INORGANIC AND PROXIMATE NUTRITIONAL COMPOSITION OF COMMON BEANS IN NIGERIA

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ABSTRACT

Inorganic and proximate nutritional composition of five common Nigerian beans: Lima bean, Adzuki bean, African locust bean, Pigeon pea and white bean, were investigated. The proximate analysis results obtained show that the moisture content ranged between Lima bean (9.20%) and Pigeon pea (0.24%), Fat content ranged between Lima bean (12.84%) and Pigeon pea (3.68%) while crude fibre was obtained between the range of 5.54% (Pigeon pea) and 0.39% (African locust bean). Relatively high content of protein was recorded for nearly all the beans with the highest in African Locust bean (33.89%) and the least in Lima bean (26.06%). All the beans recorded almost the same percentage of carbohydrate, between the range of 54.79% (white bean) and 41.62% (Lima bean). Nearly all the samples recorded very low content of: Fe, Zn, Mn, and Cu but Ca ranged between 0.266 mg/kg (African locust bean) and 0.234 mg/kg (Pigeon pea) while Mg was obtained between the range 0.396 mg/kg (white bean) and 3.20 mg/kg (Pigeon pea).

Keywords: Legumes, Nutritive – value, health and beans.

INTRODUCTION

Legumes for food are probably as old as agriculture and civilization itself. Lentils are mentioned in the Old Testament, and beans figure in designs on pre-Colombian pottery from New World archaeological sites (Welch, et al., 2000). Remains of beans have been found in diggings as old as 800BP in the Guitarrero cave in Peru. In both the old and the new Worlds, legume consumption has evolved in conjunction with cereals: lentils, chickpeas, pigeon peas, grams and cowpeas with wheat, rice, millet and sorghum in the old world, common beans and other *Phaseolus* species with maize in the new world (Beebe, 2004). Thus, the dietary role of legumes should be considered in this importance.

Beans could serve as functional food because they contain a number of bioactive compounds such as enzyme inhibitors, lectin, phytates, oligosaccharides and phenolic substance that may play metabolic roles in humans and animals that frequently consume this food (Diaz-Batalla, et al., 2006). The consumption of beans has been associated to several health benefits like reduction of cholesterol level (Rosa, et al., 1998), and coronary heart diseases (Anderson, et al., 1999). Favorable effects against cancer, decrease of diabetics, obesity, high antioxidant capacity, antimutagenic and antiprofilerative effects (Mario, et al., 2009). Developing nations, for example, Nigeria have shown mortality rate of 10 – 20 times that of developed countries due to protein – energy malnutrition (PEM) and it has been estimated that 800 children might die from malnutrition before age of 4 years (Adeyeye and Adamu, 2005).

LITERATURE REVIEW

The quality of bean seed is determined by the protein content, amino acid composition, digestibility and presence of anti-nutritional factors (Shellie-Desert and Bliss, 1991). Dry bean is considered a good source of N and protein, for example, a serving of bean (approximately 90g or ½ cup cooked beans) provides approximately 7 to 8 protein or about 15% of the recommended dietary allowance for protein for 70 kg adult (Marie et al., 2009). The high nutritional value of pigeon pea is perhaps the most important reason why it should find an important place among the small holder poor farmers in Africa. Pigeon pea is wonderfully abundant in protein, making it an ideal supplement to traditional cereal, banana or tuber – based diets of most Africans which are generally protein – deficient (Damaris, 2007).

MATERIALS AND METHODS

The sample materials (Lima, Adzuki, African Locust, Pigeon pea and white bean) were purchased from two popular markets in *Ikere, Ekiti* State, Nigeria. The sample preparations, the proximate analysis and sample solution preparation for mineral analysis were carried out in the chemistry laboratory of College of Education, *Ikere* in Ekiti State, Nigeria while the sample solutions were sent for mineral analysis at Federal University of Technology, *Akure, Ondo* State, Nigeria.

Proximate Analysis

Standard methods of the Association of Official Analytical Chemists (AOAC, 1990) were used to determine the proximate parameters: moisture, ash, crude fat, crude fibre, crude protein and carbohydrate contents in each sample. Moisture content was determined by heating 2g of each fresh sample to a constant weight in a crucible placed in an oven maintained at 105^{o}C. The ash content was determined by the incineration of 1.5g samples placed in a muffle furnace maintained at 550^{o}C for 5 – 8 hours while the crude fibre was obtained by digesting 2g of the samples with H_2SO_4 and NaOH and incinerating the residue in a muffle furnace maintained at 550^{o}C for 5 – 8 hours. The crude protein (% total nitrogen x 6.25) was determined by kjeldahl method, using 2 g of the samples. The crude lipid content was also determined by exhaustively extracting 10g of each sample in a soxhlet apparatus using n–hexane as the extracting solvent and the carbohydrate content was determined by deducting the total percent of: moisture, ash, fibre, fat and protein from 100.

Mineral Analysis

Wet ashing method was used. 1g of the dried powdered sample were digested with 10ml nitric acid and 5ml perchloric acid in 100ml digestion flask and allowed to stand overnight in fume cupboard. The mixture was heated until the yellowish fume and white dense fume of nitric and perchloric acid respectively ceased. The contents were cooled and filtered through whatman filter paper, transferred into sample bottles and made up to 100ml with deionized water. The sample solutions were taken to Federal University of Technology, Akure for determination of Iron, Zinc, Calcium, Magnesium, Manganese and Copper using Atomic Absorption Spectrophotometer (ASS).

RESULTS

Table 1: Proximate Composition of the beans: Lima, Adzuki, African Locust, Pigeon pea and white

Sample Names		Parameters (%)					
English	**Botanical**	**Ash**	**Moisture**	**Fat**	**Crude Fibre**	**Protein**	**Carbo-hydrate**
Lima Bean	*Phaseolus lunatus*	7.18	9.20	12.84	3.11	26.05	41.62
Adzuki Bean	*Phaseolus anglaris*	4.08	7.84	3.94	1.17	28.32	54.65
African Locust Bean	*Parkia biglobosa*	3.07	1.32	8.06	0.39	33.89	53.27
Pigeon pea	*Cajanus cajan*	9.93	0.24	3.68	5.54	30.53	50.08
White Bean	*Phaseolus vulgaris*	7.18	4.20	4.42	3.23	26.18	54.79

Table 2: Minerals Composition of the beans: Lima, Adzuki, African Locust, Pigeon pea and white

Sample Names		Parameters (mg/kg)					
English	Botanical	Fe	Zn	Ca	Mg	Mn	Cu
Lima Bean	*Phaseolus lunatus*	0.020	0.010	0.229	0.342	0.006	0.001
Adzuki Bean	*Phaseolus anglaris*	0.022	0.016	0.256	0.336	0.007	0.002
African Locust Bean	*Parkia biglobosa*	0.062	0.015	0.266	0.388	0.008	0.002
Pigeon Pea	*Cajanus cajan*	0.019	0.011	0.234	0.320	0.002	0.001
White Bean	*Phaseolus vulgaris*	0.018	0.015	0.251	0.396	0.003	0.001

DISCUSSION

It was found in Table 1, that African Locust bean (33.89%) indicates the highest content of protein compared to other samples and the least in the Lima bean (26.05%). The relatively high percentage of protein in African Locust bean (33.89%) and Pigeon pea (30.53%) implies that these beans can contribute significantly to the daily human protein requirement, which is in agreement with the findings of Alabi, et al., (2005). The protein content of common grown Pigeon pea has been reported to range between 18 26% while up to 30% has been reported in other closely related *Cajanus spp* (Damaris, 2007). Also, the white bean had been reported to constitute a traditional food for many people in Latin America, African and Asia and is a good source of protein, essential vitamins and minerals, soluble–fibre, starch, phytochemicals, and it is a low fat foods (Mario, 2009). Crude fibre ranges between Adzuki bean (1.17%) and Pigeon pea (5.54%). White bean (54.99%) records the highest carbohydrate content, next is in Adzuki bean (54.65%) and least is in Lima bean (41.62%). The ash content in the samples range between pigeon pea (9.93%) and Adzuki bean (4.08%) and the least in African Locust bean (3.07%). The moisture content indicates the highest in Lima bean (9.20%) with the least in Pigeon pea (0.24%). The Table 1 shows that Lima bean

(12.84%) records the highest concentration of Fat, next is in African Locust bean (8.06%) with the least in Pigeon pea (3.68%).

In Table 2, relative low content of the minerals Fe, Zn, Mn, and Cu were obtained. The low content must have due to the mature seeds used in this present research, because it had been reported that Africa Pigeon pea seeds and some related beans are mainly eaten green unlike in India where dry dehulled split-pea is most popular and such green seed are richer source of Fe, Cu and Zn than the mature seed (Adamu and Oyetunde, 2013). Fairly appreciable contents of Ca and Mg were observed, especially in white bean: Ca (0.251 mg/kg), Mg (0.396 mg/kg) and African Locust bean; Ca (0.226mg/kg), Mg (0.388mg/kg).

CONCLUSION AND RECOMMENDATIONS

Nearly all the beans contain macro-nutrient, especially protein and carbohydrate. The supplement of cereals with protein rich legumes is considered as one of the best solution to protein – calorie malnutrition in developing world (Damaris, 2007). It is therefore recommended in school feeding programs and vulnerable sections of the population in developing countries.

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