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Response of Broiler Chickens Fed Boiled Red Kidney Bean (*Phaseolus vulgaris*) Seed Meal as Protein feedstuff on Haematology and Serum Biochemical indices

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ABSTRACT: *Eight week feeding trial was conducted to determine the effects of dietry levels of Boiled red kidney bean meal (BRKBSM) in potassium carbonate solution on haematology and serum biochemical indices of broiler chickens. A total of 200 day old chicks (Anak 2000) were randomly allotted to five treatment diets (T1-T5) in a completely randomized design. Each treatment group was replicated 4 times with ten birds per replicate. T 1 contained 0% Boiled Red Kidney Bean Seed Meal (BRKBSM) as the control diet, while T2-T5 contained 25,50 75 and 100% inclusion levels of BRKBSM respectively. Results of the haematology and serum biochemical indices at finisher phase showed that Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin Concentration (MCHC) were significantly (P<0.05) influenced by the treatment diets. However, serum biochemical values were not significantly (P>0.05) affected by the diets. Albumin values (3.19 g/dl) was highest on birds fed 50% BRKBSM, globulin values was also highest at 50% BRKBSM while cholesterol values decreased with increasing levels of inclusion of BRKBSM from 0% to 100%. It is therefore concluded based on this study that BRKBSM can be included in broiler chickens diet up to 50% level without any detrimental effects on blood profile of broiler chickens.*

KEYWORDS: Red kidney bean, performance, broiler chickens, haematology, serum biochemical.

INTRODUCTION

The main limitation to expansion of poultry industry is the availability of adequate supplies of needed ingridients at reasonable prices (Ani and Okorie, 2005; Babatunde and Hamzat (2005). Mean while, poultry products have been considered to be one of the options in Nigeria for

reducing the incidence of malnutrition, particularly protein deficiency in diets of the populace (Amaefule *et al.*, 2009). The exorbitant cost of commercial poultry feeds had been identified to be largely due to high cost of Conventional feedstuffs. Feed account for about 70% of total cost of production (Ademola and Farinu, 2006). A high cost of feed is due mainly to competetion between man and Livestock for grains and conventional sources of plant (Soya beans, groundnut seed) and hence animal proteins (Emenalon, 2004). The most promising way to solve the problem of competetion between man and animal for plant protein is to identify cheaper and available feed stuff that have less or no industrial use that can meet nutritional requirement of poultry with or without processing (Akinmutimi, 2001). One of such seeds that have potential of being used in poultry feeds is the Red kidney Bean seed (*Phaseolus vulgaris*). The kidney bean (*Phaseolus vulgaris*) also known as common bean, haricot bean, navy bean, dry bean, snap bean, French bean and pinto bean are native of Central America (Olomu, 2011). The bean is an herbaceous annual plant grown worldwide for its edible fruit, either the dry seed or the unripe fruit both of which are referred to as beans (Philips and Rix, 1993). Kidney bean is a leguminous crop grown in different parts of the world. Several varieties of this crop are currently cultivated in fairly large quantities in Mangu and Bokkos areas of Jos, Plateau State, Nigeria and are worth investigating for use as a possible source of protein ingredient in poultry feed production.

However, like other grain legumes, its usefulness as a feed ingredient for monogastric animals is limited due to the presence of some anti-nutritional substances in feedstuffs which has been associated with growth depression and pancreatic hypertrophy in many monogastric animal species (Birk, 1988; Olomu, 2011). However, it has been established that heat treatment and other processing methods exert beneficial efforts on the seeds of the grain legumes by destroying the anti-nutritional factors inherent in them (Balogun *et al.*, 2001). Thus boiling tends to increase palatability and protein intake (Goshit, 2015). Results obtained from the processed methods of red kidney beans (roasting, cooking, salting, and chemical treated) improved the amino acid availability. Against this background the present study focused on the use of Red kidney bean seeds boiled in alkaline salt (potassium bicarbonate) Solution as protein feedstuff for broiler chickens.

MATERIALS AND METHODS

Location of Experiment

The study was carried out at the Poultry Research Farm of the Department of Animal Science and Range Management of Modibbo Adama University, Yola, Girei Local Government Area of Adamawa State, Nigeria. Farm lies between latitude 9^0 and 11^0 N of the equator and longitude 10^0 and 14^0 E of the Greenwich meridian. Adamawa shares its boundaries with Taraba state to the South and West, Gombe state to the North-West and Borno state to the North. The state has tropical climate with distinct dry and wet seasons. It has an average minimum and maximum temperatures of 18 and 40^0C and relative humidity of 20 and 80% Adamawa state has an international boundary with the Cameroon Republic along its eastern boarder (Adebayo, 1999).

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Source of Red Kidney Bean (*Phaseolus Vulgaris)* and Raw Materials

The red kidney bean seeds were purchased from Mangu market in Mangu Local Government Area of Plateau State. Other ingridients like Alkaline salt, Potassium bicarbonate (KCO_2) were purchased from Jimeta market. The seeds were subjected to the following processing methods before using it for the feeding trial.

Processing of Red Kidney bean seeds

Cold clean water was brought to boiling point (100 ^{0}C) in a 200 litres capacity half cut drum; a modified method of boiling pigeon pea seeds was adopted. 100g of alkaline salt, potassium bicarbonate (KCO_2) was dissolved to produce an aqueous solution. Raw red kidney bean seeds was poured into the boiling water and covered. After 60 minutes, the content was drained off and boiled seeds were sundried for 4 days, before milling and then used to formulate Boiled Red Kidney Bean Seed Meal (BRKBSM) diets.

Experimental Diets and Chemical Analysis

Raw and boiled red kidney bean seeds (Table 1) were analysed for proximate composition before used in formulating the experimental diets. Five experimental broiler Starter and finisher diets were formulated as in Tables 2 and 3. Diet 1 (T1) which served as Treatment Control contained 0% Boiled Red kidney bean seed meal while treatments 2, 3, 4 and 5 contained Boiled Red Kidney Bean Seed Meal (BRKBSM) at 25, 50, 75 and 100 % levels respectively. All diets were formulated to be isocaloric (ME 3137 and 3232 kcal/kg) and isonitrogenous (19 and 22 % CP) at both starter and finisher phases respectively. The Raw and boiled red kidney bean seeds (Table 1), and formulated broiler starter finisher feeds (Table 2 and 3) samples were analyesd for proximate composition according to the standard described by AOAC (2010) as reflected in determined analysis.

Table 1: Proximate Composition of Raw and Boiled Red Kidney Bean Seeds

Nutrient (%)	Raw	Boiled
Dry Matter	96.44	95.55
Crude Protrin	24.45	22.56
Ether Extract	3.69	3.43
Crude Ash	5.34	2.68
Nitrogen Free Extract	56.28	54.10
ME: (kcal/kg)	3796	3755

ME (kcal/kg) 37 x CP (%) + 81 x EE (%) + 35.5 x NFE (%) (Pauzenga,1995).

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Table 2: Ingredients and Percentage Composition of Experimental Diets Broiler Starter Diets (1-4 Weeks)

	Graded levels of BRKBSM				
Ingredients	**T_1 (0%)**	**T_2 (25%)**	**T_3 (50%)**	**T_4 (75%)**	**T_5 (100%)**
Maize	55.10	51.25	46.89	43.00	43.46
Groundnut cake	29.60	22.20	14.80	7.40	0.00
Soya Bean meal	6.00	6.00	8.40	11.00	12.30
Maize Bran.	3.10	3.10	3.10	3.10	0.91
Palm oil	2.30	2.40	2.11	1.60	1.40
Red kidney bean meal	0.00	7.40	14.80	22.20	29.60
Fish meal	1.30	4.49	6.00	7.30	9.20
Bone meal	1.70	1.40	1.41	1.40	0.40
Limestone	2.30	2.40	2.11	1.60	1.4
Salt	0.30	0.25	0.25	0.25	0.25
*vitamin mineral premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.15	0.30	0.30	0.30	0.30
Methionine	0.10	0.20	0.20	0.20	0.20
Total	**100**	**100**	**100**	**100**	**100**
Determined Analysis					
Crude protein%	22.23	22.23	22.06	22.70	22.30
Ether extract%	5.01	5.02	5.10	5.00	5.02
Calcium%	1.48	1.51	1.47	1.31	1.02
Phosphorus%	0.56	0.56	0.59	0.62	0.50
Crude fiber%	3.12	3.07	3.10	3.16	3.13
Lysine%	0.87	0.10	1.09	1.20	1.30
Methionine%	0.31	0.36	0.38	0.41	0.44
ME(kcal/kg)	3209	3231	3222	3210	3200
Ash %	5.12	5.25	5.29	5.21	5.01

Vitamin-mineral premix provided the following per kg: Vit A 1500 IU; Vit D_3 3000 IU; Vit E 30 IU; Vit k 2.5mg; Thamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4 mg; Nacine 40mg; Vit B_{12} 0.02mg; Pantothenic acid 10mg; Folic 1mg ; Biotin 0.08mg; Chloide 0.125 mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; Se 0.24; Co 0

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Table 3: Ingredients and Percentage Composition of Experimental Broiler Finisher Diets (5-8 Weeks)

	Graded level of BRKBSM				
Ingredients	**T_1 (0%)**	**T_2 (25%)**	**T_3 (50%)**	**T_4 (75%)**	**T_5 (100%)**
Maize	53.00	47.06	50.00	43.10	46.12
Groundnut cake	18.75	6.25	12.5	7.4	0.00
Soya Bean meal	12.00	16.00	15.00	11.00	20.00
Maize Bran.	4.00	4.10	4.00	3.10	0.90
Palm oil	1.52	2.41	1.90	2.00	2.80
Red kidney bean seed meal	6.25	18.75	12.5	22.2	25.00
Fish meal	0.48	2.00	0.50	7.30	2.00
Bone meal	1.70	1.10	1.20	1.40	0.60
Limestone	1.30	1.43	1.50	1.60	1.70
Salt	0.25	0.25	0.25	0.25	0.25
*vitamin mineral premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15	0.15
Methionine	0.10	0.2	0.2	0.2	0.2
Total	**100**	**100**	**100**	**100**	**100**
Determined Analysis					
Crude protein%	19.13	19.15	19.15	19.14	19.16
Ether extract%	4.12	4.32	4.13	4.56	4.26
Calcium%	1.08	1.00	1.01	1.31	0.10
Phosphorus%	0.54	0.47	0.46	0.62	0.40
Crude fiber%	3.78	3.83	3.53	3.81	3.47
Lysine%	0.90	1.04	0.96	1.20	1.13
Methionine%	0.29	0.32	0.30	0.41	0.33
ME(kcal/kg)	3137	3152	3148	3167	3154
Ash %	5.04	5.03	5.01	5.06	5.03

Vitamin-mineral premix provided the following per kg: Vit A 1500 IU; Vit D_3 3000 IU; Vit E 30 IU; Vit k 2.5mg; Thamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4 mg; Nacine 40mg; Vit B_{12} 0.02mg; Pantothenic acid 10mg; Folic 1mg ; Biotin 0.08mg; Chloide 0.125 mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; Se 0.24g;co 0.24g

Experimental Animal and Experimental Design

A total of Two hundred (200) day old (*Anak, 2000*) white strain broiler chicks were used for the experiment. Birds were weighed and randomly allotted to five dietary treatments of 40 birds per Treatment, 10 birds per replicate. Each treatment was replicated 4 times in a completely randomized design (CRD). Weighed quatities of experimental Diets were supplied to each group every morning. Left-over feeds were deducted from the quantity supplied the next moringing to determine the feed intake. Water was supplied *ad libitum* throughout the period of the experiment for (8 weeks).

Hematological and Serum Biochemical Studies

On the 56th day of the feeding trial, the birds were starved overnight, four birds per treatment were randomly picked and each was bled. This was achieved by puncturing the web vein with a 5 ml gauge syringe and needle, transfering the blood into labeled sterile universal bottle containing 1.0mg/ml ethylene diamine tetracetate acid (EDTA) as anti-coagulant. This was used to determine the hematological components according to the method described by Ajagbonna *et al.* (1999) and Uko *et al.* (2000). Another 5 ml was collected into a labeled sterile sample bottles without coagulant and was used to determine the biochemical components (Ajagbonna *et al.*, 1999; Uko *et al.*, 2000). Parameters determined include Packed Cell Volume (PVC), Hemoglobin Concentration (Hb), Red Blood Cell (RBC) and White Blood Cell (WBC), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Haemoglobin (MCH). The biochemical indices included the level of glucose, total protein, globulin, albumin, urea, creatinine and cholesterol.

Statistical Analysis

All data generated were subjected to One-Way Analysis of Variance (ANOVA) as described by Steel and Torrie (1980). And treatment means were compared using Duncan Multiple Range Test (DMRT) (Duncan, 1955).

RESULTS AND DISCUSSION

Haematology

Parameters for haematological assay were not significantly affected by the treatment diets ($P>0.05$) except MCV ($P<0.01$) and MCHC ($p<0.05$) respectively (Table 4). Values obtained for these parametres fell within the range established by Mitruka and Rawnsley (1977). Similarities in the values of heamoglobin (Hb) among birds irrespective of inclusion levels implies that diets were adequate in critical nutrients such as; iron, copper, vitamins and amino acids. Similarly, Sainsbury (1983) reported that haemoglobin measures the ability of an animal to withstand some level of respiratory strees. RBC values fell within the normal range reported by Roberts *et al.*, 2003. However, it did not agree with the work of Adejinmi *et al.* (2000) who reported inconsistent RBC values for broilers. The present study suggests that blood of birds had appreciable oxygen carrying capacity which also indicates nutrient transport by blood was not impaired by feeding the test diets. Iheukwemere (2008) observed strong influence of diets in heamoglobin traits with packed cell volume (PCV) as being strong indicators of nutrition status of the animals. White blood cell values for birds fed BRKBSM followed the same pattern with RBC values. Values obtained in this study fell within normal limits for chickens (Ross *et al.*, 1979). Esonu *et al.* (2001) reported that quality of haematological indices is always a reflection of animals responsiveness to both internal and external enviroments which includes feed and feeding. However, all heamatological values fell wothin the range for chickens (Maxwell *et al.*, 1990; CCAC, 1993).

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Table 4: Heamatological Indices of Broiler Chicken Fed Boiled Red Kidney Bean Seed Meal (BRKBSM)

	Control	Levels of Inclusion				
Parameter	**T_1 (0%)**	**T_2 (25%)**	**T_3 (50%)**	**T_4 (75%)**	**T_5 (100%)**	**SEM**
PCV%	38.54	38.17	38.61	38.68	38.65	0.91^{ns}
Hb(g/100ml)	10.12	9.98	10.05	10.12	10.16	0.13^{ns}
MCV(um^3)	152.82^a	140.22^b	140.13^a	141.10^c	146.59^b	7.79**
MCHC(g/dl)%	26.25^b	27.60^{ab}	26.06^b	27.19^a	26.24^b	0.84*
MCH (pg)	47.99	48.63	46.38	48.26	48.81	2.03^{ns}
RBC ($x10^6/mm^3$)	2.65	27.60	26.06	30.19	26.24	0.121^{ns}
WBC ($x106/mm^3$)	11.09	11.01	11.06	11.95	11.34	0.26^{ns}

$^{a-d}$Means in the same raw with different superscripts are significantly (P<0.05)

Serum Biochemical Indices

The results of the biochemical estimation of serum total protein, blood urea nitrogen, blood glucose, albumin, globulin, creatinine and cholesterol values (Table 5) showed that there were no significant (P>0.05) difference. Bamgbose *et al*. (2003) reported that total protein and albumin are indicators of protein reserve as extra source of energy to the birds (Mayes, 1996). Globulin values obtained for all the test diets could be due to the adequate protein in the treatment diets as was observed by Awojobi and Opiah (2000) that the higher the level of Globulin the greater the ability to fight infections. Urea and creatinine values indicated no obvious muscular wastage due to protein adequacy.

Table 5: Serum Biochemical Indices of Broiler Chickens Fed Boiled Red Kidney Bean Seed

	Control	Levels of Inclusion				
Parameter	**T_1 (0%)**	**T_2 (25%)**	**T_3 (50%)**	**T_4 (75%)**	**T_5 (100%)**	**SEM**
Glucose (mg/100ml)	174.02	173.83	173.37	170.93	173.24	2.06^{ns}
Albumin (g/100ml)	2.56	2.98	3.19	3.04	3.04	0.16^{ns}
Globulin (g/dl)	2.46	2.42	2.48	2.47	2.41	0.13^{ns}
Cholesterol (mg/100ml)	81.17	76.03	76.00	76.00	76.00	0.43^{ns}
Total protein (g/100ml)	5.32	5.11	5.17	5.11	5.16	0.14^{ns}
Urea (mg/100ml)	1.35	1.44	1.41	1.44	1.44	0.19^{ns}
Creatinine (mm01/c)	0.73	0.75	0.74	0.73	0.70	0.04^{ns}

CONCLUSION

The over all result indicated that Boiled Red Kidney Bean Seed meal is a satisfactory protein source which can be included in the broiler chickens diets up to 50% without any deleterious effect on the growth performance and heamatological and serum biochemical indices of broiler chickens. Hence, 50% inclusion level of Boiled Red Kidney Bean Seed Meal could be recommenmed for broiler diets.

Conflit of Interest
The authors declare no conflict of interest that may affect the outcome of the study in any way.

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REFERENCES

Adebayo, A.A. (1999). Climate II In: Adebayo, A.A. and Tukur, A. I. (Eds). Adamawa state Paraclete Publishers Yola.

Ademola, S. G. and Farinu, G. O. (2006). Performance of laying birds fed diets containing forage meal of Tithonia diversifolia (Hems1 A. Gray) and antibiotics. *Nigerian Journal of Animal Production.* 33(1):58.68.

Ajagbonna, O.P., Onifade, K.I. and Suleiman, U. (1999). Haematological and biological changes in rats given extracts of C*alotropis procera*. *Sokoto Journal of Veterinary Science 1:36-42.*

Akinmutimi A.H, Onwadike OC (2001). Soaked and Toasted Lima beans (*phaseolus lunatus*). In broiler chicken diet. Effect on Haematological parameters and Blood Chemistry.Nigeria Soc. Anim. Prod. (NSAP) Proc. 26th Annual Conference, 17 – 19 September 2001, Maiduguri. pp 48 – 49.

Amaefule, K. U., Oke, U. K and Obioha, F C. 2009. Pigeon pa (Cajanus cajan) Seed meal in layer diets to laying performance and egg quality characteristics of puulet fed rwa or processed pigeon pea seed meal diet during grower and layer stage of life, *international Journal of Poultry Science.* 6: 445-451.

Ani, A. O. and Okorie, A. U . 2005. Effect of graded levels of dehulled and cooked castor iol bean (Ricinus comunis, L.) meal onperformance of broiler starters. *Nigerian. Journal of Animal Production.* 35(1): 54-60.

AOAC (2010). Official method of analysis, 18th edition association of the official analytical chemists standard method Arlington, USA.

Awojobi, H. A. and Opiah, G. O. 2000. The effect of physiological status on some blood parameter of the New Zealand White doe rabbits. Proceedings of Animal Science Association of Nigeria. pp 14-16.

Babatunde, B. B. and Hamzat, R. A. (2005). Effect of feeding graded levels of kolanut husk meal on the performance of cokerels. *Nigerian Journal of Animal Production*. 32 (1): 61-66.

Balogun, T. F., Kaankuka, F. G. and Bawa G.S. (2001): Effect of period of boiling full-fat soya beansn on its amino acid profile and performance of pigs. *Nigerian Journal of Animal Productin*. 28(1): 45 – 51.

Bamgbose, A. M., Nwokoro, S. O. and Tewe, O. O. (2003). Serum metebolites and nutrients utilization of broilers fed extruded full fat soyabean diets. *Journal of Arid Agriculture*. 13: 167-171.

Birk, Y. (1988). Protein Protease inhibitors of plant origin and their significance in nutrition, In: J. Huisman, T.F.B. Vanda Poel A.F.B. & Liener, I.E. (Eds). Recent advances on research in anti-nutritional factors in legumes seeds. Wageningen, Netherlands. Pp. 749-752.

CCAC – Canadian Council of Animal Care (1993): Breeding, physiological and nutritional parameters by species. Extract from guide to the care and use of experimental animals. 2nd edition (Appendix D. http://www.yonsci.ac.kr) Pp 1-3.

Duncan, D. E. (1955): Multiple range and multiple F-tests. Biometrics. 11:1-42.

Esonu, B. O., Emenelom, O. O., Udedibie, A. B. I., Herbert, U., Ekpor, C. F., Okoli, I. C. and Iheukwumere, F. C. (2001). Performance and blood chemistry of Weaner Pigs Fed Raw *Mucuna* (Velvet Bean) meal. *Tropical Animal Production Investigation.* 4:49-54.

Emenalon, O.O. (2004). Comparative performance of broiler chicks fed diets Containing differently processed *Mucuna pruriens* seed meal. *Nigerian Journal of Animal production*. 31 (1): 12-16

Goshit, D. T. (2015). Nutritive value of red kidney bean (*phaseolus vulgaris*) seed meal in broiler chickens diet, PhD. Thesis.

Iheukwumere, F. C., Onyekwere, M. U. and Egu, U. E. (2008). Growth, carcass and productive characteristics of male rabbits (bucks) fed raw and boiled pigeon pea seed (*Cajanus cajan*) meal. *Pakistan Journal of Nutrition*. 7: 17-20. http://dx.doi.org/10.3923/pjn.2008.17.20

Maxwell, M. H., Robertson, G. W. and McCorquodute, C. C. (1990). Comparison of haematological values of restricted and *ad libitum* feeding in domestic fowls, red blood characteristics. *British Poultry Science.* 31(3): 407-413.

Mayes, P. A. (1996). Harpers Biochemistry. 24th Ed. New Jersey, USA: Prentice-Hall International Inc.

Mitruka, B. M and Rawnsley, H. M. (1977). Clinical Biochemical and Haematological Reference values in normal experimental animals. Manson Publishing USA Inc.

Olomu, J. M. (2011). Monogastric animal nutrition (principles and practices). 2nd Edition St. Jackson Publishing Benin City. pp.206-228.

Philips, R. and Rix (1993). Vegetables. New York: Random house
ISBN: 9780679750246. http://books.google.ca/books/ about/vegetables.html

Ross, J. G., Christies, G., Halliday, W. G. and Jones, R. M. (1979). Haematological and blood chemistry comparison values for clinical pathology in poultry. Veterinary Record. 102:29-31.

Roberts, K. M., Daryi, K. G., Peter, A. M. and Vivtor, W. R. (2003). Harper's Biochemistry 25th Edition, McGraw-Hill, New York. 25:763-765

Sainsbury, D. (1983): *Animal Health* 1st Edition. Granada Publications limited, New York, USA.

Steel, R. G. D. and Torrie, J. H. (1980). *Principles and Proceedures of Statistics. A biometric Approach*. 2nd ed. McGraw-Hill Book Co., Inc. New York.

Uko, O. J., Ataja, A. M., Tanko, H. B. (2000). Weight gain, haematology and blood chemistry of rabbits fed Offals. Sokoto *Journal of Veterinary Science. 2:18-26.*