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EFFECT OF EXTRUDED FULL-FAT SOYBEANS ON THE PERFORMANCE OF LAYERS

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ABSTRACT

A 12-week trial was conducted to study the effect of extruded full-fat soybeans on the performance of layers. One hundred and sixty 56-week old Hubbard Golden Comet layers, were randomly divided into 5 groups of 32 birds each and assigned to 5 treatments. The experimental diets were isonitrogenous and isocaloric containing on the average 16% crude protein and 2500 Kcal ME/kg. Groundnut cake (diet 1) was used as the reference protein source. Diets 2, 3, 4 and 5 had GNC partially replaced with 5.0, 10.0, 13.0 and 16.53% extruded soybeans (ES) respectively. Highly significant differences ($p < 0.01$) among treatments were observed in feed consumption and body weight charges. While birds on diets 1, 2, 4 and 5 gained weight, those on diet 3 consistently lost weight. Diet 4 (containing 13% ES) equalled the control diet in terms of percent hen-day protection, mortality, egg quality characteristics and efficiency of nutrient utilization. The results suggest that up to 16.53% extruded full-fat soybean could be incorporated into layer diets for satisfactory performance, but such ration must be stabilized with suitable antioxidants to enhance good helping quality.

Keywords: Extruded, full-fat, soybeans, performance, layers.

INTRODUCTION:

In recent years, there has been increased interest in the use of processed whole or ground soybeans as a source of protein supplement in poultry diets. Soybeans have a favourable amino acid profile and in addition the oil content represents a potential increase in the caloric density as compared to other plant protein sources.

Aribisala (1983) had observed that in Nigeria, the poultry industry was growing at the rate of about 20% per annum and estimated that the poultry population in the country could reach 5 million by 1985. Further projection shows that there would be about 76 million poultry in Nigeria by the year 2000. This quantity should meet the needs of the country for poultry products and possibly leave surpluses for export. This target was never met due to many reasons, among which have been the scarcity and higher cost of feed ingredients, and of course the introduction of Structural Adjustment Programme (SAP) by the Federal Government, which has placed a ban on the importation of feed ingredients. The result has been that most poultry producers have been thrown out of business. However, in an attempt to solve some of the problems, feed manufacturers are searching for substitute feed ingredients.

Using groundnut cake-supplemented diet as the control, the trial reported in this paper compared the effects of replacing the groundnut cake with graded levels of locally produced extruded full-fat soybeans on the performance of Hubbard Golden Comet layers.

MATERIALS AND METHODS

Source of Soybeans: Soybean seeds

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n the trial were collected from ational Institute of Tropical ilture (IITA) Ibadan.

ion of Soybean

Full-fat extruded soybean was :ed using the Insta-Pro model 600 truder, which has an internal uration setting of two single-flight ;, three-double flight screws and locks of 8, 5, 5, 5 as well as nd five sleeves in-between the

The feed intake was set to ge 300-350kg seed per hour. mperature range of 150-160°C uilt up by running the machine whole soybean seeds and uently, the prepared soybean ere fed in. The extruded full-fat ns shooting out in a very viscous as passed into a cooling drum hich blew of the heat with dry the resulting gritty product was d and packaged.

ental Diets

ive isonitrogenous (16% crude and isocaloric (2500 Kcal

diets (Table 1) were used for l. The control diet (diet 1) had nut cake as the sole protein nent. In diets 2, 3, 4 and 5, nut cake was partially replaced 5.0%, 10.0%, 13.0% and 6 respectively of full-fat extruded ns (ES).

position of Experimental Diets (%)

	DIETS				
	1	2	3	4	5
	46.59	44.14	41.69	40.22	38.49
	16.38	19.05	21.73	23.33	25.23
	16.87	11.77	6.67	3.61	0.00
	7.50	7.50	7.50	7.50	7.50
	0.25	0.25	0.25	0.25	0.25
	0.05	0.05	0.05	0.05	0.05
	0.09	0.07	0.06	0.05	0.04
	0.21	0.15	0.08	0.05	0.00
/der	8.65	8.64	8.64	8.64	8.63
	2.85	2.82	2.78	2.76	2.73
mix	0.55	0.55	0.55	0.55	0.55
/beans	0.00	5.00	10.00	13.00	16.53
	100.00	100.00	100.00	100.00	100.00

Experimental birds and their management

One hundred and sixty (160) 56-week old Hubbard Golden Comet layers managed in a cage system were randomly distributed into 5 treatment groups each with 2 replicates consisting of 16 birds, such that there were 32 birds to an experimental diet. The birds were individually weighed at the commencement of the trial and thereafter at weekly intervals throughout the 12-week experimental period.

Feed and water were supplied *ad. libitum*. Feed consumption and egg production were recorded daily on all treatments while mortality of birds on the various treatments was recorded as it occurred. Post mortem examinations were carried out on any dead bird. At the end of the 4th week, 2 birds were randomly selected from each of the two replicates in all treatments and placed in metabolism cages. After allowing sufficient period of adjustment, the droppings were collected and weighed, bulked and thoroughly mixed and dried for 72 hours at 60°C in an oven. The nitrogen content of droppings and feeds were determined using the procedure recommended by A.O.A.C (1990).

Data Analysis

The data obtained were subjected to Complete Randomized Design (CRD) analysis of variance (ANOVA) according to the method of Steel and Torrie (1980) while significant differences between means were separated using the Duncan's multiple range test (Duncan, 1970).

RESULTS AND DISCUSSION

Feed Intake

Feed intake varied significantly ($p < 0.01$) among the various treatments (Table 3). The highest average weekly feed intake of 742.65 ± 7.17g was recorded for birds on diet 3, while birds in diet 5 consumed the least feed (674.57 ± 13.12g). Birds primarily

consume fed to meet their energy requirement (Oluyemi and Roberts, 1979; Olomu, 1980). The same authors had recommended 2800-2900 Kcal/kg ME and 16-18% protein level for laying hens. However, in the work reported there, the energy level was 2500 Kcal/kg ME for the test ration, a value much lower than the recommended level. It was therefore not surprising that the birds ate much feed to satisfy their requirement for energy.

Average Body Weight Change

Average body weight gains per week differed significantly ($p<0.01$) among the various treatments (Table 3). Diet 5 (16.53% ES) promoted the highest weight gains, being 88.33 ± 7.11g. The poorest weekly weight gains were by birds on diets 3 and 2, being -2.08 ± 0.88 and 10.25 ± 5.91g, respectively. Surprisingly, birds on diet 3 which had the highest feed intake wee losing weight throughout the experimental period. Results of proximate analysis (Table 2) indicates that the fibre component of the diet was at maximum (7.0%). The high fibre level must have further diluted the caloric density of the ration, thereby accentuating an already low level of energy. Birds on diet 3 seemed to have felt this effect of low energy level much more than others. This may explain why birds on this treatment lost weight. For good performance, the level of fibre in poultry ration should be lower than 7.0% (Olomu, 1980). Arising from this low energy level is the fact that a proper energy to protein ratio could not be maintained, thus poor performance of the birds. While results of diet 3 disagree, those on other treatments support the report of Waldroup and Hazen (1978) which indicated that layers feed whole soybeans showed weight increase at dietary energy and protein levels of 16% and 2900 Kcal ME, respectively.

Table 2: Energy and Proximate Analysis of test diets (%)

Constituents	DIETS 1	2	3	4	5	Full-fat Extruded Soybean meal
Moisture	9.35	9.01	8.60	9.00	8.89	7.40
Dry matter	90.65	90.99	91.40	91.00	91.11	92.60
Crude protein	16.14	16.58	16.28	15.99	16.10	49.81
Ether extract	4.40	4.98	4.38	4.71	4.96	17.38
Ash	6.91	7.02	7.38	6.99	7.50	4.50
Crude fibre	6.90	6.83	6.78	7.01	6.84	4.29
N.F.E.	56.30	55.58	56.58	56.30	55.71	24.02
GE (Kcal/g)	4.06	4.09	3.99	4.10	4.12	5.20

Average Weekly Hen-Day Production

There were no significant differences ($p>0.05$) in average hen-day production, though birds on diet 4 showed slightly superior although not significant performance over those on other diets (Table 3). The results obtained in this study were close to 56 and 58% reported by Babatunde and Fetuga (1976) and Oluyemi and Roberts (1979), respectively, when layers were feed groundnut cake as the supplemental protein. However, the percentage hen-day production were lower than 77.2% obtained by Reid (1976) with a corn-soya diet and 78.2% reported by Sell and Hodgson (1966) using wheat soybean meal ration. Again this difference may be due to the low energy content of the ration.

Table 3: Efficiency of feed utilization, egg production, mortality and body weight changes

Parameters	DIETS 1	2	3	4	5
Av. weekly feed intake/bird(g)	$680.59^{c} \pm 0.70$	$676.59^{a} \pm 9.23$	$742.65^{a} \pm 7.17$	$722.62^{b} \pm 7.56$	$674.57^{c} \pm 13.12$
Av. body weight change/bird (g)	$45.42^{b} \pm 6.68$	$10.25^{c} \pm 5.91$	$-2.08^{d} \pm 0.88$	$33.75^{b} \pm 7.05$	$88.33^{a} \pm 7.11$
Av. weekly Hen-day production (%)	43.97 ± 2.14	36.88 ± 2.06	38.94 ± 1.39	46.26 ± 1.39	41.41 ± 1.68
Total Mortality (%)	6.25	9.38	15.63	6.25	15.63
kg feed/dozen eggs produced	3.06 ± 0.15	2.98 ± 0.10	3.26 ± 0.09	2.42 ± 0.08	2.90 ± 0.15

Means with different superscripts on the same row are significantly different ($p<0.05$).

Mortality

The average percentage mortality is recorded on Table 3. It followed no consistent trend. However, the highest losses occurred among birds fed diet 3 (10% ES diet) and those on diet 5 (10% ES diet) being 15.63%. The lowest loss (6.25%) was observed among birds fed the control diet and

those on diet 4 (13% ES diet). Few birds notably on the 16.53% ES (diet 5) died of fatty liver disease.

Efficiency of Feed Utilization (EFU)

There were no significant differences ($p > 0.05$) in the efficiency of feed utilization among birds on the various diets (Table 3). Values obtained in this study were inferior to 2.06kg/dozen eggs reported by Babatunde and Fetuga (1976) on layers fed GNC diets with supplemental methionine.

EGG QUALITY CHARACTERISTICS

Average weight of Eggs

The average egg weights of the birds on all the dietary treatments were not significantly ($p > 0.05$) different (Table 4). The results indicate that inclusion of ES up to 16.53% promoted satisfactory egg weight. The average egg weight got from this work was satisfactory and compared favourably with those obtained by Sell and Johnson (1974) using corn soybean diets supplemented with lysine and methionine at 16% protein and 2850 Kcal ME levels in the ration.

Cracked and Shelless eggs

Judged on the basis of the incidence of shelless and cracked eggs (Table 4), birds on diet 2, 3, and 4 with zero percentage cracks and shelless eggs, respectively, were superior to the rest. Birds on diet 5 yielded 1.06% cracked and 1.06% shelless eggs, while those on the control diet yielded the higher percentage, 1.85% of shelless eggs during the 12-week laying period. However, the percentage cracks obtained in this study was lower than 5% given by Oluyemi and Roberts (1979) as being acceptable under good management and nutrition in the tropics.

Table 4: Egg Characteristics during a 12-week period

	DIETS				
Parameters	1	2	3	4	5
Av.egg weight (g)	58.58 ±0.14	57.07 ±0.40	58.98 ±0.32	60.57 ±0.32	56.60 ±0.35
Cracked eggs (%)	1.85	0	0	0	1.06
Shelless eggs (%)	0	0	0	0	1.06
Albumen weight (%)	86.46 ±0.19	86.31 ±0.06	86.54 ±0.57	86.28 ±0.30	86.91 ±0.10
Egg shell thickness(mm)	0.34 ±0.001	0.34 ±0.001	0.34 ±0.001	0.34 ±0.001	0.31 ±0.004

Means are not significantly different ($p > 0.05$)

Table 5: Nitrogen Retention during the 12-week laying period

	DIETS				
Parameters	1	2	3	4	5
Nitrogen intake (g)	197.80 ±3.93	218.83 ±2.09	197.33 ±3.19	189.20 ±0.97	223.04 ±1.62
Nitrogen output (g)	44.91 ±1.80	60.72 ±0.51	55.28 ±2.14	59.85 ±0.45	61.63 ±0.51
Nitrogen retained (g)	152.89 ±4.93	158.11 ±1.74	142.05 ±2.58	129.35 ±0.64	161.41 ±1.91
Nitrogen retention (g)	77.29 ±1.20	72.25 ±0.20	71.99 ±0.20	68.37 ±0.20	72.37 ±0.37

Means are not significantly different ($p > 0.05$)

Albumen Height (Haugh Unit)

Haugh unit scores are presented on Table 4. Values were not significantly different ($p > 0.05$) among the different treatments. The figures ranged from 86.28 ± 0.30 for birds in diet 4 to 86.91 ± 0.10 for those on diets 5 (16.53% ES diet). The albumen height which are indices of protein utilization were very high for all the eggs produced by birds on the various diets. Haugh unit value as high as 88% has been reported for layers fed autoclaved or whole soybeans, which successfully replaced soybean meal in laying diets (Scott, 1973).

Egg shell thickness

The differences between treatments in egg shell thickness were not significant ($p > 0.05$). values extend from 0.31 ± 0.001 to 0.34 ± 0.001mm. The egg shell thickness obtained in this work is in agreement with 0.34mm given by Oluyemi and Roberts (1979) as being alright for the tropical condition.

Nitrogen Retention

Nitrogen retention of the birds on the various diets are presented on Table 5. There were no significant differences ($p > 0.05$) among the

various treatments. However, the percent nitrogen retained, which is an indirect measure of the efficiency of utilization of dietary proteins was quite high for all the dietary treatments. Waldroup et al 1969 had reported high percentage nitrogen retention values (extending from 77 - 80%) in birds fed extruded soybeans with supplemental lysine and methionine. This indicates that the efficiency of utilization of proteins from extruded soybeans is quite high.

CONCLUSION

This study indicates that satisfactory productivity, egg quality characteristics and efficiency of nutrient utilization are obtained on layers when upto 16.53% extruded full-fat soybeans is incorporated into layers ration. However, the feeds will need to be stabilized with suitable antioxidants, since the feed tends to go rancid after some time, due to its oily nature.

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