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Nutritional and Anti-Nutritional Composition of Strychnos Spinosa Seed Obtained From Zungeru Niger State

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ABSTRACT

The *Strychnos spinosa* seed were analysed to establish its proximate, minerals and anti-nutritional compositions using standard analytical methods. The seed, on dry weight basis, contains crude protein (6.40%), crude lipid (1.96%), ash (2.30%), available carbohydrates (66.86%), calorific value (310.68kcal/100g) and moisture (17.20%). The seed is rich in, potassium (1260mg/100g), magnesium (49.00mg/100g), iron (1.30mg/100g), sodium (20.60 mg/100g) and phosphorus (69.00mg/100g). Though, the seed also has high content of total oxalate (50.30 %) and phytic acid (198.25 mg/100g). The levels of various nutrient and mineral elements varied significantly, which indicates the potential of the seed to be harnessed for diverse application for value addition as health food provided that the anti-nutritional factors are tackled appropriately.

Introduction

The global overpopulation needs parallel increase in food and nutrition sources. Food security becomes vulnerable when it is only dependent on a few numbers of traditional crop plants and domestic animals. Food and nutrition security need to be addressed in the context of biodiversity, an important asset to domesticate new crops or improve the quality of traditional crop plants. Food biodiversity is defined as the diversity of plants, animals and other organisms used for food, covering the genetic resources within species, between species and provided by ecosystems (Johns and Eyzaguirre, 2007). Therefore, not only the quantity and energy contribution of foods are important to combat malnutrition but also their quality, including macro-and micronutrient content, and antioxidant activities. The gap between wild edible fruits and cultivated ones is wide and needs to be bridged by shedding more light on potential wild food biodiversity (Dhar et al., 2012).

Strychnos spinosa locally known as yilanchi by Nupe people of Niger State in Nigeria. It is a traditional indigenous plant, it is planted as shade tree, and grown up to 25m height with a denser down. The bark is smooth and grayish with young reddish branches, the leaves are velvety beneath when young (Abdullahi et al, 2003). The fruit is short pear shaped and can be eaten raw after it has matured or boiled before eating. Local indigenous vegetable are found to be good and affordable by low income earners in the society (Sara et al, 2008).

Materials and Methods

The fruits of Strychnos Spinosa were collected from Zungeru in Niger state. The fruit were separated from the seed. The seed were washed with clean water, dry and ground into powder form using electric grinder.

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The grinded samples were store in a well labeled air –tight container at ambient temperature for further analysis.

Proximate Analysis

The recommended methods of the Association of Official Analytical Chemists, AOAC (2000) were used for the determinations of moisture, ash, crude lipid, crude fibre and crude protein content. Available carbohydrate was estimated (by difference) using method described by James (2001). Calorific value (in kcal/100g) was estimated by multiplying the percentages of crude protein, crude lipid and available carbohydrate by factors of 4, 9 and 4 respectively and the product summed up (James, 2001).

Anti-Nutritional Analysis

The method reported by Ola and Obah (2000) was used for the determination of phytate and total oxalates. Hydrogen cyanide (HCN) and nitrate was determined using AOAC, (2000) method. The method described by El-Olemy et al. (1994) was used for the determination of saponin content.

Elemental analysis

The sample (0.5 g each) was put into Kjeldahl digestion flask to which 24cm3 of a mixture of concentrated nitric acid (HNO3), conc. H2SO4 and 60% HClO4 (9:2:1v/v) was added. The flask was allowed to stand over-night to prevent excess foaming (Sahrawat et al., 2002). The flask was put on a heating block and digested to a clear solution, cooled and the content filtered into a 50 cm3 volumetric flask. The solution was then diluted to the volume with distilled water. Blank solution was prepared in similar manner without sample being added. The solution was used for the mineral analysis.

The mineral contents (calcium, magnesium, iron, zinc, copper, manganese and lead) were analysed using AAS. Sodium and potassium were analysed using atomic emission Spectrometry and phosphorus was determined by

Colorimetric using Vanadomolybdate (blue) method (AOAC, 2000).

Statistical Analysis

Data generated in triplicates were expressed as mean ± standard deviation using SPSS version 16 statistical packages.

Results and Discussion

Table1. Proximate analysis of *S. spinosa* seed (mg/100g).

S/N	Parameters	Value
1	Ash	2.30±0.11
2	Crude protein	6.40±0.13
3	Moisture	17.20±0.62
4	Crude fat	1.96±0.50
5	Crude fibre	5.28±0.33
6	Carbohydrate	66.86±0.48
7	Calories (Kcal/100g)	310.68±0.70

Values are mean±SD of three determination

Table 2. Mineral composition of S. spinosa seed (mg/100g).

SN	Parameters	Value
1	Calcium	43.01±0.21
2	Potassium	1260.00±0.52
3	Magnesium	49.00±0.56
4	Sodium	20.60±0.30
5	Phosphorus	69.00±0.27
6	Iron	1.30±0.41
7	Zinc	1.01±0.26
8	Manganese	0.98±0.37
9	copper	0.26±0.19

Values are mean±SD of three determination

Table 3. Anti-nutritional composition of *S.spinosa* seed.

S/N	Parameters	Value
1	Cyanogenic glycoside	0.05
2	Nitrate	1.06
3	Oxalate	50.30
4	Phytate	198.25
5	saponin	3.70

The results of the proximate composition content of S. spinosa seed investigated are shown in Table 1. The moisture content of the seed is 17.20±0.62%. The value reported is low compared 71.50±2.10% for Mordii whytii seed reported by Adepoju, (2009). Low moisture content results in high shelf life during storage (Hassan et al., 2008). Protein deficiency may cause growth retardation, muscle wasting, abnormal swelling of the belly and collection of fluids in the body (Zarkada et al., 1997). The crude protein content of 6.40 ± 0.13% found in the seed of S. spinosa seed can be compared to 4.65 ± 0.33% for S. innocua reported by Bello et al. (2008). Protein is an important source of amino acids and is required for body development and maintenance (Pugalenthi et al., 2004). The ash content is 0.50±0.11% which is less than 4.65±0.33g/100g for S. innocua (Bello et al., 2008). The ash content is an index of mineral content (Aberoumand and Deokule, 2009). This shows that, S. spinosa seed contains low levels of minerals. The crude fibre content for the sample was 5.28±0.33%. It was reported that fibre in the diet reduces serum cholesterol level (Abolaji, 2007) and if in very high amount absorbs essential trace elements in the gut (Abolaji, 2007). The crude lipid content of S. spinosa seed was 1.96 ± 0.50% which is higher than 0.78±0.08% for S. innocua Bello et al., 2008. Lipids provide the body with more energy; approximately twice that of protein and carbohydrate and facilitate intestinal absorption and transportation of fat soluble vitamins (Dreon et al., 2005). The available carbohydrate content of the sample was 66.86 ± 0.48%, hence is comparable to 68.75 ± 0.89% reported for Parkia biglobosa reported by Bello et al., (2008). The calorific value of S. spinosa seed was 310.68±0.70 Kcal/100g, which is an indication that it could be an important source of dietary calories.

Table 2 presents the mineral composition of S. spinosa seed. The seed was rich in potassium, sodium, manganese, phosphorus and calcium. Hassan et al., (2008) reported that, plant based foods are usually high in potassium. The concentration of potassium contents obtained from this work was 1260.00± 0.52mg/100g. Potassium is essential in the maintenance of cellular water balance, pH regulation in the body and it is also associated with protein and carbohydrate metabolism (Onibon et al., 2007). The content of calcium value obtained from this sample was 43.01± 0.21 mg/100g. Calcium is very essential in blood clotting, muscle contraction and for the activity of certain enzymes metabolic processes (Atasie et al., 2009). Manganese content was 0.98±0.37 mg/100g. Manganese is desirable in the body as it supports the immune system, regulates blood sugar levels and is involved in the production of energy and cell and works with vitamin K to support blood clotting, and also helps to mitigate the effect of stress (Anhawange, 2004). Though the manganese content obtained from this work was small. Iron is an important element in the diet of pregnant women, nursing mothers and infants to prevent aneaemia (Oluyemi et al., 2006). The iron concentration obtained from this work was 1.30± 0.41 mg/100g. Deficiency of copper causes cardiovascular disorders as well as anaemia and disorders of the bone and nervous systems (Mielcarz et al., 1997). The content of copper concentrations in this study was 0.26± 0.19mg/100g. The phosphorus content obtained from this study was 69.00± 0.27mg/100g while sodium concentration was 20.60± 0.30mg/100g. Magnesium content was 49.00± 0.32mg/100g.

Table 3 shows the antinutritional factors present in the seed. The seed was very low in antinutritional factors such as cyanogenic glycoside (hydrocyanic acid), nitrate and saponin, with 0.05, 1.06 and 3.70 mg/100g respectively were below the established toxic level. While oxalate and phyate contents of 50.30 and 198.25 mg/100g respectively were said to be high; though the values were below the permissible limit established by WHO. However, it is known that high content of these antinutrients exert negative effects on the bioavailability of some mineral nutrient (Agbaire, and Emoyan, 2012). Therefore, the consumption of the seed cannot be considered safe since the toxicity level is yet to be established.

Conclusion

The S. spinosa seed can be considered a good source of protein, carbohydrates, calories and mineral elements such as potassium, sodium, magnesium, phosphorus and calcium. However, the seed also contains anti-nutrient content that may be harmful to health when ingested in high quantity. The non-essential substances are low indicating that little processing is needed before they can be consumed.

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