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The Influence of Heat-Treated Sheep Droppings on the Performance, Carcass Characteristics and Economics of Production of Starter Broilers

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Abstract: The goal of this study was to determine the influence of Heat-treated Sheep Droppings (HSD) on the performance, carcass characteristics and economics of production of starter broilers. One hundred and sixty eight, 7-days old Anak 2000 broiler chicks were randomly allocated to 4 dietary treatments in three replicates of14 birds each. Four broiler starter diets were formulated such that HSD were fed at 0, 5, 10 and 15% inclusion levels. The experimental period lasted from 7-35 days of age. Growth performance, carcass characteristics and economics of production were studied. Results showed that the proximate analysis indicated that HSD contains reasonable amounts of protein, ether extract, nitrogen free extract and ash as well as high amount of fibre. There was a significant) increase in feed intake with increase in dietary level of HSD. There was a significant depression of weight gain and protein efficiency ratio at 15% HSD inclusion level while the weight gain and protein efficiency ratio of bird fed 5 and 10% HSD diets were not at variance with those fed 0% diet. The feed conversion ratio of the birds depreciated significantly at 10 and 15% HSD dietary levels. The carcass parts expressed as percentages of live weight were not significantly influenced by the treatments except for the gizzard, which had significantly high values in birds fed diets 3 and 4. HSD inclusion at 10% proved more advantageous in terms of feed cost per kg of live broiler and in percentage cost saving. It is concluded from the result of this study that HSD is a potential feedstuff in broiler starter feeding at up to 10% dietary level beyond depression of growth occurs.

Key words: Carcass characteristics, heat-treat sheep manure, performance, starter broilers

INTRODUCTION

In Nigeria, as in many other developing countries, there is malnutrition, household food insecurity and inadequate access to animal protein sources. The gap between the developed and developing countries (Nigeria) with regards to animal protein consumption is enormous. For example animal protein constitutes about 17% of the total protein consumption in the average Nigerian diet, compared to 68% in New Zealand, 71% in United States of America, 67% in Denmark and 60% in United Kingdom (World Bank, 2001). Therefore, it becomes imperative to increase the animal protein intake to a level, which compares farourable to that of the developed nations.

Poultry production especially broiler production offers the fastest means world wide for attaining animal protein self-sufficiency because of their short generation interval, high prolificacy, fast growth rate and greater affordability (Ibe, 2004; Onu and Okongwu, 2006). Due to this privilege role accorded the poultry industry, there was a wide spread interest in poultry farming. However, this enthusiasm has be greatly dampened by the phenomenal rise in the cost of feed caused by the high cost of the conventional energy and protein ingredients such as maize, guinea corn, soyabean meal and groundnut cake. Today, the average price of a 25 kg bag of broiler feed stands at a staggering figure of about ₦1, 200.00/1,300.00 ($10.16) with the associated problem of dwindling quality. This situation therefore, calls for solutions that can urgently check the steadily increasing prices of feeds, so as to encourage more people to get back into poultry farming and thus increase animal protein supply (Ojewale and Annah, 2005). The need to seek for alternative, easily obtainable andunderutilized agro by-products especially those that are inedible to man therefore becomes imperative. The utilization of non-conventional feed ingredients is gaining ground daily in Nigeria. For instance, Onu *et al.* (2001) reported that wild cocoyam (*Caladium bicolor*) could replace maize up to 20% without any deleterious effect. Similarly, Onu (2006) reported that maize offal could successfully substitute maize in broiler diets without any adverse

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effect on performance. Similarly, Adeyemo and Oyejola (2004) reported that poultry droppings could be used to replace blood meal in guinea fowl diet at up to 40% dietary level without any adverse effect on performance.

Interestingly, Nigeria is blessed with many livestock species and the manure, which are often obtained in large quantities could have some potential in poultry nutrition. Sheep droppings are produced in large quantities in Nigeria. A continuous accumulation of this waste is dangerous because it causes environmental pollution. Thus, any strategy that will lead to a reduction in its accumulation in the environment should be encouraged. Although there is still scarcity of information concerning the utilization of heat-treated sheep dropping in broiler feeding its potentials as a valuable alternative feedstuff is not questionable, considering its nutrient composition (Abeke *et al.*, 2003; Egede, 2005). However, the extent of its usefulness and levels of utilization by young broiler chicks need to be established as much of the previous works have been on layers and broiler finishers.

If young broiler chicks effectively utilize this unothordox feedstuff, it will reduced the environmental pollution being caused by improper disposal of this waste and bring down the cost of broiler production. This will consequently lead to increased production and supply of the much needed animal protein at more affordable price to average Nigerian. The present study was therefore conducted to evaluate the influence of inclusion of varying levels of heat-treated sheep droppings on the performance of broiler starter chicks.

MATERIALS AND METHODS

The experiment was carried out at the Animal Production and FisheriesManagement Department of Ebonyi State University, Abakaliki, Ebonyi State,Nigeria, with the approval of the committee on Animal Experiments of the Institution.

The sheep manure used in the experiment was sourced from sheep farmers in Ngbo in Ohaukwu Local Government of Ebonyi State. The sheep manure was processed by destoning and heating (with stirring) in the oven at 60°C for 20-25 min until it becomes crispy to the touch.. Heat-treat Sheep Droppings (HSD) so prepared were ground in a hammer mill.

Proximate analysis of the Heat-treated Sheep Droppings (HSD) was conducted using standard methods (AOAC, 1995) to determine, the percentage crude protein, crude fibre, total ash and ether extract. Nitrogen free extract was calculated by difference. The Metabolizable Energy (M.E) of HSD was estimated using Pauzenga (1985) Formula: ME = 35 × CP% + 81.8 × EE% + 35.5 × NFE (Table 1).

Table 1: Ingredient composition of the experimental diets

Ingredient	T_1	T_2	T_3	T_4
Maize	52.00	50.00	47.00	44.00
SBM	15.00	12.00	10.00	8.00
GNC	10.00	10.00	10.00	10.00
Fish meal	6.00	6.00	6.00	6.00
HSD	0.00	5.00	10.00	15.00
PKC	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.00
Spent grain	8.00	8.00	8.00	8.00
Salt	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Chemical composition				
Dry matter (%)	85.58	85.48	85.41	85.33
Crude protein (%)	22.24	21.68	21.34	21.06
Crude fibre (%)	4.78	5.74	6.75	7.76
Ether extract (%)	4.24	4.21	4.18	4.14
Ash (%)	3.53	4.7	5.95	7.16
ME* (Kcal kg^{-1})	2866.43	2837.45	2774.13	2710.81

SBM = Soyabean Meal, GNC = Groundnut Cake, HSD = Heat-treated Sheep Droppings, PKC = Palm Kernel Cake. *Premix to supply the following per kg of diet: 1500 IU Vit. A; 1500 IU Vit. D; 3000 IU Vit E; 3.0g Vit K; 2.5 g Vit B_2; 0.3 g Vit. B_6; 8.0 mg B_{12}; Nicotinic acid 3.0g; ca-pantothenate 5.0 mg choline chloride 500 mg. Fe 10.0 mg; Al.0.2 mg; Cu 3.5 mg; Zn 0.15 mg; I 0.02 g Co, 0.01 g; Se, 0.02 g, Ethoxyguin 3 mg ,* ME = Metabolizable Energy

Table 2: Chemical composition of the HSD

Nutrients	HSD
Dry Matter (%)	85.89
Crude Protein (%)	17.04
Crude Fibre (%)	23.98
Ether Extract (%)	3.02
Ash (%)	26.92
NFE	29.04
ME *(Kcal kg^{-1})	1874.00

HSD= Heat-treated Sheep Dropping,* ME= Metabolizable Epnergy

Heat-treated Sheep Droppings (HSD) so processed was used to formulate four broiler started diets such that diet1 which served as the control contained 0% HSD. Diets 2, 3 and 4 contained 5, 1 and 15% HSD, respectively. The feed ingredients were ground in a hammer mill and were then mixed together in machine mixer. The ingredient composition of the experimental diet is shown in Table 2

A total number of 168 day-old, mixed sex, Anak 2000 broiler chicks, procured from a commercial hatchery were used in the study. The birds were fed heat-treated sheep manure-free diet for one week for acclimatization to our environment and management prior to the commencement of the experiment. At the 8 day, the chicks were randomly assigned equally to 4 groups of dietary treatments with 3 replicates each of 14 birds in a completely randomized design. The chicks were housed in deep litter pens (4×4 m^2) containing wood shavings throughout the experimental period. The experimental feed and clean water were provided *ad libitum* and light was provided for 24 h day^{-1}. Care and management of the chicks were in accordance with recommended guidelines (FASS, 1999).

At the end of the feeding trial, three birds were randomlyselected from each replicate, weighed starved for 12 h but not water and killed by cervical dislocation. After slaughtering and bleeding the chicks, the carcasses were scalded at 65°C in water for 30 sec before defeathering. The dressed chicks were later eviscerated and used for the measurement of carcass characteristics viz: thigh, drumstick, wing, breast, gizzard, liver and heat. All these were expressed in percentage of the live weight.

The experiment was conducted for 35 days. The daily feed requirement per replicate was weighed and served daily. The left over feed per group was collected every morning, weighed and recorded. The daily feed intake of each replicate group was determined by difference between the amount served and the residual feed. The birds were weighed at the beginning of the experiment to obtain their initial body weight and subsequently weighed weekly. At the end of the experiment, the body weight changes were calculated by subtracting the initial weight from the final body weight. The daily weight gain was determined by dividing the body weight change by the number of days the experiment lasted. The feed conversion ratio was computed by dividing the feed intake by the weight gain. Daily protein consumption (g bird^{-1}) was calculated from feed consumption data and the Protein Efficiency Ratio (PER) grams of gain per gram of protein consumed calculated.

Data collected from the various measurements were subjected to analysis of variance procedures as outlined by Steel and Torrie (1980). The means for treatments showing significant difference in the analysis of variance were compared using Duncan's New Multiple Range Test as outlined by Obi (2002). All statements of significance are based on the 5% level of probability.

The market cost of the feed ingredients at the time of the study was used to calculate the cost of feed per kg (₦), cost of feed per kg weight gain (₦) and cost saving (%).

RESULTS AND DISCUSSION

The chemical composition of HSD and the experimental diets are shown in Table 1 and 2, respectively. The results indicated that HSD contained reasonable amount of Crude Protein (CP) (17.04%), fat (EE) (3.02%), ash (25.92%), Nitrogen Free Extract (NFE) (29.04) and high amount of fibre (CF) (23.98%). these values were in agreement with the values of 16.88% CP, 2.95% EE, 26.31% ash and 24.42% EE. reported by Abeke *et al.* (2003). The crude protein content of the experimental diets seemed to decrease with increase in the level of HSD inclusion in the diet. However, these values still met the crude protein requirement of broiler chicks as recommended by NRC (1994). The energy values of the diets also decreased with increase in the level of HSD. Ash and crude fibre values of the diets increased progressively as dietary inclusion of HSD increased. However, HSD diets compared farourable with the control diet in terms of ether extract and dry matter content.

Table 3: Performance of the birds fed the experimental diets

	Treatments				
Measurements	T_1	T_2	T_3	T_4	SEM
Initial body weight	81.9	81.5	81.0	81.0	
Final body weight	651.9^a	648.9^a	644.5^a	634.3^b	1.80
Body weight gain	570.00^a	567.4^a	563.5^a	553.1^b	1.62
Daily weight gain	20.36^a	20.27^a	20.13^a	19.75^b	0.31
Total feed Intake	1413.81^a	1428.84^a	1461.04^b	1569.21^c	4.60
Daily feed Intake	50.47^a	50.90^a	51.37^b	55.61^c	085
Feed conversion ratio	2.48^a	2.51^a	2.55^b	2.81^c	0.22
Daily protein intake	11.25^b	11.01^c	10.96^b	11.71^a	0.33
Protein efficiency ratio	1.82^a	1.84^a	1.84^a	1.69^a	0.15
Survivability (%)	96	97	98	97	

^{ab}means within rows with no common superscripts differ significantly ($p<0.05$), Treatments 1, 2, 3, 4 contain 0,5,10,15% heat-treated sheep dropping, respectively. SEM- standard error of means

The performance assessment of the birds fed the respective experimental diet is shown in Table 3. Feed intake, body weight, feed conversion ratio and protein efficiency ratio of the birds were significantly ($p<0.05$) affected by the treatments. There was a significant difference ($p<0.05$) in feed intake with increase in the dietary level of HSD. This might be due to the difference in the metabolizable energy content of the diets as a consequence of high amount of fibre in HSD. This may have compelled the birds fed 10 and 15% HSD to consume more than did those feed 0 and 15% HSD to satisfy their energy requirement (Abeke *et al.*, 2003; Tequia *et al.*, 2004; Onu *et al.*, 2006).

In addition, the high fibre in the diet may have affected gut function by increasing digesta passage rate and modulating nutrient digestibity (Hetland *et al.*, 2004). Consequently, the higher feed intake of birds fed 10 and 15% HSD diets may be related to faster gut emptying of those birds. However, this reasoning contradicts the reports of Olubamiwa *et al.* (2002), Van der Klis *et al.* (1993) and Shakouri *et al.* (2006) that high fiber decreased feed intake as a result of increased digesta viscosity that causes increase of feed retention time in the gastro intestinal tract.

The body weight gain and protein efficiency ratio of the birds were significantly influenced by HSD inclusion in the diets. There was a depression of weight gain and at 15% protein efficiency ratio HSD dietary level while the weight gain and protein efficiency ratio of birds fed 5 and 10% HSD diets was not at variance ($p>0.05$) with the control. The comparable weight gain of birds on 0, 5 and 10% HSD those implies that HSD in these diets were efficiently utilized for growth than 15% level above which depression of growth occurs. The reduction in weight observed in broilers fed 15% HSD may be due to reduced protein and energy intake as a result of dilution effect by HSD fibre constituents. This observation further strengthens the reports of Babatunde and Hamzat (2005), Adeniji (2005) and Onu *et al*. (2006) that birds fed high fibre diets were unable to completely satisfy their energy and protein intake due to limitation imposed on them by the fibrous nature of the diet. The result on weight gain suggests that a decrease in energy density of feeds decreases the weight gain of birds and vice versa. The poor body weight of the birds on 15% HSD diet could also be that the high fibre content may have predisposed the birds to availability of insufficient essential nutrients (energy and protein) because of the adverse effect of fibre on nutrient digestibility (Johnson and McNab, 1983). This is evident in the poor protein efficiency ratio recorded by birds on 15% HSD diet.

There were marked variations ($p<0.05$) among treatment means in their feed conversion ratio. Feed conversion ratio of 15% HSD group was poorer ($p<0.05$) than that 10% HSD group. Also birds on 10% HSD had poorer ($p<0.05$) FCR than those on 0 and 5% HSD, while the FCR of birds on 5% HSD compared favourably ($p>0.05$) with that of 0% HSD. Reduction of dietary energy and protein density resulted in higher consumption of feed which resulted in a poor feed efficiency. This result is in agreement with those of others indicating that FCR of broilers fed high fibre diets tended to be poor due to depression of energy and protein utilization, hence the low FCR noticed in birds that received either 10 or 15% HSM (Olubamiwa *et al*., 2002; Teguia *et al*., 2004).

Results of carcass characteristics of birds feed the experimental diets are shown in Table 4 affected by the treatments except for the gizzard that had significantly ($p<0.05$) high values in birds on diets 3 and 4. This is not surprising since the gizzard weight is determined by the amount of work required of the muscular wall of the organ to grind feed particles (Abdelsamie *et al*., 1983; Johnson and McNab, 1983). HSD is fibrous in nature requiring extra work in communing the feed particles; consequently the significant gizzard weight recorded by birds feed diets 3 and 4.

Table 5 shows the economics of production of broilers fed the dietary treatments. The cost per kilogramme feed and the cost of feed consumed decreased progressively as the level of HSD inclusion increased. Ten percent HSD diet proved more advantageous in terms of cost of feed per kg weight gain and cost saving. The slightly higher cost of feed per kg weight gain and lower cost saving recoded for 15% HSD compared to 10% HSD diet may be attributed to the higher feed intake of birds fed 15% HSD diet.

Table 4: The effect of heat-treated sheep droppings on carcass characteristics of broiler chicks

Carcass characteristics	Treatments T_1	T_2	T_3	T_4	SEM
Thigh (% Lw)	18.58	18.70	18.43	18.48	0.19
Drumstick (% Lw)	15.89	16.01	15.80	15.84	0.14
Breast (% Lw)	20.15	19.97	20.01	20.20	0.16
Wing (%Lw)	12.26	12.30	12.09	11.99	0.23
Gizzard (%Lw)	3.08^a	3.00^a	3.85^b	3.92^b	0.3
Heat (%Lw)	2.13	2.11	2.90	2.09	0.09
Liver (%Lw)	3.06	3.15	3.98	3.99	0.15

Lw= line weight treatments 1,2,3,4, contain 0,5,10,15% heat-treated sheep manure respectively. $^{a\,b}$ mean in the same row following by different superscripts differ significantly ($p<0.05$), SEM-Standard error of means

Table 5: Economics of production of starter broilers fed the experimental diets

Parameter	Treatments T_1	T_2	T_3	T_4
Cost of feed per kg (₦)	54.18	50.48	46.93	43.38
Total feed consumed/ bird (g)	1413.81^a	1428.84^a	1461.04^b	1561.21^c
Cost of feed consumed per bird (₦)	76.60	72.13	68.57	68.07
Cost of daily feed intake per bird (₦)	2.74	2.58	2.45	2.43
Cost of feed per kg weight gain (₦)	117.57	111.16	106.39	107.32
Cost saving (%)	5.45	9.51	8.72	

2.^{ab}means within rows with no common superscripts differ significantly ($p<0.05$), 3. Treatments 1, 2, 3, 4 contain 0,5,10,15% heat-treated sheep dropping, 4. Respectively

Based on the encouraging weight gains obtained on 5 and 10% dietary levels, the implications of this study are that HSD is a potential feedstuff in broiler starter diet and can be included optimally at 10% in the diet, above which depression in performance occurs. However, further investigation will greatly assist in providing the necessary information on the effect of HSD on nutrient digestibility and intestinal microflora of broiler chicks.

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