mg/100g with samples from Kure market having the highest value, while the sample from Maikukele market had the highest amount of Zinc (6.80± 0.96 mg/100g).

Among the various elements analyzed, copper had the least composition in all the samples (0.91±0.16 to 1.00±0.17 mg/100g).

CONCLUSION

The proximate and mineral composition of white cow pea beans collected from three major markets in Minna(Bosso , Maikunkele and Kure) have been determined. The beans samples from Maikunkele had the highest moisture, crude fiber and lipid content while samples from Bosso had the highest crude protein content. Carbohydrate content was found to have highest value in sample from Kure market. The various samples were also found to be rich in minerals. Potassium was found to have the highest mineral composition in all the samples analyzed.

From the foregoing, it is clear that white cowpea seeds are highly nutritious food substance. The results obtained showed that the proximate and mineral compositions of cowpea seeds obtained from different markets in Minna did not differ much.

In conclusion, all the beans samples used in this study were found to be rich in diets. Based on the above, it is recommended that white cowpea seeds be used as food nutrient for human as well as livestocks, due to its high nutrient content. Cultivation of local varieties of white cow pea bean seeds should be priotized by indigenous farmer in Minna.

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