academicJournals

Vol. 4(4), pp. 42-47, July 2013
DOI 10.5897/JCO11.023
ISSN 2141-6591 ©2013 Academic Journals
http://www.academicjournals.org/JCO

Journal of Cereals and Oilseeds

Full Length Research Paper

Growth performance, carcass characteristics and economics of production of broilers fed diets with two sources of protein and two levels of wheat offal

Dieumou F. E.*, Adegbola T. A. and Doma U. D.

Animal Production Programme, School of Agriculture, Abubakar Tafawa Balewa University, P. M. B. 0248 Bauchi, Nigeria.

Accepted 1 July, 2013

A feeding trial was conducted to investigate the effects of diets containing two sources (S) of protein, soybean meal (SBM) and groundnut cake (GNC) combined with 7.5 and 15% levels (L) of inclusion of wheat offal on growth performance, carcass characteristics and economics of production of broilers. A total of 204 chicks of Anak line were assigned to four dietary treatments each replicated three times in a factorial experiment. Birds were provided with feed and water *ad libitum* and the experiment lasted for seven weeks. Protein sources affected the relative organ weights as well as the carcass characteristics except for the caeca, gut and liver. Broilers fed SBM based diets had significantly higher (P < 0.05) daily feed intake (94.64 vs 110.71 g), (P < 0.001) daily weight gain (33.90 vs 52.2 g) and better (P < 0.001) feed conversion ratio (2.12 vs 2.82) than those on GNC based diets. The cost of feed intake per bird (N/kg feed) was significantly higher (P < 0.001) on SBM based diets than those containing GNC, but the cost of feed per kilogram of bird sold (N/kg gain) was significantly lower (P < 0.001) on SBM based diets because birds on these diets achieved significantly greater (P < 0.001) weight gain than those on diets containing GNC. Wheat offal levels had no effects on any of the parameters studied. In conclusion, soybean meal is a better protein source than groundnut cake and broiler feeds could contain up to 15% level of wheat offal at the starter phase without reduction of growth performance.

Key words: Broilers, economics of production, groundnut cake, growth performance, soybean meal.

INTRODUCTION

Inadequate feeding and poor management practices are some of the major problems affecting animal production in developing countries. Animal nutritionists are challenged on a daily basis to assess the nutritive values of feedstuffs available in their communities and to propose the possible combinations of these feedstuffs into complete feeds that meet the nutrient requirements of livestock at a reasonable cost. Feed alone accounts for up to 70 to 80% of the total cost of broiler production (Akdeniz et al., 2006) and adequate nutrition is one of the major inputs necessary for the full expression of the genetic potentials of poultry and the prevention of stress (Adene, 1989). Poultry accounts for 19.4% of the world's meat production compared to beef (38.3%), pork (34.9%), mutton (4.6%), Chevon (1.4%), buffalo meat (1.0%) and horse meat (0.4%) (Considine, 1982). Moreover, poultry industry is an area where scientific innovations have served to make production one of the most technologically advanced protein production systems in the world (Dibner et al., 1998). Consequently, poultry production is the most economic route for producing high quality animal protein within the shortest possible time for

*Corresponding author. E-mail: feldieu@yahoo.com.

the rapidly increasing human population across the world, and especially in the sub-Saharan African countries. This is because of their short generation interval and the intensive method of production, which allows high stocking density. Broiler chickens are fast growing animals, which are able to achieve market weight within the short period of 6 to 7 weeks nowadays. Poultry meat has many desirable nutritional benefits such as low lipid content with a relatively high concentration of polyunsaturated fatty acids and higher protein content (Kinsella et al., 1990; Nettleton, 1991). An incentive to greater broilers production will therefore go a long way in solving the problem of low animal protein intake (3.25 - 6.8 g per person per day) of the average Nigerian (Shaib et al., 1997; Abubakar, 1998). Poor productivity and high mortality of livestock, which characterize this industry is largely explained by the inadequacy of feeding the right quantity and quality of feeds to the various livestock species. Feed insufficiency is due to stiff competition with need for human food, particularly for the fast growing and prolific monogastric species poultry and pigs, and for concentrate mixes for ruminants. The food insufficiency is further compounded by the huge foreign debt and currency devaluation, which militate against feed importation (Olumide and Mpoko, 2001). This study was therefore designed to ascertain the effects of two sources of plant protein and two wheat offal levels based diets on the growth performance attributes, carcass characteristiccs, and economics of production of broiler chickens.

MATERIALS AND METHODS

Experimental birds and management

A total of 204 day old chicks of *Anak* 2000 line purchased from ECWA farms in Jos were received at the brooding room of the University Poultry Research Farm, brooded for one week before being transferred into the experimental pens. Four experimental diets and water were offered *ad libitum* every day. Brooding continued for the next three weeks using 200 watts electric bulbs with adjustable height above the floor. The feeding trial lasted for seven weeks during which feed intake, weight gain and feed conversion ratio were monitored on weekly basis. Vaccinations were given when due. Seven cases of mortality were recorded through out the feeding trial all occurring in the starter phase due to physical and mechanical injuries, giving an overall percentage mortality of 3.43%.

Feed preparation

Four iso-nitrogenous diets with varying energy densities were used both at the starter phase (23% crude protein) and the finisher phase (20% crude protein) using soybean meal and groundnut cake as test protein sources and two levels of wheat offal of 7.5 and 15%. The starter phase began from the second week of age and lasted for three weeks and the finisher phase lasted from 5 to 8 weeks of age (4 weeks).

From the various treatment combinations, the following diets were obtained:

Diet 1: Groundnut cake and wheat offal at 7.5% level of inclusion,
Diet 2: Groundnut cake and wheat offal at 15% level of inclusion,
Diet 3: Soybean meal and wheat offal at 7.5% level of inclusion,
Diet 4: Soybean meal and wheat offal at 15% level of inclusion.

The composition of diets are shown in Table 1 for the starter and finisher phases.

Experimental design, data collection and statistical analysis

The 204 chicks of Anak 2000 line were assigned to four treatments using 51 chicks per treatment, each at the start of the experiment. Each experimental diet was replicated three times with 17 birds per replicate in deep litter pens. The birds were arranged in a 2 x 2 factorial experiment of a completely randomised design. At eight day of age, the chicks were weighed and randomly allotted to the dietary treatments. Data collected were subject to the analysis of variance (ANOVA) option of SPSS statistical software version 11.0 as described by Nie et al. (1970). Significantly different means among treatments were separated as per the standard method of Duncan (1955) at 5% level of probability ($P < 0.05$).

RESULTS

The main effects (Table 2) shows that birds fed SBM based diets during the experimental period consumed significantly ($P < 0.001$) more feed (94.64 vs 110.71 g) than those fed GNC based diets. The better performance of birds on SBM based diets observed in this work could be due to better nutrient digestibility coupled with a more correctly balanced amino acid profile of soybean meal. The wheat offal levels in diets did not influence feed consumption in birds throughout the feeding trial neither did interaction between protein sources (S) and wheat offal levels (L) had any effects on the pooled performance of broilers.

Table 3 presents the main effect of protein sources and wheat offal levels on relative organs weight (expressed in percentage body weight) and carcass characteristics of broilers. There were significant ($P < 0.001$) effects of the protein sources on live weight, eviscerated weight, plucked weight, carcass weight and dressing percentage of broilers. The protein sources also had a very highly significant ($P < 0.001$) effect on the heart, abdominal fat and the neck. The protein sources and wheat offal levels had no significant effect on the liver, gut and caeca indicating that the diets were devoid of any toxic materials. The wheat offal levels in the diets had no significant effects on either the carcass characteristics or on the internal organs and offal. Birds fed SBM based diets had very highly ($P < 0.001$) significant weights of all the carcass parameters, the weight of the heart, the abdominal fat pad and the legs; a significantly greater ($P < 0.01$) weight of the lungs, the gizzard, the kidneys and the head compared to those fed GNM based diets.

The effects of protein sources and wheat offal levels interaction on the carcass characteristics (kg) and relative organs weight (expressed in percentage body weight) of

Table 1. Percentage composition of experimental diets in the starter and finisher phases.

Ingredient	Starter phase (Diet)				Finisher phase (Diet)			
	1	2	3	4	1	2	3	4
Yellow maize	52.00	46.00	53.00	53.00	59.70	53.80	60.60	54.60
Soybean meal (SBM)	-	-	32.70	32.70	-	-	28.10	26.60
Groundnut cake (GNC)	33.70	32.20	-	59.70	29.00	27.40	-	-
Fish meal (FM)	03.00	03.00	03.00	03.00	-	-	-	-
Wheat offal (WO)	07.50	15.00	07.50	15.00	07.50	15.00	07.50	15.00
Bone meal	02.00	02.00	02.00	02.00	02.00	02.00	02.00	02.00
Limestone	01.00	01.00	01.00	01.00	01.00	01.00	01.00	01.00
Sodium chloride(NaCl)	00.25	00.25	00.25	00.25	00.25	00.25	00.25	00.25
Vit/Min premix[k] (0.25)	00.25	00.25	00.25	00.25	00.25	00.25	00.25	00.25
Lysine	00.10	00.10	00.10	00.10	00.10	00.10	00.10	00.10
Methionine	00.20	00.20	00.20	00.20	00.15	00.15	00.15	00.15
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated nutrients content								
Metabolizable energy (Kcal/kg)	2866.67	2722.90	2927.92	2781.74	2925.75	2822.87	2978.74	2872.57
Crude protein (%)	23.00	23.00	23.00	23.00	20.00	20.00	20.00	20.00
Crude fibre (%)	03.47	04.01	04.35	04.84	03.46	04.00	04.21	04.70
Calcium (%)	01.35	01.36	01.35	01.36	01.18	01.19	01.18	01.18
Phosphorus (%)	00.86	00.88	00.86	00.92	00.77	00.84	00.77	00.83
Lysine (%)	01.01	01.03	01.31	01.32	00.82	00.83	01.08	01.08
Methionine (%)	00.54	00.53	00.59	00.58	00.42	00.41	00.46	00.45

[K]Each 2.5 kg premix contained the followings: Vit. A 10,000,000 IU; Vit. D_3 3,000,000 IU; Vit. E 30,000 IU; Vitamin K_2.3 g; Vit. B_1 1.7 g; Vit B_2 5.0 g; Vit. B_6 3.1 g; Vit. B_{12} 16 mg; Biotin 60 mg; Niacin 31.0 g; Pantothenic Acid 8 g; Folic Acid 0.8 g; Manganese 85 g; Zinc 50 g; Iron 25 g; Copper 6 g; Iodine 1.1 g; Selenium 120 mg; Cobalt 220 mg; B.H.T 60 g; Ethoxyquin 65 g; Choline Chloride 200 g.

Table 2. Main effects of protein sources and wheat offal levels on the growth performance of broiler chickens (2 to 8 weeks of age).

Parameter	Protein sources (PS)		Wheat offal levels (WOL)		Levels of significance	
	GNM	SBM	7.5%	15%	PS	WOL
Daily feed intake (g/bird)	94.64	110.7	101.86	103.49	*	ns
Daily weight gain (g/ bird)	33.90	52.20	42.40	43.70	***	ns
Feed conversion ratio	2.82	2.12	2.52	2.42	***	ns
Mortality	0	3				

Mean values within a row under protein sources (PS) differ significantly. Mean values in the same row under wheat offal levels (WOL) are all statistically similar.

Table 3. Main effects of protein sources and wheat offal levels on carcass characteristics (kg) of broiler chickens and relative organs weight expressed as (% body weight).

Parameter	Protein sources (PS)		Wheat offal levels (WOL)		Levels of significance	
	GNM	SBM	7.5%	15%	PS	WOL
Live weight	2.16	2.88	2.54	2.50	***	ns
Plucked weight	1.90	2.58	2.26	2.22	***	ns
Eviscerated weight	1.69	2.32	2.02	1.99	***	ns
Carcass weight	1.47	2.05	1.77	1.75	***	ns
Dressing percentage	67.8	71.05	69.38	69.48	***	ns
Lungs	0.50	0.40	0.44	0.44	**	ns
Liver	1.53	1.47	1.46	1.54	ns	ns
Heart	0.48	0.33	0.40	0.41	***	ns
Gizzard	2.21	1.70	1.94	1.96	**	ns
Kidneys	0.23	1.18	0.19	0.20	**	ns
Abdominal fat pad	1.68	0.59	1.17	1.09	***	ns
Gut	2.63	2.42	2.55	2.49	ns	ns
Caeca	0.51	0.48	0.51	0.48	ns	ns
Head	2.53	2.23	2.37	2.39	**	ns
Neck	3.71	2.99	3.30	3.40	***	ns
Legs	3.66	3.42	3.60	3.48	ns	ns

Mean values within a row under protein sources (PS) differ significantly ($P < 0.05$) except for the liver, gut, caeca and legs. Mean values in the same row under wheat offal levels (WOL) are all not significant ($P > 0.05$).

Table 4. Effects of protein sources and wheat offal levels interaction on the carcass characteristics (kg) and relative organs weight (expressed in % body weight) of broiler chickens.

Parameter	Protein sources	Groundnut meal (%)		Soyabean meal (%)		SEM
	Wheat offal levels	7.5	15	7.5	15	
	Diets	1	2	3	4	
Live weight		2.22	2.11	2.87	2.90	0.15^{ns}
Plucked weight		1.96	1.84	2.57	2.60	0.15^{ns}
Eviscerated weight		1.74	1.64	2.30	2.35	0.13^{ns}
Carcass weight		1.51	1.42	2.02	2.07	0.11^{ns}
Dressing percentage		68.23	67.40	70.54	71.57	1.21^{ns}
Lungs		0.48	0.51	0.41	0.38	0.05^{ns}
Liver		1.54	1.53	1.39	1.56	0.11^{ns}
Heart		0.46	0.51	0.34	0.33	0.03^{ns}
Gizzard		2.11	2.31	1.77	1.62	0.26^{ns}
Kidneys		0.21	0.24	0.18	0.17	0.02^{ns}
Abdominal fat		1.67	1.70	0.68	0.49	0.34^{ns}
Gut		2.58	2.68	2.53	2.32	0.23^{ns}
Caeca		0.49^{ab}	0.53^{ab}	0.54^{a}	0.42^{b}	0.06*
Head		2.45	2.60	2.29	2.17	0.17^{ns}
Neck		3.56	3.86	3.03	2.95	0.29^{ns}
Legs		3.75	3.57	3.44	3.39	0.25^{ns}

^{ab}Means bearing no superscripts in the same row are all statistically similar ($P > 0.05$).

broiler chickens had no effects on any of the parameters studied except for the caeca ($P < 0.05$) of broilers Table 4. This variation in the relative caeca weight indicates that the effect of wheat offal levels in the diets depended on the protein sources.

The economics of production of birds fed experimental

Table 5. Economics of production of broilers fed diets with two sources of protein and two levels of wheat offal (2 to 8 weeks of age).

Parameter	Diet 1	Diet 2	Diet 3	Diet 4	SEM
Daily feed intake (g/ bird)	93.76	95.51	109.96	111.46	1.33^{ns}
Daily weight gain (g/ bird)	32.36	35.45	52.44	51.96	1.54^{ns}
Feed conversion ratio	2.94	2.70	2.09	2.15	0.15^{ns}
Total feed cost (₦)	159.62^{b}	156.60^{b}	207.52^{a}	207.2^{a}	2.25***
Total weight gain (kg/bird)	1.75^{b}	1.74^{b}	2.57^{a}	2.50^{a}	0.04***
Feed cost (₦/kg gain)	91.24^{a}	90.25^{a}	80.66^{b}	82.77^{ab}	1.22***
Mortality	0	0	2	1	-

[ab]Means bearing common superscripts in the same row are not significantly different (P > 0.05).

diets is shown in Table 5. The cost per kilogram feed and total cost of feed consumed per bird were significantly higher (P < 0.001) on the SBM based diets. In like manner, the total weight gain was significantly higher (P < 0.001) in birds fed SBM based diets than those fed GNC based diets. The feed cost per kilogram gain on diets 1, 2 and 4 were statistically similar and were significantly higher (P < 0.001) than for that on diet 3. However, diets 3 and 4 were statistically similar indicating that SBM based diets were cheaper and more economical for broilers production than GNC based diets.

DISCUSSION

Generally, the growth performance attributes of birds on SBM were significantly better (P < 0.05) than those on GNM. These results agree with the findings of Mustafa et al. (2012) who fed broilers with diets including different percentage of animal protein and plant protein sources and obtained significant (P < 0.05) effects on their growth and economic parameters. Three cases of mortality were recorded on SBM based diets due to physical and mechanical injuries. This mortality rate falls within the accepted range of 0-5% for good management practices and safety of diets as advocated by ISA (1996).

There was a significant (P < 0.05) protein source and wheat offal level interaction effect on the caeca relative weight alone meaning that the effect of wheat offal levels in the diets depended on the protein sources. This is a reflexion of the fibre digesting ability attributed to the caecum in non ruminant animals and it agrees with the report of Steenfeldt et al. (2007) who found fibre digestibility to vary from 24 to 29% in layer hens fed large amounts of roughage, thus indicating that caecal fibre digestion can be significant in layer hens.

The cost per kilogram feed and total cost of feed consumed per bird were significantly higher (P < 0.001) on the SBM based diets. In like manner, the total weight gain was significantly higher (P < 0.001) in birds fed SBM based diets than those fed GNM based diets. The feed cost per kilogram gain on diets 1, 2 and 4 were statistically similar and were significantly higher (P < 0.001) than for that on diet 3. However, diets 3 and 4 were statistically similar indicating that SBM based diets were cheaper and more economical for broilers production than GNM based diets. These results are in line with the report of Ojewola et al. (2005) who compared the utilization of three animal protein sources by broiler chickens and found significant treatment effects (P < 0.05) in gross margins.

Conclusion

It was concluded that soybean meal based diets gave higher carcass yield at eight weeks of age with concomitant reduction in feed cost regardless of dietary contents of wheat offal and produced better returns compared to groundnut cake based diets. Therefore, iso-nitrogenous as well as iso-caloric diets containing soybean meal with up to 15% level of inclusion of wheat offal could bring about efficient growth performance in broilers.

REFERENCES

Abubakar MM (1998). Utilization of unconventional feedstuffs for sustainable livestock production**.** Inaugural Lecture Series Number 9. Abubakar Tafawa Balewa University, Bauchi, Nigeria.

Adene DF (1989). Feed-related deficiencies, diseases and anomalies in livestock poultry. Feed Mill Management in Nigeria. Federal Livestock Department. Ibadan University Press, Ibadan, pp. 174-197.

Akdeniz RC, Ak I, Boyar S (2006). Feed Industry and Problems in Turkey, Turkish Agricultural Engineering VI. Technical Congress Proceedings Ankara 2:935-960.

Considine DM (1982). Foods and Food Production. Encyclopaedia, VanNorstrand, New York.

Dibner JJ, Knight CD, Ivey FJ (1998). The feeding of neonatal poultry. World Poult. 14(5):36-40.

Duncan DB (1955). Multiple range and F-test. Biometrics 11:1-42.

ISA (Institut de Selection Animale) (1996). Guide d'Elevage des Poulets de Chair. Service Production et d'Assistance Technique, Quintin, France. pp. 3-10.

Kinsella JE, Lokesh B, Stone RA (1990). Dietary n-3 polyunsaturated fatty acids and amelioration of cardiovascular disease: Possible mechanism. Am. J. Clin. Nutr. 52:1-28.

Mustafa R A, Hakim AS, Azizullah M, Rab NS, Hidayatullah SN, Ahmed

U (2012). Effect of various protein source feed ingredients on the growth performance of broiler. Int. J. Med. Plant Res. 1(4):038-044.
Nettleton JA (1991). n-3 Fatty acids composition of plant and seafood sources in human nutrition. J. Am. Diet. Ass. 91:331-337.
Nie N, Bent DH, Hull CH (1970). Statistical Package for Social Sciences survival manual: a step by step guide to data analysis using SPSS. New York, Mc GrawHill, 1st edition, P. 343.
Ojewola GS, Okoye FC, Ukoha OA (2005). Comparative Utilization of Three Animal Protein Sources by Broiler Chickens. Int. J. Poult. Sci. 4(7):462-467.
Olumide OT, Mpoko B (2001). Post-harvest technologies in nigeria's livestock industry: status, challenges and capacities. A Presentation at the GFAR – GIPhT Workshop, 17–21 September 2001, Entebbe Uganda.
Shaib B, Adedipe NO, Aliyu A, Jir MA (1997). Integrated Agricultural Production in Nigeria. In: Strategies and Mechanisms for Food Security. Proceedings of the National Workshop on Nigeria's Position at the World Food Summit, Abuja, July 31st-August 2nd, 1996. pp. 11-74.
Steenfeldt, S, Kjaer JB, Engberg RM (2007). Effect of feeding silages or carrots as supplements to laying hens on production performance, nutrient digestibility, gut structure, gut microflora and feather pecking behaviour. Br. Poult. Sci. 48(4):454-468.