

## **Carcass Characteristics and Serum Biochemistry of Rabbits Fed Diets Containing Differently Processed Kidney Bean (*Phaseolus vulgaris*) Seed Meal**

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### **Abstract**

*The effect of feeding grower rabbits with differently processed kidney bean (*Phaseolus vulgaris*) seed meal was determined during a forty-two (42) days feeding trial. Six diets were compounded to contain 15% crude protein and 2300kcal/kg of metabolizable energy. Thirty (30) grower rabbits of mixed breeds and sexes were obtained from National Animal Production Research Institute (NAPRI), Zaria. The rabbits were allocated to 6 dietary treatments of five (5) rabbits per treatment with one (1) rabbit per replicate in a Completely Randomized Design (CRD). The experimental diets were; T1 without kidney bean seed meal (control), while diets T2, T3, T4, T5 and T6 contained raw, cooked, soaked, fermented and sprouted kidney bean seed meal respectively. Feed and water were given ad-libitum during the period of the experiment. Parameters measured were carcass characteristics and serum biochemistry of the animals. Carcass cut up parts were significantly ( $P < 0.05$ ) affected except the dressed weight, fore-limb length, hind-limb weight, shank length, thorax weight, lumbar weight and dressing percentage. The result of the carcass characteristics showed that animal fed fermented diet (T5) kidney bean seed meal had the highest slaughtered weight followed by those fed the cooked (T3) and sprouted (T6) diets. The serum biochemistry indices of all parameters showed no significant ( $P > 0.05$ ) difference except total cholesterol and glucose levels. The total cholesterol and glucose levels of the animals fed raw kidney bean seed meal are significantly higher than others. Different processing methods of kidney beans seed meal were observed not to have effect on the carcass characteristics and serum biochemistry of the rabbits.*

**Keywords:** Carcass; Kidney beans; Serum biochemistry; Rabbit; Processing.

### **Description of Problem**

The increase in human population growth in developing countries makes a higher demand for animal protein which is already in short

supply in those areas. The shortage is due to low level of large animals' productivity (1). Rabbit provide healthy meat due to its low levels of cholesterol and salt content, being a

white meat like poultry (2). The recent knowledge of the usefulness of the meat for diabetes, hypertensive and middle aged people has further raised awareness on the production of rabbits, thus increasing the demand for rabbit meat (3). Animal protein contains essential amino acids, which helps in the body tissues synthesis, replacing of Nitrogen lost in urine, faeces and saliva. Protein also supplies a level of energy and growth, increase body immunities (4).

The overall strategy is not only to increase the production of animals but also the efficient utilization of protein ingredients. There is high competition for protein ingredients like soyabean, so there is need to search for other protein source in which one of them is kidney bean (*Phaseolus vulgaris*) seeds. Kidney bean is a leguminous crop grown in different parts of the world. Several varieties are currently cultivated in fairly large quantities in Mangu and Bokkos areas in the Jos Plateau State, Nigeria (5). However, like other grains legumes, its usefulness as a protein feed ingredient for monogastric animals may be limited due to the presence of some antinutritional factors (5), and the pancreatic hypertrophy in many species of animal (7); (8). These anti-nutrients can be destroyed by different processing methods (5). It has been discovered by (9) that heat treatment can make beneficial effects on the seed of grain legumes by destroying the anti-nutritional factors existing in them.

The efficient utilization of kidney beans is hereby expressed in organ development in

term of weight and function. A reduction or increase in the size of an organ may be an indication of injury or disease condition. This study is aimed at determining the effect of differently processed kidney bean seed meal on the carcass and serum biochemistry of grower rabbits.

## Materials and Methods

### Experimental site

The experiment was carried out at the Livestock Research farm, College of Agriculture, Garkawa in Plateau State, Nigeria. Garkawa town is located on latitude 8°58'E and longitude 9°45'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 materials and processing

The raw Kidney bean seeds were purchased at Mangu market of Plateau State, Nigeria and were sorted to remove dirt and contaminants before subjecting it to different processing methods. The processing was done during the dry season (January). The clean seeds were sun-dried for 96hours.

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

**Soaking:** The clean seeds were soaked in water for 12hours, after which the first water

was drained and fresh water was replaced and left for another 12 hours.

**Fermenting:** The clean seeds were turned into boiling water and allowed to boiled for 60 minutes. The boiled seeds were drained and put in a plastic container, covered and kept in an air tight enclosure for 96 hours 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 48 hours and allowed to be sprouted. The sprouted seeds were removed and thoroughly washed. The processed kidney bean seeds in all the methods were sun-dried for 96 hours.

The processed materials from all the treatments were stored in a clean and well ventilated room before feed formulation to ensure nutrient preservation. The materials were analyzed to obtain its proximate composition.

**Chemical analysis:** A sample of the kidney bean seeds from each of the processing methods were finely grounded and taken to the laboratory to analyze for its proximate composition to determine the effect of processing methods as reported by (10).

### **Experimental Animals Management and Design**

The total numbers of thirty (30) mixed breeds of grower rabbits of 6-7 weeks 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). Feeds and water were given *ad-libitum*.

**Experimental diets:** The experimental diets were compounded to contain 2300 kcal/kg metabolizable energy and 15% crude protein using differently processed kidney bean seed meal. The experimental diets for the rabbits comprise 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 beans seeds, T2, T3, T4, T5 and T6 contained raw, cooked, soaked, fermented and sprouted kidney bean seeds meal respectively.

### **Parameters measured**

#### **a. carcass and organ characteristics**

At the of the experiment two rabbits per treatment were randomly selected for carcass evaluation. The rabbits were fasted for 12 hours preceding slaughtering of the animals but allowed them access to water. The rabbits were weight and slaughtered to determine the live and slaughtered weights respectively. The internal organs (liver, kidney, lungs and heart) were weighed. The dressed carcass were weighed and subsequently cut into different parts ( head, neck, forelimb, hind limb, thorax, shank thigh lumbar, sacral)

#### **b. serum biochemistry analysis**

At the end of the experiment, blood was collected at the point of slaughter. Blood sample were channeled into clean and dry plain bottles. The bottles were kept in a

slanting position to allow the clotted blood form serum which was collected and used for biochemistry analysis in the laboratory. The serum biochemistry analyzed are: total protein (TP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alanine phosphase (ALP) and total cholesterol (TC), albumin, urea, creatine and glucose.

**Statistical analysis:** Data collected were subjected to One Way Analysis of Variance (ANOVA). Where significance difference existed, Duncan multiple range tests was used to detect differences among treatments (11).

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

<b>Ingredient</b>	<b>T1 Control</b>	<b>T2 RKB</b>	<b>T3 CKB</b>	<b>T4 SKB</b>	<b>T5 FKB</b>	<b>T6 SpKB</b>
<i>Maize</i>	27.91	8.99	11.74	9.39	14.46	10.55
<i>Rice offal</i>	28.00	28.20	28.20	29.80	29.80	30.25
<i>Soya Bean (whole)</i>	1.93	1.90	1.90	2.30	1.31	3.20
<i>GNC</i>	16.85	5.25	6.30	5.89	1.97	2.22
<i>Kidney Beans</i>	0.00	30.00	30.00	30.00	30.00	30.00
<i>Maize offal</i>	15.00	17.30	13.50	13.80	13.64	14.96
<i>Tridax procumbent</i>	8.95	6.93	6.95	7.39	7.39	7.39
<i>Bone Meal</i>	0.12	0.12	0.10	0.12	0.12	0.12
<i>Limestone</i>	0.64	0.64	0.64	0.64	0.64	0.64
<i>Common Salt</i>	0.25	0.25	0.25	0.25	0.25	0.25
<i>Lysine</i>	0.05	0.05	0.05	0.05	0.05	0.05
<i>Methionine</i>	0.05	0.12	0.12	0.12	0.12	0.12
<i>Premix</i>	0.25	0.25	0.25	0.25	0.25	0.25
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>Chemical analysis</b>						
<i>Crude Protein (%)</i>	15.01	15.01	15.01	15.04	15.01	15.00
<i>ME ( Kcal/kg)</i>	2300.40	2302.29	2307.75	2308.61	2300.16	2306.22
<i>E: Protein (%)</i>	1:153.25	1:153.38	1:153.74	1:153.49	1:153.24	1:153.74
<i>Ether extract (%)</i>	5.86	5.44	5.42	5.37	5.06	5.47
<i>Crude fibre (%)</i>	12.44	13.20	13.30	12.84	13.71	13.14
<i>Calcium (%)</i>	0.39	0.39	0.39	0.42	0.41	0.41
<i>Available P (%)</i>	0.72	0.61	0.61	0.63	0.62	0.63
<i>CA:P (%)</i>	1:0.54	1:0.63	1:0.63	1:0.66	1:0.66	1:0.65
<i>Lysine (%)</i>	0.53	0.35	0.35	0.36	0.30	0.34
<i>MET + Cys (%)</i>	0.47	0.38	0.38	0.38	0.37	0.38
<i>Methionine (%)</i>	0.26	0.25	0.25	0.25	0.25	0.26
<i>Cost ₦/kg</i>	165.86	160.00	115.35	118.65	115.26	129.35

GNC = Ground nut Cake , FKB = Fermented Kidney Bean Seed Meal, SpKB = Germinated Kidney Beans Seed Meal, CP = Crude Protein, CF = Crude Fibre, EE = Ether Extra, CA = Calcium, P = Phosphorus, \* Vitamin-mineral premix (BIOMIX)®supplied the following per Nut Cake, RKB = Raw Kidney Bean Seed Meal, CKB = Cooked Kidney Bean Seed Meal, SKB = Soaked Kidney Bean 100Kg of diet: Vit. A 5000 I.U; Vit.D 3 888 I.U; Vit. E 125000MG; Vit. K 3 15000mg; Niacin 12000mg; Pantothenic 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**

The carcass characteristics of the rabbits fed differently processed kidney bean seeds meal were presented in Table 2. There were significant ( $P < 0.05$ ) difference in all the parameters assessed except the dressed weight, forelimb length, hind limb weight, shank length, thorax weight and dressing percentage. The live weight of the animals fed cooked, fermented and sprouted kidney bean seeds were statistically similar and significantly higher than those fed raw and soaked kidney bean seeds. The live weight of the animals of this study ranges from 1350 – 2000g which was higher than the finding of (12) which ranges from 1325 - 1575g when he fed rabbits with toasted kidney bean seed meal as a replacement for soyabean meal. Higher live weight in this study implies that the processing technique enhances the digestibility and nutrient availability of kidney bean seeds which ultimately affects the rabbit's growth and weight. The skinned weight of the animals fed fermented (1800g) kidney bean seeds was significantly ( $P < 0.05$ ) higher than those fed cooked (1700g), and sprouted (1650g) kidney beans but similar to those fed control (1550g). However, the effect of anti-nutrient like phytic acid, tannins and protease inhibitors reduced nutrient bioavailability on skin health and weight of rabbit fed raw kidney bean seeds which was significantly inferior to those fed differently processed kidney bean seeds and the control. The head weight of the animals in all the treatment were similar except those fed soaked kidney bean seeds. The head weight of the animals falls within the ranges

of the finding of (12). Rabbit feed fermented kidney bean seeds was observed to have higher neck weight than other treatments. The forelimb weight of the rabbits fed cooked and fermented were similar to the control and were significantly higher than others. The thigh weight of the rabbits fed cooked (192g), fermented (211g) and sprouted (137g) were similar to the animals fed the control (198g) diet and were significantly higher than those fed the raw (120.5g) and soaked (104.5g) kidney bean seeds. The sacral weights of the rabbits in all the treatments were similar to the control. This suggested that support, stability, protection of nerve, and attachment points for muscles and ligaments was not affected by feeding kidney bean seed to rabbits irrespective of processing methods. The dressing percentage of the rabbits in this study were higher than the finding of (13) when he fed rabbits with diets containing palm kernel oil residues as substitute for wheat bran. The results obtained the carcass parameters measured across the treatments group were the true reflection of the body weight performance and development. The overall result indicated that rabbits fed diet containing fermented kidney bean seed meal had significant ( $P < 0.05$ ) higher dressed weight compared to other treatment groups. The dressing percentage obtained in this study was higher than those reported by other authors as (15); (12);(16). This suggested that feeding rabbit with kidney bean seed revealed more economic value, indicates meat quality, and the animal efficiency in converting the test material to muscle mass.

**Table 2: Effect of differently processed kidney bean seeds on the carcass characteristics of rabbits**

Parameters	T1 (CLT)	T2(RKB)	T3(CKB)	T4(SKB)	T5(FKB)	T6(SpKB)	SEM
Live weight (g)	1775.00 <sup>ab</sup>	1350.00 <sup>b</sup>	1925.00 <sup>a</sup>	1375.00 <sup>b</sup>	2000.00 <sup>a</sup>	1875.00 <sup>a</sup>	86.90*
Slaughter weight (g)	1650.00 <sup>abc</sup>	1275.00 <sup>c</sup>	1800.00 <sup>ab</sup>	1325.00 <sup>bc</sup>	1875.00 <sup>a</sup>	1750.00 <sup>abc</sup>	80.04*
Skinned weight (g)	1550.00 <sup>abc</sup>	1200.00 <sup>c</sup>	1700.00 <sup>ab</sup>	1250.00 <sup>bc</sup>	1800.00 <sup>a</sup>	1650.00 <sup>abc</sup>	78.21*
Dressed weight (g)	1175.00	950.00	1250.00	975.00	1400.00	1250.00	61.95 <sup>NS</sup>
Head weight (g)	101.00 <sup>ab</sup>	91.50 <sup>ab</sup>	106.50 <sup>ab</sup>	82.00 <sup>b</sup>	121.50 <sup>a</sup>	89.50 <sup>ab</sup>	87.87*
Neck weight (g)	43.00 <sup>b</sup>	29.00 <sup>bc</sup>	44.00 <sup>b</sup>	22.00 <sup>c</sup>	63.50 <sup>a</sup>	34 <sup>b</sup>	29.78*
Forelimb weight (g)	121.50 <sup>a</sup>	73.00 <sup>b</sup>	121.50 <sup>a</sup>	66.50 <sup>b</sup>	124.50 <sup>a</sup>	66.00 <sup>b</sup>	75.76*
Forelimb length (cm)	5.75	5.45	5.50	6.06	6.25	6.50	5.51 <sup>NS</sup>
Hind limb weight (g)	208.50	127.50	216.00	182.00	206.00	143.50	149.02 <sup>NS</sup>
Shank length (cm)	9.55	9.25	8.75	8.65	10.25	9.50	8.79 <sup>NS</sup>
Thigh weight (g)	198.00 <sup>ab</sup>	120.50 <sup>bc</sup>	192.00 <sup>abc</sup>	104.00 <sup>c</sup>	211.50 <sup>a</sup>	135.00 <sup>abc</sup>	128.66*
Thorax weight (g)	147.50	147.50	147.50	146.93	147.50	146.90	51.32 <sup>NS</sup>
Lumbar weight (g)	155.50 <sup>ab</sup>	86.00 <sup>c</sup>	176.00 <sup>a</sup>	73.00 <sup>c</sup>	168.00 <sup>a</sup>	94.50 <sup>b</sup>	95.05*
Sacral weight (g)	98.00 <sup>a</sup>	69.00 <sup>ab</sup>	75.00 <sup>ab</sup>	53.00 <sup>ab</sup>	83.50 <sup>ab</sup>	70.50 <sup>ab</sup>	74.83*
Dressing percentage	65.64	70.05	64.97	70.89	69.95	66.64	64.82 <sup>NS</sup>

<sup>abc</sup> Means within row 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, SpKB = Sprouted kidney bean

The results of the serum biochemical study of grower rabbits fed differently processed kidney bean seed meal were showed in Table 3. All the parameters studied shows no significant ( $P > 0.05$ ) difference except total cholesterol and glucose levels. Total cholesterol of rabbits fed raw (119.18mmol/L) and cooked (90.49mmol/L) kidney bean seed meal are statistically similar to those fed the control diet (104.41mmol/L) and those fed the sprouted (39.88mmol/L) kidney bean seed meal had the lowest total cholesterol level. Animals fed the raw (4.15mmol/L) and cooked (3.36mmol/L) and fermented (3.29mmol/L) kidney bean seed meal are statistically similar and significantly higher than those fed sprouted (2.79mmol/L), soaked (1.88mmol/L) and the control (2.69mmol/L) diet in their glucose level. Animals fed

soaked (1.88mmol/L) and fermented (2.79mmol/L) kidney bean did not differ significantly ( $P > 0.05$ ) from each but are similar to those of the control in their glucose levels and had significant lower level of cholesterol than others. The absorption and utilization of nutrients by animals is a major function of the diet. Adult rabbits absorbed most nutrients in the small intestine. This result indicates that the processing methods in this study had no negative effect on the blood parameters of the rabbits and hence the health status of the rabbits was not affected. This means that the values falls within the normal range of physiological values of the rabbits.(17); (18) reported that dietary proteins were well utilized by rabbits and the residue of HCN I the treated parboiled sun-dried yam meal did not interfere with the nutrients utilization. The total cholesterol

**Table 3: Effect of differently processed kidney bean seeds on the serum biochemical constituents of grower rabbits.**

Serum	T1(CLT)	T2(RKB)	T3(CKB)	T4(SKB)	T5(FKB)	T6(SpKB)	SEM
AST (u/L)	43.29	43.68	34.77	40.23	42.05	39.16	36.93 <sup>NS</sup>
ALT(u/L)	13.50	17.50	16.00	16.00	14.50	18.00	14.33 <sup>NS</sup>
ALP(u/L)	33.12	35.16	43.12	44.80	53.82	55.81	34.92 <sup>NS</sup>
TP(g/L)	66.06	56.07	73.05	58.33	56.08	66.70	55.85 <sup>NS</sup>
(Albumin(g/L)	37.73	44.79	39.08	40.58	37.31	37.44	37.24 <sup>NS</sup>
Urea(mmol/L)	4.55	5.40	7.88	7.39	4.59	6.12	4.91 <sup>NS</sup>
Creatinine(mg/dL)	55.83	54.37	59.40	83.61	53.98	77.96	52.06 <sup>NS</sup>
TC(mmol/L)	104.41 <sup>ab</sup>	119.18 <sup>a</sup>	90.49 <sup>ab</sup>	58.91 <sup>bcd</sup>	53.88 <sup>cd</sup>	39.88 <sup>d</sup>	56.74 <sup>*</sup>
Glucose(mmol/L)	2.69 <sup>bc</sup>	4.15 <sup>a</sup>	3.36 <sup>ab</sup>	1.88 <sup>c</sup>	3.29 <sup>ab</sup>	2.79 <sup>bc</sup>	2.51 <sup>*</sup>

<sup>Abc</sup> Means within row 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, SpKB = Sprouted kidney bean, /; AST = Aspartate aminotransferase, ALT = Alanine aminotransferase, ALP = Alanine phosphate, TP = Total protein, TC = Total cholesterol.

and glucose were significantly higher in rabbits fed raw kidney bean seeds than others. This means that processing of kidney bean seeds helps in the nutrients absorption of the animals.

### Conclusion

1. The result of this finding showed that differently processed kidney bean seed meal does not have any adverse effect on the carcass and serum biochemistry of the animals.
2. The carcass quality showed that the rabbits fed fermented diet had the highest carcass weights followed by those fed cooked kidney bean seed meal.
4. The serum biochemistry of the animals fed differently processed kidney bean seeds was not significantly affected so the dietary inclusion had no negative effect on the health status of the rabbits.

5. Also, the total cholesterol of rabbit fed differently processed kidney bean seeds plays crucial role in cell membrane structure, hormone synthesis, and nerve function since mean value obtained in this study was within the normal range value of 50 – 100 mg/dL.

### Recommendation

This study find out that feeding rabbits with kidney bean seed meal does not have any adverse effect on the carcass and health status of the animals, however, kidney bean seeds can be used as protein source ingredient for rabbits

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