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EFFECT OF COOKING DURATION ON PROXIMATE COMPOSITION AND PHYTOCHEMICAL CONTENTS OF KIDNEY BEAN SEED (*PHASEOLUS VULGARIS*)

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Abstract

This study aimed at evaluating the effect of cooking duration on proximate composition and phytochemical contents of kidney bean seed (Phaseolus vulgaris). The seeds were cleaned and extraneous materials like dry leaves, stones, and dirt were removed and divided into five portions. They

were further cooked for 0, 1, 2, 3 and 4 hours respectively. Proximate and phytochemical compositions were investigated using standard analytical techniques. The cooking durations showed deviations in nutrients from the raw seeds. Crude protein was found to be enhanced by cooking for 3 hours (18.49%) while all the cooking durations were found to reduce the contents of crude fat and crude fibre (P>0.05). Ash contents increases with increase in cooking duration from 1.31% to 3.68% while NFE decreases with increase in cooking duration. The result of phytochemical contents showed (saponin, phytate, oxalate and flavonoids) were not significantly different (P>0.05) in all the kidney beans cooked under different cooking durations and were within safe limits for both human and animals consumption.

It was therefore concluded that kidney bean must be cooked at least for 3 hours before consumption to prevent deleterious effects on both human and animals.

Keywords: Cooking, Duration, Proximate Composition, Phytochemical, Kidney Bean

Introduction

The utilization and exploitation of a crop generally depends on the available knowledge on it. The dearth of information on Kidney beans in line with their optimum nutritional and functional properties has made this potentially beneficial legume under-utilized.

Under-utilized food crops also have under exploited potential to contribute to food and nutrition security, health, and income generation (Arija *et al*., 2006). Legumes refer to the seeds of Leguminosae including peas, beans and pulses. Legumes are considered as "poor man's meat" due to their high protein content and low cost compared to meat and meat products (Audu and Aremu, 2011). Legumes generally contain relatively high amount of protein than other plant food stuff. Though legumes are important sources of dietary proteins for human and animals, their usefulness have been hindered by the presence of some anti–nutritional factors known as toxins Kidney bean (*Phaseolus vulgaris*), is herbaceous annual plant of the family leguminosae. It is domesticated independently in ancient Mesoamerica and the Andes; although widely cultivated in hot climate throughout the world. It is one of the neglected tropical legumes that can be used to improve the nutritional well-being of Nigerians, because of its high protein content (Akobundu and Hoskins, 1992). Even though kidney bean has a lot to offer nutritionally, it is still an underutilized food crop in Nigeria, because of its hard to cook nature and presence of anti-nutrients as well (Asogwa and Onweluzo, 2010).

Nutritional quality is affected by these factors that interact with the intestinal tract such as phytate, tannins and oxalates which reduce protein digestibility and amino acid absorption (NAS, 1999). However, these substances need to be destroyed either by heat or other treatments otherwise concentration of toxins will exert adverse physiological effects when ingested by man and animals (Harbone, 1973). Processing methods such as dehusking, soaking, germination, cooking and roasting inactivate the anti-nutrients and can be used to improve the nutritional quality of the beans (Davis, 1981).

The objective of the present work was to determine the effect of cooking duration on proximate composition and phytochemical contents of kidney beans (*Phaseolus* vulgaris).

MATERIALS AND METHODS

Collection and preparation of sample

The kidney bean seeds were purchased at Akwanga Market, in Akwanga, Nasarawa State Nigeria. The seeds were cleaned and extraneous materials were removed and divided into five portions. The first part was uncooked (raw), The second part was cooked for 1hour; the third part was cooked for two hours; the fourth part was cooked for 3 hours while the fifth part was cooked for 4 hours. The cooked bean samples were oven dried to constant mass, milled to a particle size of about 0.2mm using mortar and pestle, packaged in a low density polyethylene bag (LDPE) and kept in a cool dry place pending analysis.

Proximate and Phytochemical Analysis

Proximate analysis of the kidney bean was carried out to at the Institute for Agricultural Research and Training, Ibadan, Oyo State, Nigeria to determine crude protein, ether extract, crude fibre, ash, moisture content, NFE and energy using the methods of AOAC (2010). Replicate determinations were made whereby the average and standard deviations are reported.

Phytochemical examination of the oven dried and grinded samples were carried out using the standard methods (Gurfinkel and Rao, 2002).

Statistical Analysis

Data were subjected to analysis of variance and means were compared with Duncan Multiple range test using SPSS (version 20, IBM SPSS Statistics, US).

RESULTS AND DISCUSSION

Proximate composition:

The results of the effect of cooking duration on proximate composition of kidney bean (*Pheasolus* vulgaris) are presented in Table 1. The crude protein ranged from 8.83 to 18.49% with the control (0hr) recording the lowest and 3hrs cooking recording the highest protein content. However, there was no significant difference in the crude protein contents of kidney bean cooked for both 2 and 3hours respectively. These values are in conformity with values obtained by Asogwa and Onweluzo (2010). The high values obtained for protein in this research (18.34% to 18.49%) indicates that kidney bean is a good source of protein and compares favorably with values obtained for other legumes like cowpea (Nzawi and Egbuonu, 2011). The fat content (ether extract) for all samples is lower than that reported for red kidney beans (Asogwa and Onweluzo, 2010) this variance may be due to varietal difference. Values of between 2.24, and 3.78%, revealed that kidney bean is not a good source of fat. Crude fiber refers to the indigestible plant material. It lowers blood cholesterol level in humans, prevent cancer and reduces the risk of developing diabetes, hypertension, and hypercholesterolemia. The fiber content recorded in the current study ranged between 1.86% and 2.84% with the control treatment recording the highest value while kidney beans cooked for 3hrs recorded the lowest value (Table 1). These values obtained in this study are lower than the values recorded by Asogwa and Onweluzo (2010). Current results for different cooked kidney beans are in agreement with findings of Deshpande and Deshpande (1991) who recorded

values of 1.98% to 7.20% fiber for different legumes. There was no significant difference between the kidney cooked for 0hr, 1hr, 2hrs and 4hrs respectively.

Results for ash content demonstrated significantly highest values in 4hrs cooking (3.37%), 2hrs cooking (3.50%) and 1 hour cooking (3.37) but lowest in the control (0 hour) (1.31). These values are similar to those previously reported by Asogwa and Onweluzo (2019). Moisture content estimates directly the water content and indirectly the dry matter content of the sample. The moisture contents of the five cooked kidney bean ranged from 6.78% to 10.71% kidney bean cooked for 3 hours recoding the lowest moisture content (6.78%) while the control (0hour) recorded the highest moisture content (10.71). Results obtained in the current study agrees with the findings of Asogwa and Onweluzo (2019).

Nitrogen free extract has the highest composition by percentage in all the samples; with the control (0hour) having the highest value (72.55%). This indicates that the kidney bean flour will be a good source of energy for poultry birds and humans.

The energy contents obtained in this study were between 2848.46 and 3305.64.The energy values obtained were found to be higher than 313 to 328kcal/100g reported in literatures by Marzo *et al*. (2002); Deshpande and Deshpande (1991). The metabolizable energy in this study showed that the sample has an energy concentration more favourable than cereals (Adeyeye and Aye, 1998). The values for metabolizable energy compare favourable well with those reported for some legumes such as Bambara groundnut (1691.3 J/100 g), kersting's groundnut (1692.9 kJ/100 g) cranberry beans (1,651.7 kJ/100 g) (Aremu *et al*., 2006).

Table 1: Effect of Cooking Duration on Proximate Composition of *Phaseolus vulgaris* Seed

Nutrients	0hr	1hr	2hrs	3hrs	4hrs	SEM	LOS
Crude protein %	8.83^{d}	15.4^{c}	18.34^{a}	18.49^{a}	17.03^{b}	1.59	**
Ether extract %	3.78^{a}	2.24^{ab}	2.80^{a}	3.71^{a}	3.17^{a}	0.29	**
Crude fibre %	2.84^{a}	2.49^{a}	2.28^{a}	1.86^{b}	2.65^{a}	0.15	**
Ash %	1.31^{c}	3.37^{a}	3.50^{a}	2.82^{b}	3.68^{a}	0.38	**
NFE %	72.55^{a}	66.70^{b}	66.19^{b}	66.36^{b}	65.47^{b}	1.15	**
Energy (ME) kcal/kg	3193.02	2848.46	3176.53	3305.64	3187.30	2.18	**

SEM = Standard Error of Means* - Significantly Difference (P< 0.05)NS – Not Significant (P>0.05)

Phytochemical Composition

The result showed that cooking duration significantly (p<0.05) reduced the anti-nutrient content of the seeds (Table 2), as it has been reported by Apata and Ologhobo (1994) that some anti-nutrients are heat labile and therefore will be reduced to a great extent by the application of heat to the food. It was observed that cooking reduced the anti-nutrients to very low levels. Tannin value (0.0012) in the raw kidney bean and (0.0034) in the cooked kidney bean was lower than the 0.7 and 0.24% reported for raw cowpea and raw pigeon pea respectively; this suggests that the tannin content in the kidney bean will have no adverse effect on the birds and consumers. Saponin value obtained was higher (0.140) in the raw kidney and lowest 0.117 in kidney bean cooked for 3 hours. Phytate value was also highest (0.018) in the raw kidney bean and lowest (0.015) in the kidney bean cooked for 3 hours. Oxalate and flavonoids also followed similar trend as they were higher in the raw kidney and lowest in the cooked kidney bean. However, trypsin inhibitor did not follow the trend as it was lowest (1.95) in the raw kidney and highest 19.26 in kidney bean cooked for 1 hour. There was no significant difference (P>0.05) in saponin, phytate, oxalate and flavonoids values of the differently cooked kidney bean. The Tannin, Saponin, phytate, oxalate and flavanoids values obtained for the raw and processed kidney beans were within safe levels (Fasoyiro *et al.,* 2006).

Table 2: Effect of Cooking Duration on Phytochemical of *Phaseolusvulgaris*

Nutrients	0hr	1hr	2hrs	3hrs	4hrs	SEM	LOS
Tannin %	0.0012	0.0034	0.0034	0.0027	0.0028	0.00030	**
Saponin %	0.1400	0.1260	0.1260	0.1170	0.1200	0.00040	NS
Phytate %	0.0180	0.0168	0.0168	0.0158	0.0162	0.00040	NS
Oxalate %	0.0163	0.0125	0.0125	0.0115	0.0118	0.00080	NS
Flavonoids %	0.0007	0.0076	0.0076	0.0070	0.0068	0.00040	NS
Trypsin Inhibitor (Tiμ/mg)	1.95^{c}	19.26^{a}	15.45^{a}	13.26^{a}	11.57^{ab}	1.89	**

SEM = Standard Error of Means * Significantly Difference (P< 0.05) NS – Not Significant (P>0.05)

Conclusion

Kidney bean must be cooked before consumption to prevent deleterious effects; reports have it that animals fed on raw kidney beans exhibited various physiological disorders like increase in relative weight of pancreas and liver, and also diarrhea (Aremu *et al.,* 2010). As thermal processes, boiling and roasting

of legumes could enhance tenderization of the cotyledons thereby increasing palatability and nutritional value by inactivating endogenous toxic factors (Norwacki, 1980).

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