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Effect of Substituting Soyabean Meal with Chicken Eviscerated Waste Meal on Performance Characteristics of Broiler Chicken Finishers

Folorunso, R.O.[1]* and Onibi, G.E.[2]

[1]Department of Animal Production Technology, Federal College of Agriculture, Akure Nigeria
[2]Department of Animal Production and Health, Federal University of Technology, Akure, Nigeria
*Corresponding author: rasheedfolorunso02@gmail.com

ABSTRACT

There is persistent quest for alternative feed resources hence the need to explore the use of wastes from chicken processing plants, which would otherwise constitute environmental pollutants. This study evaluated the replacement value of chicken eviscerated waste meal (CEWM) for soyabean meal (SBM) in a maize-SBM diet, on an equal protein basis, in the diets of broiler chickens. The experiment was arranged in completely randomized design with four replicates per dietary treatment using two hundred (200) 4-week old broilers at 10 birds per replicate. A total of four diets and control were used for the experiment. Diet A was the Control diet with SBM only. Diets B, C, D and E had equi-protein replacement of the dietary SBM with CEWM at 25, 50, 75 and 100%, respectively. Feed and water were provided ad libitum. Growth performance, carcass and organ characteristics as well as haematological variables of the chickens were evaluated. The results showed that there were no significant ($p>0.05$) differences in the final live weights, weight gains, feed consumption and feed conversion ratios of the birds due to the dietary treatments. The carcass parameters were not significantly ($p>0.05$) influenced by the dietary treatments. The relative weights of the chickens' abdominal fat increased with increasing dietary CEWM and that of the gizzard were higher for chickens offered CEWM than the control. Inclusion of CEWM in the diets of broiler finishers had no significant ($p>0.05$) effect on all the blood indices. It was concluded that CEWM could replace SBM completely in maize-SBM finisher broiler diets (with 14% dietary SBM) without any adverse effects on performance characteristics. However, adequate processing to avoid pathogenic organisms in the meal should be considered..

Key words: Soyabean meal, chicken eviscerated waste meal, protein, broiler finishers, performance characteristics.

INTRODUCTION

Poultry production is one of the most popular animal agriculture enterprises in Nigeria and remains a veritable gold mine in bridging the gap in animal protein needs and supplies, especially in Nigeria. Poultry is also popular because it enjoys a relative advantage of easy management, high turnover, quick returns on capital investment and wide acceptance of its products for human consumption (Haruna and Hamidu, 2004). Unfortunately, the feeding of poultry is a major problem threatening the survival of the industry. Generally, the prices of conventional protein sources like fish meal, soyabean meal (SBM) and groundnut cake have being on the increase thereby affecting poultry farming. For example, the cost of feeding has been put at 60-80% of the total cost of production for intensively reared poultry (Tewe, 1997). Thus, the high cost and poor quality of finished feeds are causing serious economic losses in poultry production and population.

In the light of this therefore, Hossain *et al*. (2003) emphasised the need to harness the potentials of good quality and relatively inexpensive feed ingredients as replacement for the more expensive conventional feed ingredients. Maggots from poultry droppings (Atteh and Oyedeji, 1990), housefly-pupa meal (El-Boushy, 1991), spent-sorghum mash fermented with *Ruminococcus flaveciens* (Abasienkong, 1991), poultry offal meal (Udedibie *et al*., 1988), chicken offal meal (Nwokoro, 1993), waste products from poultry eviscerating plants (Salami, 1997) and shrimp waste meal (Fanimo *et al*., 1996; Rosenfield *et al*., 1997) are some of the unconventional protein sources that have been successfully used to partially or completely replace the expensive conventional protein sources (Ojewola *et al*., 2005). Chicken offal meal is the processed edible offal from poultry processing plants. It has been used as protein supplement for feeding poultry and pigs for more than 30 years and has been found to have similar growth promoting properties to those of fish meal (Ndifon, 1985).

In the quest to reduce feeding cost of broiler chickens and environmental pollution, one of the options available is the possibility of using chicken eviscerated wastes (CEW). The CEW include all the inedible parts removed from broiler chickens during dressing operations and comprise the crop, intestines and gizzard linings with their contents. They are generated in reasonable quantity in poultry processing plants. Thus, this study is aimed at investigating the effects of replacement of soyabean meal (SBM) with Chicken Eviscerated Waste Meal (CEWM) in the diets of broiler finishers on the performance characteristics, carcass characteristics and haematological profiles of the chickens.

MATERIALS AND METHODS

The study involved the use of five diets with the gross, calculated nutrient and proximate composition shown in Table 1. Diet A, which was the Control diet had the test ingredient (SBM) included at 14% of the diet. Diets B, C, D and E had equi-protein replacement of the dietary SBM with CEWM at 25, 50, 75 and 100%, respectively. The diets were formulated to meet the NRC (1994) minimum nutrient requirements for broiler chicken finishers. The "wet rendering" method of Nwokoro (1993) for producing chicken offal meal was modified and used for processing the CEW into CEWM. This involved soaking fresh CEW (crop, intestines and gizzard linings with their contents) in hot water initially at boiling point in a 200L metal drum with its lid at a ratio of 1:2 (w/v) of CEW to water until it cooled down naturally after 12 hours. This was followed by skimming of surface oil and draining of parboiled CEW in a jute bag under hydraulic pressure to expel water and more oil. The drained CEW was sun-dried on concrete slab for 3-4 days during which feather contaminant was removed manually. The dried CEW was then milled and stored in polythene bags at room temperature until needed for preparation of the diets. The recovery rate of CEWM from CEW was 28%.

The experiment was arranged in completely randomised design. A total of 200 birds were selected at the end of a 4-week pre-experimental brooding period and placed on the dietary treatments. There were 10 birds per replicate and 4 replicates per dietary treatment. The birds were reared on deep litter, and feed and water were provided *ad libitum*. Vaccinations, medications and other management practices as outlined by the Federal College of Agriculture, Akure Research Farm, South-West, Nigeria. Weekly group live weights of birds and feed intakes were taken, and from the records, live weight gains, feed intakes and feed conversion ratios were determined. Birds were starved overnight prior to the end of the feeding trial and 2 birds per replicate (8 birds/treatment) were stunned, sacrificed and blood collected into heparinised bottles for haematological analysis as described by Lambs (1981). The slaughtered birds were scalded in hot water (60 - 65ºC), dressed, eviscerated and dissected into parts as described for turkey by Hahn and Spindler (2002). Proximate composition of the CEWM and experimental diets was determined as described by AOAC (2002). All data were subjected to one-way analysis of variance using the Minitab Statistical Package (v.17.1 Minitab Inc., USA).

RESULTS AND DISCUSSION

The CEWM contained 43.75% CP, which is similar to the 42% CP in SBM; 5.96% crude fibre and 8.53% ether extract. The comparable CP content of CEWM to that of SBM suggests that it could be an important protein source in non-ruminant animal diets. The higher ether extract of CEWM (8.53%) than SBM would contribute substantially to dietary oil and supply of energy. The results showed that the ether extract content of the diets slightly increased with increased levels of dietary CEWM (Table 1). The calculated and analysed nutritional compositions of the various diets are similar (Table 1).

Table 2 shows the performance characteristics of the broiler chickens fed the experimental diets. There were no significant ($p>0.05$) differences in the final live weights (2.20-2.40 kg/bird), daily weight gain (39.05-44.76 g/bird), daily feed intake (103.21-112.86 g/bird) and feed conversion ratios (2.33-2.82) of the birds on the different dietary treatments. These results suggest that CEWM would successfully substitute SBM in broiler finisher diets without adverse effect on the growth performances, thus indicating that CEWM is not inferior to SBM in terms of nutrient quality. This finding corroborates earlier observation of Nwokoro (1993) with chicken offal meal on the nutritional value of this processing by-product in poultry nutrition.

The results of the relative carcass weights and organ characteristics of the experimental broiler chickens are shown in Table 3. There were no significant ($p>0.05$) dietary treatment effect on all the carcass parameters measured showing that the diets similarly met the nutrient requirements of the broilers for carcass yield. Akinwande and Bragg (1974), Bates and Millward (1983) and Butsonand Carter (1985) demonstrated that different muscles exhibit differential rate of accretion in response to nutritional influences, which would affect carcass characteristics but the present study indicates that equi-protein replacement of dietary SBM with CEWM would supply similar nutrients thereby exerting comparable influence of the carcass parts. The relative weights of the abdominal fat (6.32 – 9.00 g/kgLW) and gizzard (19.06 – 25.56 g/kgLW) were significantly (p<0.05) influenced by dietary treatments The relative weights of the chickens' abdominal fat increased with increasing dietary CEWM, that of the gizzard were higher for chickens offered CEWM than the control. The increasing dietary metabolisable energy and fat with increasing dietary CEWM could be attributed to the increase in abdominal fat of the chickens. The diets containing CEWM had higher crude fibre contents than the control diet which could have led to higher relative weight of the gizzard of chickens fed the CEWM-diets due to higher muscular activities of the gizzard in fibre degradation. Keene *et al*., 1998). Clove oil is highly effective even at low concentrations. Keene *et al*, (1998) reported that it

Table 1: Gross (%), nutritional and proximate compositions of the experimental diets

Ingredients	A(0%)	B(25%)	C(50%)	D(75%)	E(100%)
Maize	46	46	46	46	46
Maize offal	14.5	15	15.28	15.67	16.06
Soyabean meal (42% CP)	14	10.5	7	3.5	-
Chicken eviscerated waste meal#	-	3.36	6.72	10.08	13.44
Groundnut cake	14.5	14.5	14.5	14.5	14.5
Brewers dried grain	5	5	5	5	5
Oyster shell	1	1	1	1	1
Bone meal	2.5	2.5	2.5	2.5	2.5
Methionine	0.3	0.3	0.3	0.3	0.3
Lysine	0.2	0.2	0.2	0.2	0.2
Broiler finisher premix	0.5	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5	0.5
Palm oil	1	0.64	0.5	0.25	-
	100	100	100	100	100
Composition					
Calculated					
Crude protein (%)	19.57	19.62	19.65	19.7	19.79
Metabolisable energy (kcal/kg)	2918.7	2921.21	2929.6	2935.61	2942.34
Ether extract (%)	6.24	6.31	6.58	6.75	6.91
Crude fibre (%)	4.6	4.8	5	5.18	5.38
Lysine (%)	1.03	0.94	0.84	0.75	0.65
Methionine (%)	0.6	0.57	0.55	0.53	0.51
Calcium (%)	1.36	1.35	1.34	1.34	1.33
Phosphorus (%)	0.57	0.55	0.53	0.51	0.49
Analysed					
Dry matter (%)	90.85	90.65	90.01	90.04	89.73
Crude protein (%)	19.08	19.88	19.63	19.67	19.65
Ether extract (%)	6.37	6.39	6.49	6.67	7.1
Crude fibre (%)	4.58	4.66	5.16	5.44	4.61
Ash (%)	7.41	7.99	7.04	7.5	7.25
Nitrogen free extract	53.41	51.73	51.69	50.76	51.12

#Chicken Eviscerated Waste Meal - 90.12% dry matter, 43.75% crude protein, 5.96% crude fibre and 8.53% ether extract,

Table 2: Performance characteristics of broiler chickens fed diets with soyabean meal replaced with chicken eviscerated waste meal

Performance	Dietary Treatments (% SBM replaced by CEWM protein)					Statistical significance
	A (0)	B (25)	C (50)	D (75)	E (100)	
Initial live weight (kg/bird)	1.17±0.07	1.11±0.02	1.09±0.04	1.11±0.04	1.11±0.04	NS
Final live weight (kg/bird)	2.40±0.10	2.20±0.27	2.20±0.07	2.31±0.15	2.36±0.20	NS
Total weight gain (kg/bird)	1.23±0.12	1.09±0.25	1.11±0.03	1.20±0.11	1.25±0.17	NS
Daily weight gain (g/bird/day)	44.05±4.14	39.05±9.03	39.52±1.09	42.74±3.93	44.76±5.94	NS
Total feed intake (kg/bird)	3.14±0.14	3.08±0.07	2.89±0.12	3.16±0.16	2.92±0.19	NS
Daily feed intake (g/bird/day)	112.14±5.15	110.12±2.63	103.21±4.39	112.86±5.88	104.17±6.91	NS
Feed conversion ratio	2.55±0.22	2.82±0.58	2.61±0.06	2.65±0.21	2.33±0.45	NS

Values are Mean ± SD, NS = Not significant (p>0.05), SBM = Soyabean meal, CEWM = Chicken eviscerated waste meal

Table3: Relative weights of selected carcass and organs characteristics of broiler chickens fed diets with soyabean meal replaced with chicken eviscerated waste meal

Parameter	Dietary Treatments (% SBM protein replaced by CEWM protein)					Statistical significance
	A (0)	B (25)	C (50)	D (75)	E (100)	
Dressed weight (%)	92.74±0.39	92.68±0.21	92.94±0.45	92.57±0.47	92.95±0.37	NS
Eviscerated weight (%)	81.54±1.49	79.99±2.75	81.56±1.42	83.19±1.09	83.34±2.57	NS
Thigh (g/kg LW)	111.51±9.93	103.52±6.46	99.29±8.79	94.36±7.04	112.36±7.02	NS
Drumstick (g/kg LW)	91.89±1.67	80.18±11.81	92.57±6.09	92.08±5.64	93.28±16.52	NS
Wings (g/kg LW)	79.78±6.16	76.52±6.73	78.87±3.27	81.36±5.01	79.98±4.99	NS
Chest (g/kg LW)	177.96±15.90	179.33±11.36	191.23±6.04	189.55±4.43	175.22±12.07	NS
Back (g/kg LW)	123.92±11.96	124.90±9.78	127.23±13.37	139.10±20.90	139.92±10.33	NS
Head (g/kg LW)	29.91±2.88	29.43±1.62	29.94±2.36	30.18±1.41	33.16±4.50	NS
Abdominal fat (g/kg LW)	$6.32{\pm}1.15^{a}$	$6.93{\pm}2.94^{a}$	$7.91{\pm}4.24^{ab}$	$8.64{\pm}1.37^{b}$	$9.00{\pm}0.27^{b}$	*
Heart (g/kg LW)	4.88±0.27	5.26±0.54	4.59±0.70	4.53±0.19	5.07±0.48	NS
Liver (g/kg LW)	20.24±0.31	26.90±1.30	20.21±5.24	23.69±5.13	24.34±6.75	NS
Gizzard (g/kg LW)	$19.06{\pm}1.87^{b}$	$25.56{\pm}1.69^{a}$	$25.36{\pm}2.34^{a}$	$22.50{\pm}1.86^{a}$	$24.56{\pm}1.55^{a}$	*

Mean ± SD, NS = Not significant (p>0.05), *= significant (p<0.05), LW= Live weight; SBM = Soyabean meal;CEWM = Chicken eviscerated waste meal, Means with different superscripts within the same row are significant (p<0.05)

induced anaesthesia. The haematological profiles of broiler chickens are presented in Table 4. Results indicated that the dietary treatments had no significant (p>0.05) effect on all the blood parameters; red blood cells (RBC; 2.22-2.55 x $10^6/mm^3$), erythrocyte sedimentation rate (ESR; 2.53-2.68 mm/hr), packed cell volume (PCV; 27.33-30.00%), haemoglobin (Hb; 8.77-9.90 g/ml), lymphocytes (52.60-59.29%), heterophils (28.33-35.00%), monocytes (7.33-10.33%), basophils (1.00-2.33%) and eosinophils (1.67-2.60%). Previous reports by Aletor and Egberongbe (1992) showed that blood variables most commonly affected by dietary treatments include red blood cell, packed cell volume and Hb contents. Thus, there was no negative effect of CEWM inclusion in the diets of finishing broilers on their haematological profiles, and all the haematological parameters fell within the range reported for chickens by Agbede *et al*. (2000). The birds on all the dietary treatments were apparently healthy throughout the experimental period.

Table 4: Haematological variables of broiler chickens fed diets with soyabean meal replaced with chicken eviscerated waste meal

Parameter	Dietary Treatments (% SBM protein replaced by CEWM protein)					Statistical significance
	A (0)	B (25)	C (50)	D (75)	E (100)	
RBC (10^6/mm³)	2.22±0.12	2.64±0.55	2.28±0.39	2.47±0.61	2.55±0.71	NS
ESR (mm/hr)	2.53±0.29	2.83±0.29	2.67±0.29	2.83±0.76	2.68±0.58	NS
PCV (%)	28.00±0.00	30.00±1.73	27.67±2.52	27.33±2.52	28.67±1.16	NS
Hb (g/100ml)	8.77±0.67	9.90±0.70	9.20±0.95	9.17±0.96	9.63±0.39	NS
Lymphocytes (%)	59.20±2.65	52.60±2.52	57.00±4.36	58.33±2.52	56.33±2.08	NS
Heterophils (%)	31.00±4.58	35.00±2.00	28.33±4.04	28.33±4.04	32.67±4.16	NS
Monocytes (%)	7.33±2.08	8.33±1.53	10.00±1.00	10.33±1.53	8.33±3.21	NS
Basophils (%)	1.00±1.00	1.33±1.16	2.33±0.58	1.00±1.00	1.67±1.53	NS
Eosinophils (%)	1.67±0.58	2.60±0.58	2.33±1.53	2.00±1.00	1.67±2.08	*

Values are Mean ± SD, NS-Not significant

CONCLUSION AND RECOMMENDATION

Chicken eviscerated waste meal (CEWM) would completely substitute soyabean meal (SBM) in maize-SBM diets with 14% dietary SBM for broiler chicken finishers without any detrimental effects on performance characteristics. The use of CEWM in broiler-chicken diet could also reduce the problems of waste disposal vis-à-vis environmental pollution in chicken processing plants in Nigeria. However, before the large scale adoption of CEWM for poultry diets, adequate studies should be conducted on the appropriate sterilization methods that would not compromise its quality while at the same time mitigating the effects of intrinsic pathogenic organisms.

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