

Proximate Analysis and Elemental Composition of *Vigna membranacea* Seeds

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Abstract

This study was conducted to investigate the proximate composition and toxic metals composition of *Vigna membranacea* cultivated in Kano state, Nigeria. The results of proximate composition showed the presence of ash, protein, crude fibre, moisture, Lipid and carbohydrate. From the result obtained, carbohydrate was found to be the dominant nutrient in the seed, followed by ash content, then protein content, then moisture content, crude fibre and finally lipid. Elemental analysis revealed the presence of the following toxic elements: lead (Pb), Cobalt (Co), Nickel (Ni) and Chromium (Cr) with Chromium been the highest while cobalt was found to be lowest. For the non-toxic elements, Zinc (Zn) was recorded to be the dominant element, followed by Calcium (Ca), then Manganese (Mn), then Potassium (K), then Magnesium (Mg), followed by Iron (Fe) with Copper (Cu) been the lowest. The results obtained from the present studies could be a source of valuable information and a guideline for food scientists, researchers and even the legume consumers not only in Nigeria but all over the world where this seed is found.

Keywords: Proximate analysis, Elemental analysis, *Vigna membranacea* and seeds.

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1.0 INTRODUCTION

Vegetables make up a major portion of the diet of humans in many parts of the world and play a significant role in human nutrition, especially as sources of phyto-nutraceuticals: vitamins (C, A, B₁, B₆, B₉, E), minerals, dietary fiber and phytochemicals. Some phytochemicals of vegetables are strong antioxidants and are thought to reduce the risk of chronic disease by protecting against free-radical damage, modifying metabolic activation and detoxification of carcinogens, or even influencing processes that alter the course of tumor cells (Khairiah *et al.*, 2002). Vegetables in the daily diet have been strongly associated with overall good health, improvement of gastrointestinal health and vision, reduced risk for some forms of cancer, heart disease, stroke, diabetes, anaemia, gastric ulcer, rheumatoid arthritis, and other chronic diseases (Obizoba, 1998). A high vegetable diet has been associated with lower risk of cardiovascular disease in humans while Low vegetable intake has been estimated to cause about 31% of ischemic heart disease and 11% of stroke worldwide (Halliwell and Gutteridge, 1992). According to World Health Report unbalanced diets with low vegetable intake and low consumption of complex carbohydrates and dietary fiber are estimated to cause some 2.7 million deaths each year, and were among the top 10 risk factors contributing to mortality. The exact mechanisms by which vegetable consumption reduces human diseases have not yet been fully understood, however the general consensus among physicians and nutritionists is that phytonutraceuticals in vegetables are responsible for mitigating some of these diseases.

Toxic metals are example of heavy metals that variously defined to have higher atomic number (Norman, 1981), associated with little or no biochemical functions. However; they have many industrial and agricultural applications (Alloway, 1995) and are generally metallic of relatively high density with potential toxicity at low concentration (Holding, 2004). According to WHO (2014), toxic metals occur in trace amount and are at least five times denser than water, They are stable and persistent in environmental samples, hence bioaccumulates to pass up via food chain to humans. According to Alhassan *et al* (2012) sources of heavy metals are varied and include natural sources and all human activities, which have the possibility of polluting the environment, in other perspective, environmental toxic metals are mainly direct deposition from mining activities, industrial processes as well as waste water from domestic processes, in addition to agricultural practices (Madyiwa, 2006). Heavy metals contamination to agricultural soils could be through a variety of sources among which is land application of bio solids, fertilizers, livestock manure, agrochemicals (Pesticides), irrigation activities and atmospheric droplet. Worthy of consideration is accumulation of these metals in agricultural soils and possible negative impacts on soil fertility and large potential accumulation in crops for possible incorporation to human food chains (Gray *et al.*, 2003). Unlike the inorganic, the organic (alkylated) forms are readily taken up by body tissues and can be retained for a considerable length of time (Garrett *et al.*, 1992) this is due to their lipid solubility. The tissue penetrating power of organometals crown them more toxic to humans than the inorganic form (Carpenter, 2001).

Vigna membranacea is a leguminous beans belonging to the *Vigna* specie, although it is readily available in northern region of Nigeria, it is underutilized because of speculations that it has some anti-nutritional or elemental components which make it toxic. This study was therefore aimed at determining the proximate composition and the toxic minerals of *Vigna membranacea*.

2.0 MATERIALS AND METHODS

2.1 Collection and Preparation of *Vigna membranacea* seed

Fresh and apparently uninfected seeds of *Vigna membranacea* were collected from their natural habitat in Bari, Rogo Local Government area of Kano State on September, 2015. The samples were shade dried and identified by a plant taxonomist of the Department of Botany, Bayero University Kano, Nigeria. 200g of the seeds were dehulled and grounded manually using an aluminium mortar to fine flour, packaged and labeled appropriately.

2.2 Proximate Analysis

Ten gram (10g) of the flour was soaked in 100 ml of pre-boiled distilled water. The solution was shook vigorously and allowed to stand for 24 hours. It was then filtered using Whatman's No. 1 filter paper and concentrated by freeze-drying to solvent free extract. The proximate analysis of the seed extract for moisture, ash, fibre carbohydrate, crude protein and fat contents were determined as described by AOAC standard assay method (AOAC, 2005).

2.3 Elemental Determination

Five gram (5.0g) of the prepared samples were air dried, ground in an agate mortar and was placed in quartz crucibles for dry ashing and mineralized thermally in a muffle furnace at 450°C for 12hrs. The mineralized samples was then acid digested by dissolving in 20ml of 1:1 (v/v) concentrated HNO₃ and HCl acids in 100ml volumetric flask. The flask was then heated in an electro thermal heater with gentle swirling till digestion completed by evolution of white fumes. The cooled digests was filtered through Whatman No 1 filter paper into 50ml volumetric flask and was diluted to 50ml mark with de-ionized water. The heavy metals content of the samples were determined using the atomic absorption spectrophotometer (AAS) and calculated using the relation $y = mx + c$ from calibration of each metal standard (AOAC, 2005).

3.0 RESULT AND DISCUSSION

3.1 Results

Figure 1 presents the proximate composition of *Vigna membranacea* cowpea. The results revealed that processing had no significant effect ($P > 0.05$) on the following proximate composition in *Vigna membranacea* cowpea analysed: Crude protein, carbohydrate, ash, crude fibre and moisture contents. Carbohydrate was found to be the highest proportion with a percentage of 42.50 ± 0.02 , followed by protein with 21.22 ± 0.01 . The least is fat with percentage composition of 1.16 ± 0.01 .

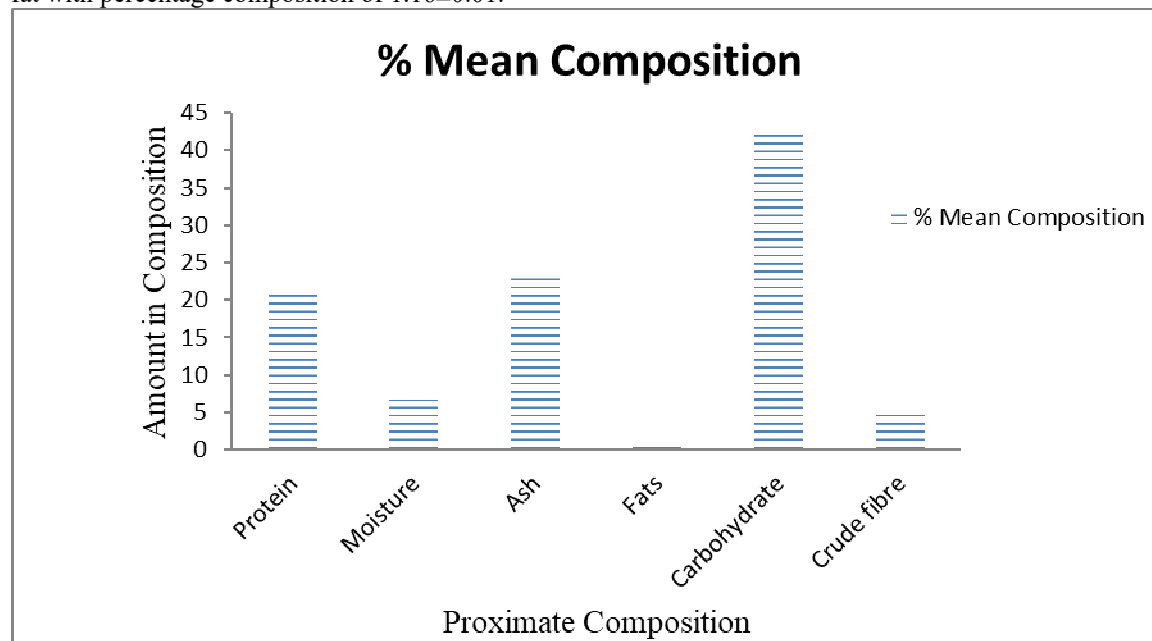


Table 1: Proximate Analysis of *Vigna membranacea* seed

Table 1 shows the mineral components of the *Vigna membranacea* per 100g of the sample. Zinc (Zn) was

observed to be dominant in the seed with an amount 172.23µg/100g, followed by other mineral element that are significantly in low quantity.

Table 1: The Table below Shows the Mineral Contents of *Vigna membranacea* in µg/100g

Pb	Zn	Mn	Fe	Cr	Cu	Ni	K	Ca
1.45±0.2	172.23±3.	5.83±1.1	3.09±1.3	3.09±1.1	1.52±0.2	1.92±0.1	4.44±1.0	6.94±2.1
1	2	0	5	5	1	0	5	0

3.2 Discussion

Diet must provide macro and micro elements. The moisture content is the loss on drying at oven temperature of 100°C. Besides water, the loss will include other volatile matter at 100°C. The samples had a moisture content of 7.89%. This moisture content is safe for storage the results for the moisture content of the seed was comparable with 4.85, 5.21 and 6.10 reported for *Colocynthis citrullus* from Akure *Cucumeropsis edulis prumus* and *amygdalus* seed flour respectively (Akpambang *et al.*, 2008). The result of the ash content yields 25.67% indicating that the seeds will be a good source of minerals. Since the ash content of a sample is a reflection of the minerals it contains therefore, pumpkin seeds are expected to be rich in minerals needed for good body development (Hamed *et al.*, 2008). The crude fat content showed that the pumpkin seeds contain a good amount of oil that can be exploited i.e (be refined to edible vegetable oil for domestic use). This value fell in the range reported for different species of legumes (Stevenson *et al.*, 2007). The recommended daily allowance (RDA) of fiber are 19 to 25, 21 to 38, 28 and 29%, for children, adults, pregnant and lactating mothers respectively. Thus the seeds can be considered as a valuable source of dietary fiber in human nutrition. Fibre rich foods are normally prescribed to diabetics for reduction of glycemic response to the food and consequently the need for insulin (Guillon and Champ, 2000). Legumes and cereals have relatively low mineral contents Legumes and nuts are rich sources of copper. The result obtained for copper is in accordance with the study of Opeolu *et al* (2010) investigated the mineral content of six varieties of beans that were taken from seven different regions in north-western Argentina.

4.0 CONCLUSION

The research revealed *Vigna membranacea* to be nutritionally rich. However, excess consumption of this seed as food by both humans and animals can lead to the fast increase of mineral element in the body which can result to metabolic diseases. Therefore the use of the seed as food should be minimized.

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