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Effects of Quantitative Replacement of Soya Bean Meal with Raw Sword Bean (*Canavalia gladiata*) Meal in Grower Rabbit Diets

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Abstract: The effect of quantitative replacement of soyabean meal with raw sword bean meal in grower rabbit diets was investigated using twelve grower rabbits in a completely randomised design experiment. There were four dietary treatments and three rabbits were allocated to each of the diets, therefore by implication, one rabbit per replicate. The experiment lasted for 56 days. The result showed that there was no significant difference ($p>0.05$) among the treatments with regard to the growth performance parameters. The highest gross margin of N1660.2k was obtained with 15% dietary level of inclusion (96.76% replacement of soyabean meal). The cut-parts and organ weights showed no significant difference ($p>0.05$) among the treatment means with the exception of the thigh and back-cut for cut-parts and liver and spleen for organ weights. The highest value for back-cut and thigh occurred in diets three and four respectively. The liver and spleen values did not follow any specific trend. Based on the above results, 15% dietary level of inclusion of raw sword bean (96.76% quantitative replacements soyabean meal) compared favourably with control diet (soyabean meal based diet) and hence recommended.

Key words: Effects, soya bean meal, raw sword bean meal, rabbit diets

INTRODUCTION

Like other monogastric animal species, commercial rabbit production is contrained by the phenomenal rise in the cost of the major conventional energy and protein feed ingredients. The competition between humans and livestock for available cereal and legume grains makes it difficult to meet up the nutrient requirements of these animals at a more economical cost[1]. There is the need therefore to focus on the use of alternative unconventional feed ingredients for the monogastric[2]. One of such alternative green legume envisage is sword bean.

Sword bean (*Canavalia gladiata*) has such potential[3]. It is a lesser known tropical legume, which is widely available in Nigeria and thrives well on portions of lands where most crops fail due to its excellent adaptability to extreme climatic conditions. It yields about 4,600 kg of seed per hectare, with crude protein content of about 22-29% and is rarely edible by man[4,5]. The presence of anti-nutritional factors such as con-canavalin-A, canavalin, canalin, phytins, tannis, saponins etc have been reported in sword beans[6,4,7].

There is dearth of information on the extent to which grower rabbits can utilize the raw sword bean especially when the raw sword bean is quantitatively replacing conventional protein sources such as soyabean meal. This therefore, forms the basis for which this experiment was carried out.

MATERIALS AND METHODS

Experimental animal, procedure and management: A total of twelve grower rabbits of mixed sexes and breeds of Chinchilla, New Zealand and Dutch averaging 0.76 kg were used for the investigation. They were housed in hutches of 50 cm×50 cm×50 cm type made of wooden skeleton and wire mesh of 0.3m on the sides and the floor. The rabbits were randomly assigned to four treatments having three replicates with a rabbit per pen in a Completely Randomised Design.

The raw sword bean was harvested from Umudike environment, dried, milled and incorporated into the rabbit diets. Four experimental diets were formulated. Diet one was purely soyabean-based diet (control diet) while the test feedstuff (raw sword bean) quantitatively replaced soyabean meal in diets two, three and four (Table 1).

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Table 1: Composition of experimental diets

Ingredients	T_1 (0%)	T_2 (32.25%)	T_3 (64.5%)	T_4 (96.72%)
Maize	55	55	55	55
Soya bean	15.5	10.5	5.5	0.5
Raw sword bean	-	5	10	15
PKC	25	25	25	25
Blood meal	3	3	3	3
Salt	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25
Total	100	100	100	100
Crude protein (%)	17.31	16.60	16.01	15.36
ME (kcal kg^{-1})	2879.55	2874.55	2869.55	2864.55

1 Kg of premix contains Vitamins A (5,000,000 i.u), Vitamins D3 (1,000,000 i.u), Vitamin E (16,000 mg), Vitamin K3 (800 mg), Vitamin B1 (1,200 mg), Vitamin B2 (22,000 mg), Niacin (22,000 mg), Calcium pentothenate (4,600 mg), Vitamin B6 (2,000 mg), Vitamin B12 (10 mg), Folic acid (400 mg), Biotin (32 mg), choline chloride (200,000 mg), Manganese (948,000 mg), Iron (40,000 mg), Zinc (32,00 mg), Copper (3,400 mg), Iodine (600 mg), Cobalt (120 mg), Selenium (48 mg), Anti-oxidant (48,000 mg)

Table 2: Proximate composition of experimental diets and test feedstuff

Constituents (%)	T_1	T_2	T_3	T_4	Raw sword bean
Dry matter	87.89	90.11	90.13	89.86	90.91
Crude protein	16.31	15.57	16.11	16.51	24.96
Ether extract	3.6	3.8	3.72	3.89	2.14
Crude fibre	3.54	4.15	4.26	4.20	5.4
Ash	7.2	7.8	8.21	8.38	3.72
Gross energy (kcal kg^{-1})	3099	3093	3088.5	3087	4230.5

The rabbits were then assigned to these diets, feed and water were given ad-libitum throughout the period of the experiment which lasted for 56 days.

Data were collected weekly for feed intake and weight-gain, while feed conversion ratio was derived from both. Gross margin was evaluated using the method of Sonaya[8]. At the end of the trial, two rabbits per treatment were randomly selected and fasted overnight and later bled by severing the jugular rein. Evaluation of carcass characteristics and organ weights were carried out as described by Ojewola and Longe[9].

The raw beans and the respective diets (1-4) were analysed for proximate composition using the procedure of AOAC[10] (Table 2) The gross energy was determined using Gallenkanp Ballistic Bomb Calorimeter. Determination of tannin, phytic acid, trypsin inhibitor and hydrogen cyanide were carried out using the procedures of Maga[13], Lucas and Markaka[14], Kakade *et al*[15]. and Knowles *et al*[16].

The data were subjected to analysis of variance (ANOVA) as described by Steel and Torrie[11] while means separation was carried out using Duncan Multiple Range Tests as described by Duncan[17].

RESULTS AND DISCUSSION

Table 3 shows the growth performance of rabbits fed quantitative replacement of soyabean meal with raw sword bean meal. For all the parameters measured there were no significant differences ($p>0.05$), although there was a declining tendency in numerical values of final body weight, feed intake and weight gain as the quantity of raw sword bean meal increased in the diets. This may be due to the effect of anti-nutritional factors (Table 4), which have been reported to have negative influence on feed intake and/or weight gain[5-7,12]. The non- significant level for all the parameters above shows that the anti-nutritional factors are still within a tolerable level.

Table 3: Mean values for growth performance and gross margin for rabbits fed experimental diets

Parameters	T_1 (0%)	T_2 (32.25%)	T_3 (64.5%)	T_4 (96.72%)	SEM
Initial weight (g)	753	763	760	747	191.4
Final weight (g)	1792	1775	1708	1617	151.2
Weight gain/ rabbit/day (g)	18.55	18.06	16.993	15.54	1.70
Feed intake/ rabbit/day (g)	71.7	63.1	66.7	63.6	4.89
Feed conversion ratio	3.87	3.49	3.94	4.09	0.356
Gross margin (N)	1622.15	1651.42	1652.34	1666.26	0.577

Table 4: Anti-nutritional factors in test feedstuff

Anti-nutritional factors	Value
Tannin (g $100g^{-1}$)	1.03
Phytic acid (g $100g^{-1}$)	2.00
Trypsin inhibitor (TIU mg $protein^{-1}$)	33.59
HCN (mg kg^{-1})	28.92

Table 5: Mean weight of cut parts as a percentage of dressed weight

Cut-parts	T_1 (0%)	T_2 (32.25%)	T_3 (64.5%)	T_4 (96.72%)	SEM
Thigh	21.89^b	24.57^a	21.31^b	25.00^a	0.231
Drumstick	5.76	6.25	6.45	7.14	0.102
Forearm	5.49	6.25	6.45	6.70	0.102
Shoulder	8.49	7.98	5.81	8.48	2.061
Chest cavity	17.57	15.15	15.17	15.18	1.835
Back cut	40.64	42.57^a	45.77	36.61^b	2.538
Dressed weight (%)	52.90	52.11	52.89	53.3	0.056

a-b means with different superscripts on the same row differ significantly ($p>0.05$)

Table 6: mean weight of organ as a percentage of dressed weight

Parts	T_1 (0%)	T_2 (32.25%)	T_3 (64.5%)	T_4 (96.72%)	SEM
Spleen	0.0710^b	0.0880^a	0.0730^b	0.0857^a	0.000706
Heart	0.50	0.57	0.57	0.57	0.000
Kidney	1.17	1.49	1.29	1.83	0.000
Liver	5.00033^b	6.250000^a	3.230000^d	3.570000^c	0.0002357

a-d means with different superscripts on the same row differ significantly ($p>0.05$)

Although the feed conversion ratio did not show significant difference ($p>0.05$) among the treatment means, it numerically favours diet two, since the lower the values of feed conversion ratio, the better[18]. This was a product of moderate feed intake and good weight gain. Since for all parameters measured there were no significant differences, it then implies that 15% (96.72% quantitative replacement of soyabean meal) dietary level of inclusion of raw sword bean meal could be chosen, particularly where the cost-effectiveness is an issue of

importance. The non-deleterious effect of 15% (96.72% quantitative replacement of soyabean meal) dietary level of inclusion of raw sword bean meal on growth performance of rabbits is not in agreement with the report of Akinmutimi[5] who reported deleterious effect on growth performance of another monogastric animal (broiler) at 5% quantitative replacement of soyabean meal with raw sword bean meal. This may be attributed to species difference. The above result is in agreement with the report of Akinmutimi and Abasiekong[4] who reported non-deleterious effect on growth performance of rabbit fed raw soyabean meal (another grain legume) even at 25% dietary level of inclusion. The gross margin of the experimental diets is as shown in Table 3. It ranges from N1622.13 (0%) to N1666.26 (15%) raw sword bean meal.

The diets containing the test ingredients had higher values of gross margin than the control diet. This may be the product of favourable weight gain, moderate feed cost and good market price for the rabbits placed on the test diets. Among the experimental diets, diet four, 15% (96.72% quantitative replacement of soyabean meal) dietary level of inclusion of raw sword bean meal had the highest gross margin, making it the most cost-effective.

Result of cut-parts expressed as percentage dressed weight of rabbits fed experimental diets is as shown in Table 5. There was no significant difference ($p>0.05$) for the treatment means in all the parameters measured, with the exception of thigh and back cut. The highest values for thigh and back-cut occurred at 15 and 10% (96.72 and 64.50% quantitative replacement of soyabean meal, respectively) dietary levels of inclusion of raw sword bean meal respectively. This result shows differentiability of the test diets to support tissue deposition[18]. In all, considering appreciable values of Diet four for thigh, drumstick, shoulder, forearm and dressing percentage, diet four is recommended. The mean weights of organs expressed as percentage dressed weight of rabbits fed experimental diets are shown in Table 6. There were no significant differences ($p>0.05$) for the values of the heart and kidney among the treatment means but there were significant differences for the values of liver and spleen. The significant differences did not follow specific pattern that could be attributed to the effect of the test ingredient. The non-significant difference ($p>0.05$) for the values of heart and kidney still confirms that the anti-nutritional level is still within a tolerable level since the metabolic activities of the organs, especially kidney which is the major organ for cyanide detoxification could not lead to significant increase in weight of the kidney of the rabbits fed the test ingredient[9,5].

In conclusion, 15% (96.72% quantitative replacement in soyabean meal) dietary level of inclusion of raw sword bean meal compares favourably with the control diet (soyabean-based diet) and hence recommended.

REFERENCES

1. Ugwuene, M.C., O.C Onwudike, S.F. Abasiekong and C.N. Nnadiekeze, 2005. Effect of replacing maize with full-fat palm kernel meal in broiler diets. Proceedings of the 30th Annual Conference of the Nigerian Soc. Anim. Prod., 30: 179.
2. Bawa, G.S., M. Orunmuyi and O.A Onabanjo, 2005. Effect of dietary inclusion levels of mechanically extracted neem seed cake on performance of young rabbits. Nig. J. Anim. Prod., Nigerian Soc. Anim. Prod., 32: 233-239.
3. NAS, 1979. National Academy of Science. Tropical Legume Resource for the future. Washington D.C., pp: 33-45.
4. Akinmutimi, A.H., S.F. Abasiekong and O.C. Onwudike, 1997. Development of sword bean as protein concentrate for animal feeding. Nig. J. Agric. Tech., 16: 82-87.
5. Akinmutimi, A.H., 2004. Evaluation of sword bean (*Canavalia gladiata*). As an alternative feed resource for broiler chickens. Ph.D Thesis, College of Animal Science and Animal Health. Michael Okpara University of Agriculture, Umudike, pp: 4-17.
6. Udedibie, A.B.I., 1990. Nutritional Evaluation of Jackbean (*C. ensiformis*) for the Nigerian Poultry Industry. AMBIO, 19: 361-365.
7. Akinmutimi, A.H., S.F. Abasiekong and R.O. Izundu, 2002. Effect of processing on metabolisable energy and protein content of sword bean (*Canavalia gladiata*) using Muscovy duck (*Carina moshata*) Trp. J. Anim. Sci., 5: 51-56.
8. Sonaiya, E.B., A.R. William and S.A. Oni, 1986. A biological and economic appraisal of broiler production up to 16 weeks. J. Anim. Sci. Res., 6: 115-125.
9. Ojewola, G.S. and O.G Longe, 1999. Comparative response and carcass composition of broiler chickens feed varying protein concentration. ASAN Conference Proceedings, pp: 69-72.
10. A.O.A.C., 1990. Association of Official Analytical Chemists. (15th Edn Published by the association of official analytical chemists, Washington D.C.
11. Steel, R.G. and J.H. Torrie, 1980. Principle and procedure of statistics. A Biometric Approach and Edition. Mac Graw Hill Book Co.

12. Fielding, D., 1991. Rabbits: In Tropical Agricultural Series C.T.A./Macmillan Education Ltd. London, pp: 39-50.
13. Maga, J.A., 1982. Phytate. Its chemistry, occurrence, food interaction, nutritional significance and method of analysis. J. Agric. Food Chem., 30: 1.
14. Lucas, G.M. and P. Markaka, 1975. Phytic acid and other phosphorus compounds of bean (*Phaseolus vulgaris*). J. Agric. Edn. Chem., 23: 13-15.
15. Kakade, M.L., J.J. Rachis, J.E. Meghee and C. Puski, 1974. Determination of Trypsin Inhibitor Activity of Soy Products: A collaboration analysis of improved procedure. Cereals Chem., 51: 376.
16. Knowles, W. and R.D. Montgomery, 1990. Toxic constituents of plant food stuffs-2nd Ed. Academic Press, New York, pp: 10-15.
17. Duncan, D.B., 1995. Multiple Range Tests Biometrics, 11: 1-42.
18. Abiola, S.S., 1999. Comparative utilization of toasted and cooked soyabean in broiler ration. NSAP proceedings. Ilorin, pp: 189-199.
19. Ologhobo, A.D., A. Apata, A. Oyejide and R.O. Akinpelu 1993. A comparison of protein fractions prepared from lima beans (*Phaseolus lunatus*) in starter diets. Animal Resources, 4: 13-30.