EFFECT OF FEEDING DIFFERENTLY PROCESSED KIDNEY BEAN *(PHASEOLUS* VULGARIS) SEED MEAL ON THE VISCERAL ORGANS OF GROWER RABBITS

***Gulukun, E. Z; **Ari, M. M; **Alu, S. E; *Yakubu, R. N; ***Dastu, A. J.**
*Department of Animal Production Technology, Plateau State College of Agriculture, Garkawa.
**Department of Animal Science, Faculty of Agriculture, Nassarawa State University, Keffi.
***Department of Animal Health Technology, Plateau State College of Agriculture, Garkawa.
Corresponding author: egulukun@gmail.com; 08065095255

ABSTRACT
An experiment was conducted to determine the effect of rabbits fed differently processed kidney bean (phaseolus vulgaris) seed meal for 42 days for grower rabbits. The kidney bean seeds were subjected to various processing methods. The different processed kidney bean seeds were analyzed for their proximate composition, amino acid profile and antinutritional factors. Five diets were compounded to contain 15% crude protein and 2300kcal/kg of metabolizable energy for the grower rabbits. 30 mixed breed rabbits of 5 and 6 weeks old were obtained from National Animal Production Research Institute (NAPRI) Zaria. The rabbits were allocated to 6 dietary treatments; T (0% as control diet), T2, T3, T4, T5 and T6 of raw, cooked, soaked, fermented and sprouted kidney bean seeds of five replicates with one rabbit per replicate in a completely randomized design. Feeds and water were given ad-libitum. The study was to determine the effect of differently processed kidney bean seed meal on the visceral organs of grower rabbits. Results showed that intestine weight, caecum length and kidney weight did not show any significant ($p>0.05$) difference. But significant ($P<0.05$) differences existed in the small intestine length, large intestine length, stomach weight, liver weight and heart weight of the animals, but all were similar to those fed the control diet. The result showed that the different processing methods of the kidney bean seed meal does not affect the visceral organs of the animals so far they were similar to those fed the control diet.

Keywords: Kidney beans, processing, grower rabbits, visceral organs.

INTRODUCTION

There is need to support and encourage the rearing of micro-livestock species such as rabbits, considering the comparative advantage of these animals over large animals like cattle, sheep and goats. These advantages range from small space requirement, low initial capital, low labour demand and quick high return over an investment (Oseni and Lukefahr, (2014). Rabbits are herbivorous animals with earlier maturity, short gestation interval, high prolificacy and ability to utilize forages which are abundant in rural communities (Ojebiyi *et al*., 2010; Dalle Zatte, 2014).

The general acceptance of feedstuffs like cereal grains and legumes are expensive and highly competitive demand by humans. These increases production cost and makes it uneconomical to feed conventional feedstuff to rabbits in the developing countries like Nigeria (Oles *et al*., 2016). However, to ensure all year round rabbit production at a minimal cost, alternative, cheap and available feed ingredients such as kidney bean *(Phaseolus vulgaris)* which can replace soya bean as rabbit diet (Gulukun *et al.,* 2021). Kidney beans are a leguminous crop and are of the most important domestic legumes in the world, because they are high in protein concentration varying from 17-28% (Olomu, 2011). The visceral organs (gastrointestinal tract) comprise approximately 10% of body mass, but account for more than 50% of whole body energy expenditure (Reynolds *et al*., 1991). Therefore, any changes in the energy metabolism of these tissues could determine the variation in efficiency of energy utilization by the whole animal. Visceral tissues differ in their demand for energy and amino acids, and the energy expenditure of the visceral organs is a function of the metabolic rate and size of the organs (Koong *et al.*, 1985). Dietary protein digestion, absorption and metabolism in tissues are accompanied by energy utilization (Nelson *et al*., 2005). Increase in organ weights would result in increase in amount of energy required for maintenance. Altering dietary crude protein (CP) intake may alter visceral organ mass and metabolism resulting in altered energy and amino acids available for gain and the efficiency of gain (Gidenne *et al*., 2010)

The experiment was therefore carried out to determine the effect of differently processed kidney bean seed meal on the visceral organs of grower rabbits.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Livestock Research Farm, College of Agriculture, Garkawa, Plateau State, Nigeria. Garkawa town is located on latitude $8^058^/E$ and longitude $9^045^/N$, with an elevation of 240m above sea level determined using Global positioning system (GPS). It lies within the southern Guinea savannah zone of Nigeria characterized by six months of raining season (May to October) and six months of dry season (November to April).

Experimental procedure

Kidney beans seed procurement and processing

The raw kidney bean seeds were purchased at Mangu market of Plateau State, Nigeria. The seeds were sorted to remove dirts and contaminants before subjecting it to different processing methods.

Cooking: The water was boiled at 100^0C and then the kidney beans were poured into the boiling water and allowed to cook for 60min.

Soaking: The clean seeds were soaked in water for 12hours, after which the first water was drained and fresh water replaced and left for another 12hours.

Fermenting: The clean seeds were turned into boiling water and allowed to be cooked for 60minutes. The tampered seeds were drained and put in a plastic container, covered and kept in an air tight enclosure for 96hours for fermentation to take place.

Sprouting: The kidney bean seeds were broadcasted in woven basket containing sand and saw-dust. The broadcasted seeds were watered daily for 48hour and allowed to be sprouted. The sprouted seeds were removed and thoroughly washed. Thereafter, processed kidney bean seeds in all the methods were sun-dried for 96 hours.

Experimental Animals Management and Design

The total number of thirty (30) mixed breed of rabbits were obtained from National Animal Production Research Institute (NAPRI) Zaria, Nigeria. The rabbits were weighed and randomly distributed to six dietary treatments with five replicates in a Completely Randomized Design (CRD). Each rabbit represents a replicate. Feeds and water were given *ad-libitum*. Afterward, faecal sample from each replicate was collected for seven days using an aluminum material. The faecal samples were collected daily and dried for each treatment, weighed, thoroughly mixed, ground and analyzed for digestibility.

Experimental diets: The experimental diets were compounded to contained 2300kcal/kg metabolizable energy and 15% crude protein of processed kidney bean seed meal. The experimental diets for grower rabbits comprised of 30% inclusion levels of kidney beans seeds across the treatments; variations were only seen in the processing methods. There were 6 dietary treatments: T1=diet without kidney bean seeds, T2, T3, T4, T5 and T6 contained raw, cooked, soaked, fermented and sprouted kidney bean seeds meal respectively. The experimental diet is presented in Table 1.

Organs evaluation

The rabbits were tagged and fasted overnight. Two rabbits were randomly selected from each treatment, weigh before and after slaughtering to determine the live and slaughtered weights respectively. The fur of the animals was removed by skinning. The visceral organs (liver, heart, lungs, kidney, intestines, caecum) of the animals were removed and weighed using a weighing balance.

Statistical analysis: The data were subjected to analysis of variance. Where treatment means were significant, separation of means was done using the Duncan's Multiple Range Test (9) at 5%
Level of significance (SSPS, 2010).

Table 1: Composition of experimental diets (kg/100kg) for grower rabbits

Ingredient	T1 Control	T2 RKB	T3 CKB	T4 SKB	T5 FKB	T6 SpKB
Maize	27.91	8.36	11.79	9.39	14.48	10.50
Rice offal	28.00	28.20	28.20	29.80	29.80	30.25
Soya Bean (whole)	1.90	1.90	1.90	2.30	1.27	3.20
Groundnut cake	17.00	5.25	6.30	5.85	1.97	2.22
Kidney Beans	0.00	30.00	30.00	30.00	30.00	30.00
Maize offal	15.00	18.00	13.50	13.80	13,64	14.96
Tridax procumbens	8.95	6.95	6.95	7.39	7.39	7.39
Bone Meal	0.15	0.10	0.10	0.12	0.12	0.12
Limestone	0.49	0.57	0.59	0.65	0.64	0.64
Common Salt	0.25	0.25	0.25	0.28	0.25	0.28
Lysine	0.05	0.05	0.05	0.05	0.05	0.05
Methionine	0.05	0.12	0.12	0.12	0.14	0.14
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Chemical analysis						
Crude Protein (%)	15.01	15.01	15.01	15.04	15.01	15.00
ME (Kcal/kg)	2300.40	2302.29	2307.75	2308.61	2300.16	2306.22
Energy: Protein (%)	1:153.25	1:153.38	1:153.74	1:153.49	1:153.24	1:153.74
Ether extract (%)	5.86	5.44	5.42	5.37	5.06	5.47
Crude fibre (%)	12.44	13.20	13.30	12.84	13.71	13.14
Calcium (%)	0.39	0.39	0.39	0.42	0.41	0.41
Available P (%)	0.72	0.61	0.61	0.63	0.62	0.63
CA:P (%)	1:0.54	1:0.63	1:0.63	1:0.66	1:0.66	1:0.65
Lysine (%)	0.53	0.35	0.35	0.36	0.30	0.34
MET + Cys (%)	0.47	0.38	0.38	0.38	0.37	0.38
Methionine (%)	0.26	0.25	0.25	0.25	0.25	0.26
Cost ₦/kg	165.86	160.00	115.35	118.65	115.26	129.35

GNC = Ground Nut Cake, RKB = Raw Kidney Bean Seed Meal, CKB = Cooked Kidney Bean Seed Meal, SKB = Soaked Kidney Bean Seed Meal, FKB = Fermented Kidney Bean Seed Meal, SpKB = Germinated Kidney Beans Seed Meal, CP = Crude Protein, CF = Crude Fibre, EE = Ether Extra, CA = Calcium, P = Phospho rus, * Vitamin-mineral premix (BIOMIX)®supplied the following per *100Kg of diet: Vit. A 5000 I.U; Vit.D_3 888 I.U; Vit. E_{12} 5000MG; Vit. K_3 15000mg; Niacin 12000mg; Pantothemic acid 2000mg; Biotin 1000mg; Vit. B_{12} 3000mg; Folic acid 15000mg; Choline chloride 6000mg; Manganese 1000mg; Vit. Iron 15000mg; Zinc 800mg; Copper 400mg; Iodine 80mg; Cobalt 400mg; Selenium 8000mg; Anti- oxidant 1.50mg. Using Feedwin software version 1.01*

RESULTS AND DISCUSSION

Table 2: Effect of differently processed kidney bean seed meal on the visceral organs of rabbits

Organs	T1(CLT)	T2(RAW)	T3(CKB)	T4(SKB)	T5(FKB)	T6(GKB)	SEM
Intestinal wt(g)	174.00	153.00	264.00	200.00	207.00	256.00	16.27^{NS}
Length of small intestine(cm)	239.00^{ab}	144.00^{c}	198.00^{ab}	190.00^{ab}	198.00^{ab}	259.00^{a}	14.30*
Legnth of large intestine (cm)	122.00^{a}	88.00^{ab}	117.00^{ab}	69.50^{c}	125.50^{a}	80.00ab	7.89*
Caecum length (cm)	47.00	43.00	50.00	44.00	52.00	49.50	1.94^{NS}
Stomach wt (g)	57.50^{c}	84.00^{ab}	95.50^{a}	72.00^{ab}	67.00^{ab}	95.00^{a}	4.10*
Liver wt (g)	38.50^{abc}	33.50^{bc}	51.00^{a}	25.00^{c}	43.00^{ab}	32.00^{bc}	2.79*
Kidney (wt)	11.00	9.50	10.50	8.00	9.50	7.50	0.52^{NS}
Heart wt(g)	4.50^{ab}	5.50^{a}	4.00^{ab}	2.50^{c}	3.50^{ab}	4.00^{ab}	0.35*
Lung wt (g)	7.00	4.50	7.50	4.50	7.00	6.50	0.56^{NS}

^{abc} Means within column having different superscripts differed significantly (P<0.05), SEM = Standard error of mean, * = Significant (P<0.05), NS= Not significant (P>0.05), Clt= Control, RKB=Raw kidney bean, CKD= Cooked kidney bean, SKB= Soaked kidney bean, FKB= Fermented kidney bean, GKB= Sprouted kidney bean,

Effect of differently processed kidney bean seed meal on the visceral organ of grower rabbits

The results of the visceral organ of grower rabbits fed differently processed kidney bean seeds were presented in Table 2. There were significant (P<0.05) difference in the small length, large intestine length, stomach content weight, liver weight and heart weight of the animals fed differently processed kidney bean seeds. The small intestine length of the rabbits fed all the diets did not differ significantly from those fed the control but those fed germinated kidney bean were significantly higher than others. The large intestine length of animals fed fermented kidney bean were similar to those fed the control diet which were significantly higher than others. The stomach content weight of the animals in all treatments did not differ from each other but had significant higher values than those fed the control diet. The liver weight of the animals in treatment three are significant higher but similar to those fed fermented and control diet. The heart weight of the animals fed raw, cooked, fermented and sprouted kidney bean seeds did not differ significantly from those fed the control diet. The heart and the liver weights of the rabbits falls within the ranges of the finding of Alu (2018), while the kidney and the lung weights were lower than his finding. The liver, lung and heart weight in this research were significantly higher than (P<0.05) the finding of Maidala *et al*. (2016). However, the significant (P<0.05) difference in this research may be due to the breed difference since the rabbits used for the experiment were mixed breeds or manual cutting of the parts.

CONCLUSION

The result of this finding showed that processing of kidney bean seeds does not affect the visceral organs of the animals. This implies that processed kidney bean seeds could be used as energy and protein source.

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