RESEARCH ARTICLE

Sokoto Journal of Veterinary Sciences
(P-ISSN 1595-093X/ E-ISSN 2315-6201)
Sanusi *et al*/*Sokoto Journal of Veterinary Sciences* (2015) 13(2): 14-19
http://dx.doi.org/10.4314/sokjvs.v13i2.3

Comparative effect of self–formulated and four commercial diets on the growth performance, carcass and haematological parameters of broiler finishers in the tropics

M Sanusi[1]*, A Rabi[2], UD Doma[1] & J Haruna[3]

1. *Department of Animal Production, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi, Nigeria*
2. *Livestock Department, Ministry of Agriculture, Lafiya, Nasarawa State, Nigeria*
3. *National Veterinary Research Institute, (NVRI) Vom, Plateau State, Nigeria*

*Correspondence: Tel.: +234 8137799835, E-mail: drmsanusi@gmail.com

Abstract

This study was conducted to evaluate growth performance, carcass characteristics, haematological parameters and cost effectiveness in broilers fed self-formulated and four commercial diets as coded T1 (Control diet), T2, T3, T4 and T5. A total of 220 Anak 2000 broiler chicks were allotted to five dietary treatments with 44 birds per diet and 11 birds per replicate in a completely randomized design. Feed and water were supplied *ad libitum* and the experiment lasted for 49 days. The daily feed intake (53.00 – 75.55 g), daily weight gain (26.73 – 43.36 g), feed conversion ratio (1.69 – 2.29) and mortality (4 - 14) were significantly affected by the dietary treatments ($P < 0.001$). Many of the carcass parameters measured were not significantly affected ($P > 0.05$) by the treatments. However, significant ($P < 0.05$) variations were observed in plucked weight (1.22-1.69 kg), eviscerated weight (1.13-1.59 kg), carcass weight (1.12-1.48 kg) and relative weight of pancreas (0.15-0.31%) as a proportion of live weight. The relative weight of head, spleen, and abdominal fat also differ ($P<0.05$) among the diets. Most of the haematological parameters studied were within the normal range and were similar except white blood cell (2.18-3.28%) which was significantly affected ($P < 0.01$) by the dietary treatment. The feed cost per kilogram gained ranged between ₦124.67 – ₦190.29 ($0.86 – 1.31) with the lowest value obtained for the self-formulated diet which proved to be most economical.

Keywords: Carcass yield, Economy, Gut weight, Performance, Poultry feeds

Received: 24-10- 2014 Accepted: 02-06-2015

Introduction

Poultry production is an important rapid growing money making industry. The advantage of poultry over other livestock is primarily due to the short and relatively quick turn over on investments and high quality protein products (Adeyemo *et al.,* 2010). As a result of growing human population, there is high demand for poultry products (FAO, 2002). The rapid growth of broilers demands that they be supplied with high quality diets, which will satisfy both their nutritional demand as well as ensuring high profits. Feed cost is often a major limiting factor in chicken production. According to Akpodiete *et al. (*2001), feed alone accounts for 70-80% of total variable cost of intensive broiler production. Doma *et al. (*2001) and Uchegbu *et al. (*2007) reported inadequacies in the quality of some commercial feeds and poor performance by broiler birds that consumed them. This situation has serious implications on small scale poultry farmers, who have little capacity to produce their own feeds. It is hypothesized that farmers, who operate at a small- or medium-scale level and do not produce their own feeds but rely on relatively expensive commercial feeds, may be incurring higher feed costs than necessary. This study was therefore conducted to determine the comparative advantage of self-formulated feed over commercial feeds on growth performance, carcass yield, haematological parameters and economics of production.

Materials and methods

The experimental diets consisted of a self-formulated finisher diet (Table 1), which served as control and four of the most commonly used commercial diets in Bauchi (Table 2), coded T1, T2, T3, T4 and T5, respectively. Each diet constituted a treatment and each replicated four times in a completely randomized design (CRD) with 11 birds per replicate for a total of 220 Anak 2000 broiler chicks. At starter phase all broiler chicks were fed with the same ration under the same management condition. The broiler finisher diet was formulated with ingredients commonly used by poultry farmers in the area and according to the NRC (1994) nutrients requirements for broilers (Table 1). Proximate composition and metabolizable energy (ME) of the feeds were determined by procedures of the Association of Official Analytical Chemists (AOAC, 1990). Feed and water were provided *ad libitum*. Broiler finisher rations were fed from 5^{th} to the 7^{th} week of age. Daily feed intake (DFI) was calculated on daily basis while birds were weighed at weekly intervals to observe weight changes. Feed conversion ratio (FCR) was calculated as feed/gain ratio. At the end of the experiment, two birds per replicate were randomly selected from the five diets and fasted for 10 hours before slaughtering. Each bird was weighed and slaughtered by severing of the jugular vein to bleed. Birds were defeathered by scalding in hot water at 60^{0}C. The live weight, plucked weight, eviscerated weight and carcass weight were measured and expressed in kilogram. Blood samples were collected from the jugular veins immediately after slaughter, into labeled bottles containing ethylene diamine tetra acetic acid (EDTA) which were gently rolled for proper mixing. Manual counts of the total red and white blood cells were carried out using haemocytometer (Campbell, 1995). Packed cell volume (PCV) was determined using micro-haematocrit capillary tubes, which were centrifuged at 2500 rpm for 5 minutes. Haemoglobin concentration (Hb) was also determined with the use of the cyanmethemoglobin method.

All data collected were subjected to one-way analysis of variance (ANOVA) as described by Steel & Torrie (1980) using the computer software package Minitab (2004) and significant differences between treatment means were separated using least significant difference (LSD) at $P<0.05$. The cost of the commercial feeds and ingredients used in compounding the control diet were all recorded.

Table 1: Percentage formulation of control diet fed to broiler at the finisher phase

Feed ingredients	Percentage
Maize	55.42
Soya beans	14.03
Groundnut cake	9.35
Wheat offal	12.0
Fish meal	5.00
Limestone	1.50
Bone meal	2.0
Salt	0.25
Premix*	0.25
Methionine	0.10
Lysine	0.20
Total	100.0
Calculated analysis	
Crude Protein	20.28
Crude fibre	7.70
Ether extract	9.56
Calcium	1.66
Total Phosphorus	1.53
Metabolizable energy (Kcal/kg)	2839

*Finisher Vitamin and mineral premix: provided per kg of diet: Vit. A 13,340 IU; Vit. D3 2680 IU, Vit. E 10; Vit. K 2.68 mg; Vit. B12 12.02 mg; Calcium pantothenate 10.68 mg; Folic acid 0.668 mg; Chloride 400 mg; Chlortetracycline 26.68 mg; Mn 133.34 mg; Fe 66.68 mg; Zn 53.34 mg; Cu 3.2 mg; Iodine 1.86 mg; Cobalt 0.268 mg; Se 0.108 mg

Table 2: Energy and nutrient compositions of control diet and four different commercial diets fed to broilers at the finisher phase (Means)

Components (%)		Commercial feeds			
	T1	T2	T3	T4	T5
Crude protein	20.28	19.00	18.00	20,00	19.50
Fat and oil	9.56	8.60	NA	NA	3.50
Fibre	7.70	5.40	NA	NA	3.50
Calcium	1.66	1.20	0.79	NA	3.50
Phosphorus	1.53	0.41	0.40	NA	0.95
Methionine	ND	NA	0.75	NA	0.40
Lysine	ND	NA	0.93	NA	0.10
ME (kcal/kg)	2,839	2,900	2,992	NA	2,800

T1 – self – formulated diet; T2 – T5 commercial feeds; NA – Not available; ND – Not determined

Table 3: Overall Performance of broilers fed different commercial diets and control diet at finisher phase

Parameters		Commercial diets				
	T1	T2	T3	T4	T5	LSD
Daily feed intake g/d	70.73^{ab}	75.55^{a}	60.57^{c}	53.00^{c}	69.79^{bc}	13.28***
Daily weight gain g/d	34.04^{b}	43.36^{b}	28.52^{b}	26.73^{c}	33.36^{b}	7.54***
Feed conversion ratio	2.28^{a}	1.69^{b}	2.29^{a}	2.16^{a}	2.11^{a}	1.45***
Mortality	9^{b}	11^{ab}	9^{b}	14^{a}	4^{c}	1.96***

Note: T1 – Self formulated, T2 – T5 commercial diets, ^{abc} means with different superscripts differ significantly, LSD least significant difference, *** P< 0.001

Results

The growth performance of finisher broiler birds (Table 3) showed that average daily feed intake (DFI) ranged from 53.00 – 75.55g, daily weight gain (DWG) from 26.73 – 43.36 g and feed conversion ratio (FCR) 1.69 – 2.29 were significantly (P < 0.001) influenced by the treatments. During the finisher phase a total of 47 mortalities ranging between 4 and 14 birds recorded on T5 and T4 respectively. The effects of dietary treatments on live weight (LW), carcass weight and gut characteristics are presented in Table 4. The results indicated that the feeding of self-formulated feed did not significantly influence (P>0.05) the final LW when compared to other groups. The organs characteristics measured showed no significant (P>0.05) effect of the treatments on lungs, liver, heart and kidney. The dressing percentage obtained ranged from 68.99 to 72.54% in birds did not differ among treatments. There was significant (P < 0.05) effect of diet on gizzard, spleen and abdominal fat. The highest (2.23%) gizzard value was observed in the T4 diet as compared to other treatments, which ranged from 1.69 to 2.21%. Results of haematological characteristics of the birds are presented in Table 5. Dietary treatments did not show significant effect (P > 0.05) on PCV, RBC and Haemoglobin levels. Similar trend was observed for lymphocytes, neutrophils, eosinophils, basophils and monocytes except WBC that was affected (P < 0.05) with the highest value obtained in the self-formulated diet. Cost evaluation in Table 6 revealed that the self-formulated diet was cheaper to compound and had least cost of N 60.00 / kg feed.

Discussion

The effects of dietary treatments on growth performance of finisher broiler birds showed that average daily feed intake (DFI), daily weight gain (DWG), and feed conversion ratio (FCR) were significantly influenced by the treatments (P < 0.001). These values were comparable to the report of Doma *et al*. (2001) in broilers fed different commercial diets. Birds fed under T4 had the lowest (53.00g/d) DFI which resulted in significantly lower (26.73g/d) weight gain (P < 0.001) as compared to other treatments. This could be attributed to the low protein content of the diet. Similar observations were also made by Hussein *et al.* (2001), who reported that low protein diet leads to poor performance. The results indicated that the feeding of self-formulated feed did not significantly influence (P>0.05) the final LW and dressing percentage when compared to other groups. This finding was contrary to the report of Doma *et al*. (2001) who observed a significantly (P < 0.01) better final LW in broilers fed

Table 4: Carcass and organ yield (% live weight) of broilers fed different commercial and self-formulated diets

Parameters		Commercial Diets				LSD	Remarks
	T1	T2	T3	T4	T5		
Live weight (kg)	1.85	2.11	1.62	1.56	1.96	0.27	NS
Plucked weight (kg)	1.48^{b}	1.69^{a}	1.23^{bc}	1.22^{c}	1.53^{b}	0.36	***
Eviscerated weight (kg)	1.34^{a}	1.59^{a}	1.21^{b}	1.13^{c}	1.33^{a}	1.13	***
Carcass weight (kg)	1.29^{b}	1.48^{a}	1.12^{c}	1.12^{c}	1.35^{ab}	0.20	***
Dressing percentage	69.88	71.09	68.99	72.54	69.60	5.17	NS
Head (%)	3.01^{ab}	2.57^{c}	2.93^{c}	2.15^{a}	2.96^{ab}	0.38	*
Lungs (%)	0.58	0.51	0.51	0.56	0.58	0.06	NS
Liver (%)	2.14	1.86	2.27	2.29	1.96	0.001	NS
Heart (%)	0.45	0.46	0.45	0.45	0.45	0.001	NS
Kidney (%)	0.27	0.33	0.29	0.32	0.24	0.021	NS
Gizzard (%)	2.00^{b}	1.69^{c}	2.21^{ab}	2.23^{a}	2.11^{ab}	0.34	*
Pancreas (%)	0.31^{a}	0.15^{c}	0.19^{bc}	0.29^{b}	0.26^{b}	0.11	***
Caeca (%)	0.49	0.60	0.45	0.48	0.54	0.003	NS
Small intestine (%)	3.17	2.79	2.89	3.16	2.82	0.03	NS
Large intestine (%)	0.20	0.18	0.18	0.18	0.18	0.001	NS
Spleen (%)	0.12^{b}	0.07^{c}	0.10^{b}	0.23^{a}	0.10^{b}	0.10	*
Abdominal fat (%)	2.00^{b}	2.58^{a}	2.21^{b}	2.00^{b}	1.55c	0.73	*

^{abc}Means in the same row with different superscripts differ significantly; (P < 0.001) = ***; (P <0.01) = **; (P <0.05) = *; NS = Not significant.
Note: T1 = self – formulated diet; T2 – T5 = commercial diets; LSD = Least significant difference; !Each carcass, compose of the eviscerated weight of the chicken comprising: the wings, legs (drumstick), whole breast (with breast meat, back, bone and skin) and neck

Table 5: Haematological parameters of broilers fed four different commercial and self –formulated diets

Parameters		Commercial Diets				
	T1	T2	T3	T4	T5	LSD
Packed cell volume (%)	26.25	25.00	26.38	25.38	26.13	0.14^{NS}
Haemoglobin (× 10 g/dL)	8.59	8.44	8.74	8.46	8.63	0.06^{NS}
Red blood cell (× 10^{12}g/L mm^{3})	3.42	3.06	3.05	2.56	3.03	0.03^{NS}
White blood cell (× 10^{9}g/L)	3.28^{a}	2.81^{b}	2.24^{c}	21.18^{c}	2.80^{b}	0.67**
Neutrophils (%)	56.62	56.75	65.00	58.63	49.13	14.79^{NS}
Lymphocytes (%)	41.75	45.38	40.50	17.75	40.06	3.88^{NS}
Eosinophils (%)	1.13	1.00	1.00	1.38	1.25	0.01^{NS}
Basophils (%)	1.00	1.00	1.00	1.38	1.00	0.0^{NS}
Monocytes (%)	1.25	1.38	1.38	1.38	1.38	1.75^{NS}

Note: T1 = self-formulated diet; T2, - T5 commercial diets; ** level of significant (P<0.01); NS = Not significant; LSD – least significant difference

Table 6: Economic analysis of broilers fed different commercial diets and control diet

		Commercial diets			
	T1	T2	T3	T4	T5
Total feed intake (kg)	3.47	3.70	2.96	2.60	3.42
Feed cost (₦/kg)	60.00 (0.41)	86.60 (0.60)	90.00 (0.62)	67.00 (0.46)	86.00 (0.59)
Total feed cost (₦)	208.20 (1.43)	318.20 (2.19)	266.40 (1.83)	174.20 (1.20)	294.12 (2.02)
Total weight gain (kg)	1.67	2.12	1.40	1.31	1.64
Feed cost (₦/kg gain)	124.67 (0.86)	150.09 (1.03)	190.29 (1.31)	132.98 (0.92)	172.27 (1.19)
Cost saving (₦)	0.00	25.42	65.62	8.31	47.60

Note: Values in parenthesis are the USD equivalents at CBN rate: \$ 1 = ₦ 145.3 (CBN, 2009), T1 = self-formulated, T2 – T5 = commercial diets self-formulated diet compared to those on commercial diets. The values for LW of chickens at the end of the experiment was numerically higher in T2 when compared to other groups. However, the significant ($P < 0.001$) increase on plucked weight, eviscerated weight, carcass weight and pancreas weight was similar to observations made by Doma *et al. (*2001). The lowest values for plucked weight (PW) and eviscerated weight (1.22 and 1.13 kg) respectively were obtained in T4. This could be attributed to the low feed intake observed. The organs characteristics measured showed no significant (P>0.05) effect of the treatments on lungs, liver, heart and kidney. During the finisher phase a total of 47 mortalities was recorded which could be attributed to some disease conditions observed which include weakness (T1), rickets (T2), and mild arthritis (T3 andT4). These conditions may be due to nutritional deficiencies, stress and subclinical infections.

Dressing percentage ranged from 68.99 to 72.54% and did not differ amongst treatments. There were significant ($P < 0.05$) effects of diet on gizzard, spleen and abdominal fat. The highest value was observed in the T4 diet on gizzard (2.23%) as compared to other treatments, which ranged from 1.69 to 2.23%. This finding could be attributed to high fiber contents in the diet and is similar to the reports of González-alvarado *et al. (*2007), Mateos *et al. (*2012) and Varastegani & Dahlan (2014) who reported that feeding high fiber diets enhanced relative length and weight of intestine, caeca and sizes of various digestive components resulting in decreasing dressing percentage.

Dietary treatments did not show significant effect ($P > 0.05$) on PCV, RBC and Haemoglobin levels. Similar trend was observed for lymphocytes, neutrophils, eosinophils, basophils and monocytes except the WBC with the highest ($P < 0.05$) in birds fed control diet.

There is evidence in literature that haematological characteristic of livestock is suggestive of their physiological disposition of the plane of nutrition (Madubuike & Ekenyemi 2006). The high value of 3.28×10^9 g/L WBC observed in T2 was significantly ($P < 0.01$) greater than the values obtained in the 4 remaining treatments. This could be as a result of mild infection observed which may cause mobilization of cells from the marginal pool (Reece, 2004). The lower values obtained in T3 and T4 of 2.24×10^9 g/L and 2.18×10^9 g/L respectively were statistically similar. The average values recorded in this study for RBC, PCV, Haemoglobin and other values for the differential counts showed no significant ($P > 0.05$) differences among dietary treatments, but were slightly above normal. This finding is consistent with the findings of Olorede *et al.* (1996) who indicated that haematological and erythrocytic indices in the broilers fed sheabutter cake or palm kernel cake were generally similar. The highest and lowest values for eosinophils: 1.38 and 1.00% recorded in T4 and T2 respectively, did not differ significantly and were within the normal range. Similar trend was observed in the values for basophils and monocytes. The relatively high values for lymphocytes, neutrophils and monocytes recorded in this study are not unusual and are suggestive of adequate immunity of birds in all the treatments.

Cost evaluation revealed that the self-formulated diet was cheaper to compound and had least cost of ₦ 60.00 / kg feed. This finding is similar to report by Apantaku *et al.* (2006) in Oyo area where poultry farmers prefer and use self-formulated feeds instead of commercially compounded feeds, which is perceived to be of higher quality and lower cost. The highest feed cost of ₦ 90.00/kg was recorded on T3 diet.

Feed utilization efficiency as feed cost in ₦ / kg gain was observed to be lowest in birds feed T1 diet as ₦124.67k followed by T4 with ₦ 132.98k and the highest observed in birds fed T3 with ₦ 190.29k. The low feed cost (₦ /kg feed) in self – formulated feeds during in this study agreed with the results of Adeshinwa *et al. (*1996), Adebayo *et al. (*2002) and Afolayan *et al. (*2009) who reported that on – farm feeds are cheaper than commercial feeds.

In clonclusion, the study indicates that most of the commercial feeds used in the study area could be successfully substituted by self-formulated feed at the finisher stage.

Using self-formulated feed at finisher stage will be cheaeper and may attract more profit to the farmer as compared to the commercial feeds. The replacement in this study did not show any detrimental effect on carcass yield, internal organs and haematological parameters.

References

Adebayo AA, Salami SB & Oloyinde L (2002).The influence of selected social-economic variable on poultry farmer choice of commercial and self – compounded feeds in Lagos Area of Nigeria. *Nigeria Journal of Animal Production,* **29** (2): 226-233.

Adeshinwa AO, Ikani EI & Dafwang II (1996). Feed production of small scale livestock farmer in NAERLS, *Extension Bulletin* Zaria. Pp 36.

Adeyemo GO, Olughobo AD & Adebiyi OA (2010). The effect of graded levels of dietary methionine on the haematology and serum biochemistry of broilers. *International Journal of Poultry Science,* **9**(2): 158 – 161.

Afolayan M, Dafwang II & Omage JJ (2009). Performance of Broiler Fed on-farm versus commercial feeds *Nigerian Journal of Animal Production.* **36** (1): 41-51.

Akpodiete OJ, Okagbara GO, Omeje SI & Orugun JA (2001). Effect of roasting, boiling and boiling with potash on soyabean and its utilization by finishing broilers. In: *Proceeding of 6th Annual Conference of Animal Science Association of Nigeria held at the* University of Maiduguri, Borno State*. (CO Ubochi, A Kibon, ID Kwari, JU Igwebuike, ID Mohammed, NK Alade, FI Abbator, SB Adamu, editors)*. Pp 50-52.

AOAC (1990). Association of Official Analytical Chemists, Official methods of analysis, fifteenth edition, Washington, DC.

Apantaku SO, Oluwalana EOA & Adepegba OA (2006). Poultry farmers' preference and use of commercial and self-compounded feeds in Oyo area of Oyo State, Nigeria. *Agriculture and Human Values*, **23**(20): 245.

Campbell TW (1995). *Avian Haematology and cytology* Iowa state university press, Ames Iowa, USA. Pp 12-50.

Central Bank of Nigeria (2009) Nigerian Naira Exchange Rates for 7/04/2009 http://www.cenbank.org/rates/Exchange Archives.asp retrieved 07-04-2009.

Doma UD, Muhammad AS, Bello KM & Ugbeh E (2001). Performance of Broilers chickens fed with local formulated fed and commercial feeds. *Nigerian Journal of Tropical Agriculture*, **3**: 83-86.

FAO (2002). World Agriculture: Towards 2015/2030 Summary report. Rome, Italy. Pp 106.

González-alvarado, JM, Jiménez-Moreno E, lázaro R & Mateos GG (2007). Effects of type of cereal, heat processing of the cereal, and inclusion of fiber in the diet on productive performance and digestive traits of broilers. *Poultry Sciences,* **86**(8): 1705–1715.

Hussein, AS, Cantor AH, Pescatore AJ, Gates RS, Burnham D, Ford MJ & Paton ND (2001). Effect of low protein diets with amino acid supplementation on broiler growth. *Journal of Applied Poultry Research*, **10**(4): 354–362.

Madubuike FN & Ekenyemi BU (2006). Haematology and serum Biochemistry characteristics of Broiler chicks fed varying Dietary levels of it, Ipomoea Asarifolia leaf meal *International Journal of poultry Science,* **5**(4): 9-12.

Mateos GG, Jiménez-Moreno E, Serrano MP & Lázaro RP (2012). Poultry response to high levels of dietary fiber sources varying in physical and chemical characteristics. *Journal of Applied Poultry Research,* **21**(2): 156–174.

Minitab-statistical software (2004). Minitab incorporation USA.

NRC (National Research Council) (1994). Nutrient requirements of poultry. 9th revised edition. National Academy Press, Washington, DC.

Olorede BR, Onifade AA, Okpara AO & Babatunde GM (1996). Growth, nutrient retention, haematology and serum chemistry of broiler chickens fed shea butter or palm kernel cake in the humid tropics, *Journal of Applied Research,* **10**(2): 173-180.

Reece WO (2004). *Dukes Physiology of Domestic Animals twelfth edition.* Cornell University Press New York USA, Pp 999.

Steel RGD & Torrie JH (1980). *Principles and procedures of statistics.* A Biometrical Approach. second edition. McGraw-Hill Book Co., New York. USA. Pp 633.

Uchegbu MC, Irechukwu NM, Omede AA, Nwaodu CH, Anyanwu GA, Okoli IC & Udedibie AB (2007). Comparative evaluation of three commercial feed on the performance of broilers. In *Proceedings of the forty first Annual Conference of Agricultural Society of Nigeria Zaria, Nigeria,* Pp 359 - 363.

Varastegani A & Dahlan I (2014). Influence of Dietary Fiber Levels on Feed Utilization and Growth Performance in Poultry. *Journal of Animal Production Advances*, **4**(6): 422-429.