AN EVALUATION OF RAW AND COOKED WHOLE SOYABEANS FOR BROILERS

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ABSTRACT

Two hundred day old broiler chicks were allotted to five treatment groups to evaluate the effect of whole soyabean and fish meal supplementation on productivity of the experimental birds. Feed consumption and weight gains were similar on diets 1 and 3, while feed efficiency and protein efficiency ratio were better ($P < 0.05$) on the cooked soyabean diet 3 as compared to the groundnut cake based (control) ration. Fish meal supplementation also improved performance. The raw soyabean diet gave the poorest performance. Metabolizable energy was higher ($P < 0.05$) on cooked soyabean (diet 3) than the groundnut cake based ration. Carcass characteristics were similar on the control and cooked soyabean based rations when supplemented with fish meal. The cost of feed per kg. live weight gained was least on cooked soyabean and highest on raw soyabean based rations.

INTRODUCTION

Soyabean cultivation is becoming popular in Nigeria in recent times. Its use in livestock feeding is however limited by the need to process the legume before incorporation into rations due to the presence of anti-nutritional factors in the raw seeds. There are a limited number of soyabean processing plants in the country and its use at centres of production therefore requires adoption of simple techniques practicable at the village

level. Soyabean is deficient in methionine and its use in livestock feeding requires its supplementation with synthetic amino acids or animal protein source (Balloun, 1980). It is the aim of this study to compare the utilization of soyabeans and groundnut cake as plant protein sources in broiler rations. The effect of supplementation of soyabean rations with fish and/or blood meal is also evaluated.

MATERIALS AND METHODS

200 day old cobb broiler chicks were randomly allotted to five treatment groups with two replicates consisting of 20 birds each. The diets were formulated as shown in table 1. Diet 1 was the control containing groundnut meal (G.N.M) as the plant protein source. Diet 2 had GNM replaced with raw soyabean while diet 3 had the GNM replaced cooked soyabean. Diet 4 also contained cooked soyabean without fish meal supplementation while diet 5 had no fish meal nor blood meal supplementation. Chicks were raised for four weeks in the tier brooder cage before they were transferred to floored pens. Feed and water were provided *ad libitum* and routine vaccinations administered. Body weight and feed consumption

TABLE 1.

Gross and proximate composition of experimental diets

INGREDIENTS	DIETS (%)				
	1	2	3	4	5
Yellow Maize	60.25	55.37	55.37	46.04	37.70
Groundnut Meal	23.00				
Raw Soyabean	—	23.00	—	—	
Cooked Soyabean	—	—	23.00	40.38	53.55
Blood Meal	3.00	4.83	4.83	4.83	
Fish Meal	5.00	8.05	8.05	—	
Wheat Offal	5.00	5.00	5.00	5.00	5.00
Bone Meal	2.00	2.00	2.00	2.00	2.00
Vitamin/Min. Premix	0.50	0.50	0.50	0.50	0.50
Common Salt	0.25	0.25	0.25	0.25	0.25
TOTAL	100	100	100	100	100
<i>Proximate Constituents (%)</i>					
Moisture	9.44	9.87	9.50	10.00	10.20
Crude Protein	20.96	21.49	21.58	21.26	21.30
Ether Extract	4.03	7.00	6.86	8.64	10.65
Ash	7.10	7.80	7.76	6.87	7.65
Crude Fibre	4.47	4.65	4.51	5.96	7.00
N. F. E.	54.00	49.19	49.79	47.27	43.20

were recorded weekly. Mortality records were also kept throughout the study period. Faeces were collected at 24 hours interval from each group of birds in the tier brooder on 14 successive days during the third and fourth week for nitrogen balance studies. Proximate composition of feed and faeces were carried out using the A.O.A.C. (1975) methods. Gross energy of sample was determined with the ballistic bomb calorimeter. At the end of the trial (six weeks), three birds selected from each replicate were starved of feed for 24 hours to allow the gut to be cleared of its content before slaughtering. Live weights were recorded followed by

slaughtering by cutting the jugular vein. Carcass measurements were subsequently taken on them. All data were subjected to analysis of variance and treatment means compared using the Duncan's Multiple Range Test (Steel and Torrie, 1960). An economic appraisal of the study was carried out to show the efficiency of the rations in terms of cost per unit liveweight gain.

RESULTS

Performance and carcass characteristics: The performance of broilers on the experimental rations are presented in table 3. Feed consumption and

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TABLE 2.

Essential amino acid profile* of Experimental rations

	DIET 1 %	DIET 2 %	DIET 3 %	DIET 4 %	DIET 5 %
Arginine	1.82	1.30	1.40	1.56	1.74
Cystine	2.20	0.37	0.41	0.42	0.43
Glycine	1.25	1.14	1.29	1.21	1.29
Histidine	0.59	0.61	0.66	0.80	0.57
Isoleucine	1.00	0.94	1.06	1.07	1.27
Leucine	2.02	2.20	2.20	2.18	1.98
Lysine	1.03	1.27	1.44	1.41	1.39
Methionine	0.36	0.36	0.42	0.34	0.35
Phenylalanine	1.23	1.14	1.23	1.28	1.19
Threonine	0.82	0.90	0.99	0.99	0.99
Tryptophan	0.26	0.29	0.31	0.33	0.34
Tyrosine	0.61	0.53	0.62	0.66	0.67
Valine	1.15	1.14	1.25	1.25	1.16

*Calculated values expressed as percentage of ration.

TABLE 3:

Performance carcass characteristics and nutrient utilization of broilers on the experimental rations.

Parameters	DIETS					SE $\bar{x}$
	1	2	3	4	5	
Daily weight gain/bird	25.91 ^{ab}	17.31 ^d	28.21 ^a	23.92 ^b	20.93 ^c	± 1.91
Daily Feed, intake/bird (g)	55.84 ^a	40.55 ^c	55.30 ^a	53.97 ^a	49.72 ^b	± 2.84
Feed Conversion Ratio	2.02 ^b	2.33 ^a	1.81 ^c	2.08 ^b	2.18 ^{ab}	± 0.09
Protein Efficiency Ratio	2.26 ^b	1.85 ^c	2.84 ^a	2.19 ^b	2.11 ^b	± 0.10
Mortality (%)	0	5	0	0	0	± 1.00
Dressing Percentage (%)	66.07 ^a	62.16 ^a	63.64 ^a	57.14 ^b	52.13 ^c	± 2.50
Total edible meat (as % eviscerated weight).	86.45 ^a	85.14 ^a	85.96 ^a	83.62 ^b	86.13 ^a	± 0.51
Bone (% of eviscerated weight)	19.48 ^c	27.33 ^a	23.95 ^b	26.85 ^a	27.13 ^a	± 1.50
Metabolizable energy (Kcal/g)	3.15 ^b	2.95 ^c	3.36 ^a	3.16 ^b	2.96 ^c	± 0.08
ME _n (Kcal/g)	3.05 ^b	2.84 ^c	3.31 ^a	3.11 ^b	2.91 ^c	± 0.08
Nitrogen retained (g/bird/day)	8.12 ^a	4.54 ^d	8.54 ^a	7.29 ^b	6.41 ^c	± 0.71
Cost of feed/kg gain	1.09	2.32	1.66	1.86	2.13	± 0.21

a, b, c, d means without common superscripts in horizontal rows are significantly different ($P < 0.05$).

growth rate, were similar on diet 3 and 1 while feed conversion and protein efficiency ratio were better ($P < 0.05$) on diet 3 than 1. The poorest response was recorded on diet 2 containing raw soyabeans. Removal of fish meal (diet 4) and blood meal (diet 5) reduced performance on the cooked soyabean ration. Dressing percentages were similar on diets 1 and 3. Partial or complete removal of animal protein on diets 4 and 5 caused reduction in this parameter.

Balance studies: Metabolizable energy values of the different rations (table 3) show that diet 3 with cooked soyabeans plus fish and blood meal supplement had higher ($P < 0.05$) values than others while diet 2 (with raw soyabeans) gave the poorest value. Metabolizable energy corrected for nitrogen (ME_n) followed the same trend. The nitrogen retention shows diet 3 to be superior to others with a value of 64.78%. The lowest value of 46.9% was obtained on diet 2. Nitrogen retention of birds on diet 3 however did not differ significantly from those on diet 1.

Cost Analysis: The cost of production (table 3) on each of the experimental rations is shown in table 3. In terms of economy of feed conversion, diet 3 gave the least cost per kg. live weight gain.

DISCUSSION

Results from this trial showed that cooked soyabeans can replace groundnut cake in broiler rations. This can be inferred from the comparable performance on diet 3 and the control (diet 1). Indeed, diet 3 outstripped

other soyabean containing rations in terms of economy of feed conversion in that it gave the least cost per kilogram liveweight gain. This superiority of full fat soyabeans is due to the better amino acid balance and higher oil content than groundnut cake. Balloun (1980) reported that soyabean has the most complete amino acid profile of all the vegetable proteins although it is somewhat deficient in methionine and borderline in cystine. Groundnut cake on the other hand is deficient in both methionine and lysine (Olomu, 1971). Moreover, groundnut cake has a high risk of aflatoxin toxicity (Oyenuga, 1968). The higher oil content of full fat soyabean confers a higher caloric density on it and hence the higher metabolizable energy recorded on diet 3. The highest efficiency of energy utilization was also recorded on diet 3. The superior nitrogen retention on this latter diet is also a reflection of the favourable amino acid balance of full fat soyabean diet as shown in the amino acid profile of the diets in table 2. Specifically, the methionine and lysine content of diet 3 was higher than that on other diets. Campbell and Lasley (1969) reported that when there is lack of proper balance in amino acids, excess amino acids are deaminated and used as an expensive source of energy.

The poor performance recorded in raw soyabeans are in consonance with earlier reports that antinutritional factors present in the raw beans depress growth and nutrient utilization in chicks (Nitsan *et al.*, 1965). It should be noted that while heat treatment is desirable for efficient utilization of soyabeans, cooking beyond 30 minutes as used in this

study can result in the formation of complexes between the various amino acids, to form linkages which are either slowly hydrolysed or non-hydrolysable by enzymes of the gastro-intestinal tract (Amadi and Hewitt, 1975).

Inclusion of animal protein into rations based on cooked whole soyabeans is desirable for the proper utilization of this plant protein source. This is apparent from the poorer performance and nutrient utilization recorded on diets 4 and 5 that were either deficient in fish meal or fish meal and blood meal. This is because of the need for supplementation of soyabeans with methionine for efficient utilization (Balloun, 1980). Of particular importance is the depression in growth rate and nutrient utilization noticed in diet 4 where blood meal was included as an animal protein source. Blood meal is high in lysine but deficient in methionine. Indeed, Fetuga (1972) reported that blood meal did not support satisfactory growth in pigs or rats. The use of cooked full fat soyabeans in poultry rations therefore appears justifiable based on the criteria measured in this study.

REFERENCES

- AMADI, S.C. and HEWITT, D. (1975). The digestibility and availability of lysine and methionine in isolated soyabean protein after severe heat damage. *Proc. Nutr. Soc.* **34**: 1(26A).
- A.O.A.A.C. Association of Official Agricultural Chemists (1975). *Methods of Analysis*. 12th Ed. 2049, Washington, U.S.A.
- BALLOUN, S.L. (1980). Soyabean meal in poultry nutrition. American Soyabean Association Publication St. Louis, Missouri, U.S.A.
- CAMPBELL, J.R. and LASLEY, J.F. (1965) *The Science of the animals that serve man kind* pp. 400. McGraw Hill Book Coy. London
- FETUGA, B.L. (1972). Assessment of the protein quality of certain Nigerian foods and feedstuffs in the nutrition of the pig and of the rat. Ph.D. Thesis, University of Ibadan.
- NITSAN, Z., ALUMOT, E. and EUGENIA, A. (1965). The effect of raw soyabean levels in the diet on the proteolytic and pancreatic hypertrophy in the growing chick. *Poult. Sc.* **44**: 1210 – 1214.
- OLOMU, J.M. (1977). Optimum protein and energy levels for broiler chickens in a tropical environment. *Nig. J. Anim. Prod.* **4**(1): 239-253.
- OYENUGA, V.A. (1968). *Nigerias feeds and feeding stuffs* 3rd Edition, Ibadan University Press.
- STEEL, R.G.D. and TORRIE, J.H. (1960). *Principles and procedures of statistics*. McGraw Hill Book Coy. Inc. New York.