Nig. J. Anim. Prod. 2004, 31(2):174-181
Nigerian Society for Animal Production

Performance and carcass characteristics of broiler chicken fed high fibre sunflower seed cake diets

C.A. Adeniji

Fisheries Department. Lagos State University, Ojo-Lagos. Lagos, Nigeria

Abstract

A feeding trial was conducted to assess the levels of inclusion of high fibre sunflower seed cake (HFSSC) protein as replacement for soybean cake protein in the diets of broiler chicken at 0,25,50,75 and 100%. At the starter phase feed intake and feed efficiency ratio were significantly (P<0.05) increased as the level of HFSSC increased in the diets. Weight gain and protein efficiency ratio were however significantly (P<0.05) reduced when over 25% of HFSSC was included in the diet. At the finisher phase same trend was observed except that weight gain and protein efficiency ratio were significantly (P<0.05) reduced when over 50% HFSSC was included in the diet. Significant (P<0.05) differences were in liveweight, plucked and dressing percentages at the starter and finisher phases. Reduction in abdominal fat deposition was obtained at the starter and finisher phases while gizzard weights were significantly (P<0.05) increased. The results of this study show that 50% soybean cake protein in the diets of broiler chicken can be replaced by HFSSC.

Keywords: High fibre sunflower cake, broiler, performance

Introduction

The expansion of Nigerian commercial poultry production has great potentials in improving animal protein status of the Nigerian populace. However, the provision of feed in the right quality and quantity (especially that of protein and energy) presents a great threat in the realization of this goal. The rapid decline in the cultivation and utilization of the conventional oil seed plants in oil production has led to research into other sources of protein and energy, locally grown with less competition to alleviate poultry production problems and consequently improve the nutritional status of an average Nigerian.

Sunflower seed has been identified as a potential alternative source of vegetable oil which can be grown in great variety of soil (Ogunremi 1979, Abdullahi and Ado 1985 and 1988), tolerate low fertility than maize and sorghum, and can also be grown when soybean (Balloun, 1980) can not be grown. These suggest great potential for its increased cultivation and production of its cake. Also the oil (particularly essential fatty acids), rich methionine level as well as several B complex vitamins (Green *et al.*, 1987, Day and Levin 1954) which are limiting in other plant proteins are incentives for its utilization in poultry feeds.

However, of major concern are earlier works by Nowland *et al.*, (1981), Adeniji and Ogunmodede (2000) who reported that the nature and content of sunflower's fibre impose limitation on the utilization of its nutrients. Therefore this study was designed to assess the effect of constant higher oil levels in the performance and carcass characteristics of broiler chicken feed high fibre (22%) sunflower seed cake.

Materials and Methods

Dietary treatments.

Pressed high fibre sunflower seed cake (HFSSC) used for this study were obtained from Tallon Nigeria Limited, Lagos. Ten experimental diets were formulated, five diets at the starter phase which lasted for five weeks and another five diets at the finisher phase which lasted for four weeks. The protein supplied by soybean cake in the control diets (0% HFSSC) was taken to be 100%. In the other diets HFSSC was used to replace 25, 50,75 and 100%) of the protein supplied by soybean cake. Table 1 shows the percentage composition of the diets and test ingredients.

Management of birds.

A total of 225 unsexed day-old Anak broiler chicks were used. They were randomly allocated to the five treatments and their replicates giving 15 chicks to each replicate and 3 replicates per treatment. The birds were housed in 5 different compartments, such that each treatment is replicated in each compartment in a randomised complete block design. Birds were kept in battery brooders for the first three weeks and were later transferred to deep litter pens. Feed and water were supplied *ad libitum*.

Parameters measured.

At the beginning of the experiment the chicks were weighed as individual replicate groups. Weekly feed intake and weight gain were recorded from which feed conversion ratio (FCR) and protein efficiency ratio (PER) were calculated. Carcass evaluation were carried out at the 5^{th} and 9^{th} week, 2 birds per replicate were randomly picked fasted overnight and slaughtered by severing the jugular vein. After scalding in warm water for about a minute, the feathers were manually plucked, each bird was cut into parts for carcass evaluation. The relative weight was calculated by expressing the weight of cut part as % of the cut part as percentage of dressed weight. The cut up values, gizzard and abdominal fat values were transformed using square root transformation before they were statistically analyzed.

Chemical and statistical analysis.

Test ingredient and diets were analyzed for proximate composition using methods of A.O.A.C (1990), metabolisable energy was calculated by the WPSA (1985) method. Data were analyzed using analysis of variance as described for randomized complete block design (Steel and Torrie 1980). Significant differences were determined by the use of Duncan's multiple range test. Duncan (1955).

TABLE 1: *Percentage composition of experimental diets*

	Starter					Finisher				
	Replacement level of HFSSC(%)					Replacement of level of HFSC %				
Ingredients	0	25	50	75	100	0	25	50	75	100
Maize	53.25	45.71	38.79	30.34	24.44	55.42	49.24	42.52	35.98	29.63
Soybean cake	26.30	19.72	13.15	6.58	0.00	21.08	15.81	10.54	5.27	0.00
HFSSC	0.00	11.13	22.25	33.88	44.51	0.00	8.92	17.84	26.75	35.67
Brewer's dried grain	7.25	10.24	12.61	16.07	17.85	13.00	15.53	18.60	21.50	24.20
Constant ingredient *	13.20	13.20	13.20	13.20	13.20	8.50	8.50	8.50	8.50	8.50
Calculated Value										
Metabolisable energy(Kcal/g)	2.94	2.93	2.91	2.90	2.90	2.85	2.85	2.83	2.82	2.83
Crude protein (%)	22.96	22.94	22.84	22.84	22.66	20.02	20.02	20.09	20.06	20.17
Methionine (% of diet)	0.38	0.47	0.55	0.60	0.70	0.33	0.45	0.40	0.44	0.48
Lysine (% of diet)	1.32	1.29	1.25	1.25	1.20	1.07	1.10	0.96	0.90	0.84
Determined analysis (dry matter basis %)										
Crude protein	22.81	22.97	22.58	22.53	22.86	20.07	20.05	20.017	20.04	20.05
Crude fibre	4.24	5.56	7.85	9.96	10.41	4.06	6.03	8.20	9.74	10.47
Ether – extract	2.73	3.11	3.90	4.41	4.84	4.36	5.29	6.19	8.21	8.70

* All the starter diets contained 2.50% oil, 4% fish meal, 3% Blood meal, 2.10% bone meal, 1.10% oyster shell, 0.25% salt and 0.25% vitamin – mineral premix while finisher diets contained 0.70% oil, 2% fish and blood meal, 3.15% bone meal, 2.15% oyster shell and 0.25% salt and vitamin-mineral premix. Each kg of the diet contained 12,500 1.U vitamin (vit.) A, 2850 I. U vit D_3, 15.1U. vit. E. 2mg Vit. K, 1.5mg Vit. B_1 6mg choline chloride, 20mg zinc bacitarin, 90mg lasolocid, 100mg manganese, 50mg iron, 45 mg zinc, 2 mg copper, 1.5mg iodine, 0.225mg cobalt and 0.1mg selenium.

Table 2: *Percentage nutrient composition of high fibre sunflower seed cake and soy- beans (%)*

	HFSSC	SBC
Dry matter	92.00	91.85
Crude protein	28.00	45.34
Crude fibre	22.00	5.56
Ether extract	11.00	4.07
Nitrogen free extract	26.00	27.74
Ash	5.00	9.14

Results and Discussion.

Table 3 shows the performance characteristics of the birds fed the experimental diets. There were significant ($P<0.05$) differences in all the performance characteristics measured at both phases of the experiment. At the starter phase the inclusion of HFSSC above 25% significantly ($P<0.05$) reduced the efficiencies of feed and protein utilization, which is reflected in reduced weight gain almost commensurate to the level of HFSSC added. While at the finisher phase the same trend was observed when over 50% HFSSC was included in the diets of broiler chicken.

The lower performance of broiler chicken observed at the starter phase with HFSSC diets could be a reflection of the stringent requirement for essential nutrients (protein and energy) at this stage of life. The general reduction observed in performance of broiler fed the high level (75% and 100%) HFSSC further confirm the work of Gous *et al*, (1990) and Daghir *et al*, (1980) who reported that birds on sunflower seed cake diets were unable to completely satisfy their energy and protein intake due to limitation imposed on them by the fibrous nature of the diets. Earle *et al*, (1969) reported that sunflower seed fibre contain 25-30% lignin and pentosan and 29-32% cellulose, which have limited digestibility in chicken. Another logical explanation for the observed performance is based on the high fibre content which may predispose the birds to availability of insufficient essential nutrients. (Jonsson and McNab 1983), in this case protein. The high feed intake by birds on HFSSC is in consonance with the submission of Lipstein and Bronstein (1975) who reported that birds overeat under moderate protein insufficiency, which is not necessarily a craving for protein per se, but a compensatory increase in feed intake in response to the deficient essential nutrients. In a situation in which HFSSC and brewer's dried grain contribute substantially to the amino acid content of these diets, the results might not be unexpected. The better performance obtained by Adeniji and Ologhobo (2000), Adeniji and Ogunmodede (2001) emanated from the low fibre levels of the sunflower used 3.9% and 12% respectively, which confirmed that the nature and content of fibre of sunflower seems to be a major determinant in the utilization of its nutrients.

Results of carcass characteristics of experimental diets are shown in Table 4. There were significant ($P<0.05$) differences in live weights, plucked and dressing percentages, abdominal fat deposition and gizzard weights at the starter and finisher phases. The live weight followed the same trend observed with weight gain at both phases of the experiment. The higher plucked and dressing percentage of the HFSSC fed birds resulted from their smaller live weight (Broadbent *et al*, 1981), since the surface area and the weight determine the amount of feathers and viscera required respectively, thus the higher values obtained. The higher back weight observed with HFSSC at the finisher phase emanated from feed and nutrient utilization at the finisher phase, the fibre effect was less evidence, as deficiency of essential nutrients were less pronounced. The lower

abdominal fat seems to suggest that the availability of nutrients were impaired by high fibre content of the HFSSC. The limitation was more pronounced as the level of HFSSC increased. This might be an incentive to both producers and consumers, as less wastage and tougher broiler are anticipated due to the low fat deposition in the broiler chicken. The gizzard weight is determined by the amount of work required of the muscular wall of the organ to comminute feed particles (Abdelsamie and Panaweera 1983, Jonsson and McNab, 1983). HFSSC is gritty and fibrous in nature requiring extra work in communing the feed particles, consequently the significant gizzard weight obtained from this study.

Generally, the results obtained from this study seem to point to the fact that optimal calorie to protein ratio required for efficient utilization of HFSSC protein was yet to be met. Though the cake seems adequate in protein, the high fibre content prevented effective utilization through its effect on available nutrients, particularly energy. Conclusively, the results obtained in this study suggest that not more than 50% of protein supplied by soybean in broiler diet can be replaced by HFSSC protein.

TABLE 1: *Percentage composition of experimental diets*

	Starter					Finisher				
	Replacement level of HFSSC(%)					Replacement of level of HFSC %				
Ingredients	0	25	50	75	100	0	25	50	75	100
Maize	53.25	45.71	38.79	30.34	24.44	55.42	49.24	42.52	35.98	29.63
Soybean cake	26.30	19.72	13.15	6.58	0.00	21.08	15.81	10.54	5.27	0.00
HFSSC	0.00	11.13	22.25	33.88	44.51	0.00	8.92	17.84	26.75	35.67
Brewer's dried grain	7.25	10.24	12.61	16.07	17.85	13.00	15.53	18.60	21.50	24.20
Constant ingredient *	13.20	13.20	13.20	13.20	13.20	8.50	8.50	8.50	8.50	8.50
Calculated Value										
Metabolisable energy(Kcal/g)	2.94	2.93	2.91	2.90	2.90	2.85	2.85	2.83	2.82	2.83
Crude protein (%)	22.96	22.94	22.84	22.84	22.66	20.02	20.02	20.09	20.06	20.17
Methionine (% of diet)	0.38	0.47	0.55	0.60	0.70	0.33	0.45	0.40	0.44	0.48
Lysine (% of diet)	1.32	1.29	1.25	1.25	1.20	1.07	1.10	0.96	0.90	0.84
Determined analysis (dry matter basis %)										
Crude protein	22.81	22.97	22.58	22.53	22.86	20.07	20.05	20.017	20.04	20.05
Crude fibre	4.24	5.56	7.85	9.96	10.41	4.06	6.03	8.20	9.74	10.47
Ether – extract	2.73	3.11	3.90	4.41	4.84	4.36	5.29	6.19	8.21	8.70

* All the starter diets contained 2.50% oil, 4% fish meal, 3% Blood meal, 2.10% bone meal, 1.10% oyster shell, 0.25% salt and 0.25% vitamin – mineral premix while finisher diets contained 0.70% oil, 2% fish and blood meal, 3.15% bone meal, 2.15% oyster shell and 0.25% salt and vitamin-mineral premix. Each kg of the diet contained 12,500 1.U vitamin (vit.) A, 2850 I. U vit D_3, 15.1U. vit. E, 2mg Vit. K, 1.5mg Vit. B_1 6mg choline chloride, 20mg zinc bacitarin, 90mg lasolocid, 100mg manganese, 50mg iron, 45 mg zinc, 2 mg copper, 1.5mg iodine, 0.225mg cobalt and 0.1mg selenium.

TABLE 1: *Percentage composition of experimental diets*

	Starter					Finisher				
	Replacement level of HFSSC(%)					Replacement of level of HFSC %				
Ingredients	0	25	50	75	100	0	25	50	75	100
Maize	53.25	45.71	38.79	30.34	24.44	55.42	49.24	42.52	35.98	29.63
Soybean cake	26.30	19.72	13.15	6.58	0.00	21.08	15.81	10.54	5.27	0.00
HFSSC	0.00	11.13	22.25	33.88	44.51	0.00	8.92	17.84	26.75	35.67
Brewer's dried grain	7.25	10.24	12.61	16.07	17.85	13.00	15.53	18.60	21.50	24.20
Constant ingredient *	13.20	13.20	13.20	13.20	13.20	8.50	8.50	8.50	8.50	8.50
Calculated Value										
Metabolisable energy(Kcal/g)	2.94	2.93	2.91	2.90	2.90	2.85	2.85	2.83	2.82	2.83
Crude protein (%)	22.96	22.94	22.84	22.84	22.66	20.02	20.02	20.09	20.06	20.17
Methionine (% of diet)	0.38	0.47	0.55	0.60	0.70	0.33	0.45	0.40	0.44	0.48
Lysine (% of diet)	1.32	1.29	1.25	1.25	1.20	1.07	1.10	0.96	0.90	0.84
Determined analysis (dry matter basis %)										
Crude protein	22.81	22.97	22.58	22.53	22.86	20.07	20.05	20.017	20.04	20.05
Crude fibre	4.24	5.56	7.85	9.96	10.41	4.06	6.03	8.20	9.74	10.47
Ether – extract	2.73	3.11	3.90	4.41	4.84	4.36	5.29	6.19	8.21	8.70

* All the starter diets contained 2.50% oil, 4% fish meal, 3% Blood meal, 2.10% bone meal, 1.10% oyster shell, 0.25% salt and 0.25% vitamin – mineral premix while finisher diets contained 0.70% oil, 2% fish and blood meal, 3.15% bone meal, 2.15% oyster shell and 0.25% salt and vitamin-mineral premix. Each kg of the diet contained 12,500 I.U vitamin (vit.) A, 2850 I. U vit D_3, 15.1U. vit. E, 2mg Vit. K, 1.5mg Vit. B_1 6mg choline chloride, 20mg zinc bacitarin, 90mg lasolocid, 100mg manganese, 50mg iron, 45 mg zinc, 2 mg copper, 1.5mg iodine, 0.225mg cobalt and 0.1mg selenium.

References

Abdelsamie, A.E, Ranaweera, K.N.P ana Nano, W.E. 1983. The influence of fibre content and physical texture on the performance of broilers in the tropics. *Bri. Poult. Sci.* 24: 383-390

Abdullahi, B. and Ado S.G. 1988. The future of sunflower seed (*helianthus annus L.*) as livestock feedstuff in Nigeria. International Sunflower Association Nov. sad, Yugoslavia 1. July Proceedings of the 12th International Sun. Con 1988: 349-355.

Adeniji, C.A and Ologhobo A.D. 2000.Utilization of full-fat sunflower seed in the diets of broiler chicken *Tro. J. Anim Sci.* 3 (2) : 165-170

Adeniji, C.A and Ogunmodede B.K. 2001 . Potentials of Nigerian sunflower seed cake in broiler
chicken diets. *Annals Agri. Sci* 2 (2) :21-27

A.O.A.C. 1990. Official methods of analysis.15th Edition Ass. of analytical chemists, Washington, D.C

Balloun, S.L 1980. Soybean meal in poultry nutrition. Edited by Kenneth C. Lepley. The Ovid Bell Press, Inc. Fulton, Missouri.

Broadbent, L.A, Wilson, B.J and Fisher C. 1981. The composition of broiler chicken at 56 days of age: Output, components and chemical composition. *Bri. Poult. Sci.* 22:4-10

Daghir, N.J, Raz, M.A and Uwayjam, M. 1980. Studies on the utilization of full – fat sunflower seed in broiler rations. *Bri. Poult. Sc.* 2273 – 2278

Day, H and Levin, E. 1954 . Nutritional value of sunflower meal. *Bri. Poult. Sci.* 55: 1775-1782.

Duncan. D.R. 1995. Multiple range and multiple test Biometrics 11:42.

Earle, F.R, Vanetten, C.H, Clark T.F and Wolff I.A. 1968. Compositional data on sunflower seed. *J. American Oil Chem. Sc.* 45:876-879

Green, S, Solangeh, L, Bertrand, L, Madekine, J, Duron, C and Millard, R. 1987. Digestibility of amino acids in soybean, sunflower and groundnut meals determined with intact and caecetomised cockerels. *Bri. Poult Sc.* 28:643-652

Johnson, C and McNab, J.M. 1983. Grassmeal as an ingredient in diets of broiler chicken *Bri. Poult. Sc.* 24: 361-369

Lipstein, B and Bronstein, S. 1975. The replacement of soybean meal by the limiting amino acid in practical broiler diets 2: Special additions of methoione and lysine as partial substitute for protein in finisher diet. *Bri. Poult. Sci.* 16: 189-200.

Nowland, W.J, Pym, R.A.Eand McMaham, P.J. 1981. The 1971 random sample broiler test. Poult. Notes pp. 6-11 N.S.W Dept of Agric

Steel, R.C.D. and Torrie, J.H. 1960. Principles and procedure of statistics MCGraw Hill, N.Y

W.P.S.A (1985): In Zootenica International pp. 22-24.

(Received 03 January 2003; Accepted 13 November 2003)