Response of Laying Hens to Dietary Levels of Heat Treated Sheep Manure (HSM)

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Target Audience: Poultry Producers, Poultry Research Scientists and Teachers.

Abstract

An experiment was designed to study the effects of dietary levels of heat-dried sheep manure (HSM) on the performance of layers from point of lay for 20 weeks. Six isonitrogenous diets were formulated which contained HSM at 0.0, 7.5, 15.0, 22.5, 30.0 and 37.5 percent levels respectively. Each of the six dietary treatments was replicated three times with twelve birds per replicate. The chemical composition of the H.S.M. was determined. HSM was found to contain 86.95% dry matter, 16.88% crude protein, 24.42% crude fibre, 2.95% ether extract, 26.31% Ash, 1.32% calcium and 0.5% phosphorus. The metabolisable energy (M.E.) was found to be 1088 kcal/kg. Results obtained indicate that the higher the dietary level of H.S.M. the higher the feed intake, feed cost per ten eggs produced and Roche Yolk Colour Fan Score but the lower the efficiency of feed conversion, hen-day egg production, hen-housed egg production and percent change in body weight. It was however observed that the 7.5% H.S.M. diet gave the best result in terms of hen-day egg production, hen-housed egg production, feed cost per ten eggs and efficiency of feed conversion.

Keywords: Layers, manure, pigmentation, carotene, feed

Description of Problems

In a world where malnutrition and starvation stare the entire human race on the face, it is amazing to note that there exists much wastage of agro-industrial by-products which could be utilized for increased food production especially the animal protein supply. In cases where such by-products are utilized, they are inappropriately or grossly under utilized.

The protein intake levels of humans in most developing countries including Nigeria is very low due to the high cost of the product. Various efforts are being made by Animal Scientists in the area of nutrition research to increase the level of animal protein intake of the populace. Despite these efforts, the poultry industry is being crippled because of high cost of feeds. It is imperative therefore to look inwards for alternative and cheap sources of feed ingredients if progress is to be made in the poultry industry. The ever increasing cost of poultry feed is threatening the survival of many poultry farms today. As much as 70% of the total cost of production of poultry meat and eggs is due to feeds(4). The cost of the conventional feed ingredients has continued to increase without checks. In the past, importation had helped to meet the shortfalls to keep the prices low. Today however, the present economic crises has necessitated the conservation of scarce foreign exchange. Nutritionists therefore have to explore those areas hitherto neglected, if the poultry industry has to survive. Furthermore, a dependence on an alternative source of ingredients, especially when it encourages a shift to other ingredients for which there is no competition by humans will be of great help to the poultry industry. This process has brought into focus the need to provide more information on the nutritive value of the seemingly useless but protein rich animal egesta for poultry feeding.

Primarily, the dietary requirements of poultry parallel those of humans with a resultant competition for the already scarce conventional feed resources with man's interest having the priority. Fadugba (6) opined that where the amount of feed available to the human is limited, it would be morally wrong to use acceptable human foods for feeding animals. It then becomes imperative that other sources have to be assessed for rapid livestock output to meet the growing human demand for animal protein foods. Such other sources should be cheap and nutritionally adequate for feeding animals with the aim of lowering the cost of producing edible meat and eggs (9, 10).

Furtunately, Nigeria is blessed with many livestock species and the manure which are often obtained in large quantities have some potentials in poultry nurition. In recent years, the use of animal manure for the feeding of livestock has generated considerable interest due to the fact that the conventional sources of feed can no longer adequately supply the needs of the fast growing livestock and poultry industries. This study was therefore designed to determine the level of inclusion of heat-treated sheep manure as a feed ingredient in diets for laying hens.

Materials and Method

Heat-treated sheep manure (HSM) was processed by heating approximately three kilogrammes of fresh manure each time in an open pan for three minutes with constant stiring to prevent charring until the temperature reached about 70^{0}C as recorded by a thermocouple.

Two hundred and sixteen point of lay birds of a commercial strain at 23 weeks of age were used for this trial. The birds were selected and divided into eighteen groups of twelve birds each and housed in battery cages. There were six dietary treatments with three replicates per treatment. Ration 1 contained no HSM while the other five rations had the HSM at 7.5%, 15.0%, 22.5%, 30.0% and 37.5% levels (Table 1). All rations were isonitrogenous. Proximate analysis was carried out on the HSM (AOAC, 1990). The experimental diets and water were supplied ad libitum during the 20 weeks trial period. Records of mortality were taken as they occur. Egg production records were taken daily while feed consumption was measured weekly. The initial weights of birds per replicate at the beginning and the final weight at the end of the experiment were measured.

All eggs collected from each group for three consecutive days towards the end of every-twenty eight day period were used in estimating the average weight of the egg. After weighing, three eggs from each replicate were broken out and with the aid of a pair of vernier callipers, the albumin heights were measured for calculating the Haugh Unit values (16). Also the yolk height and width were measured for the calculation of yolk index. The Roche Yolk colour Fan (RYCF) was used to determine the yolk colour scores.

Feed conversion efficiency and feed cost per ten eggs were calculated from the record of egg produced and feed consumed. All data collected were subjected to the analysis of variance and significance of differences between treatment means were assessed by applying Duncan's multiple range test (12).

Table 1. Composition of experimental layer rations with graded level of HSM

	Diets					
Ingredients	1	2	3	4	5	6
Maize	48.66	42.85	37.05	31.24	25.42	19.61
Soyabean cake	10.00	10.00	10.00	10.00	10.00	10.00
Groundnut cake	15.44	13.75	12.05	10.36	8.68	6.99
Sheep manure	0.00	7.50	15.00	22.50	30.00	37.50
Rice offal	15.00	15.00	15.00	15.00	15.00	15.00
Limestone	7.50	7.50	7.50	7.50	7.50	7.50
Bonemeal	2.75	2.75	2.75	2.75	2.75	2.75
Salt0.30	0.30	0.30	0.30	0.30	0.30	
Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Vit/Min. Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated Composition						
ME(kcal/kg)	2408	2269	2130	1990	1851	1706
Protein %	16.5	16.5	16.5	16.5	16.5	16.5
Fibre %	8.27	9.95	11.62	13.30	14.98	16.65
Calcium	3.60	3.69	3.79	3.88	3.98	4.07
Total P	1.48	1.50	1.55	1.46	1.50	1.54
Available P	0.44	0.45	0.47	0.44	0.45	0.46
Lysine	0.76	0.72	0.67	0.63	0.59	0.55
Methionine	0.37	0.35	0.33	0.31	0.29	0.29
Cystine	0.26	0.24	0.22	0.20	0.18	0.16
Feed Cost (N.kg feed)	6.07	5.66	5.24	4.82	4.51	3.99

Premix supplied per kg ration:- Vitamin A 10.000 I.U., Vit B_3 2500 I.U., Vit E_{12} I.U. Vit. K.002 gm, Vit. B_1 0.001gm, Vit $B_2$0.0045gm, Vit. $B_6$0.003gm, Nicotinic acid 0.025gm, calcium D pantothenate 0.01gm, Vit. B_2 0.012gm, Folic acid 0.0003gm, Vit. C0.05gm, Chlorine chloride 0.3gm, Manganese 0.1gm, Iron 0.05gm, Zinc 0.045gm, copper 0.002gm, Iodine 0.001gm, Cobalt 0.000225gm, Selenium 0.0001gm.

Table 2a: Proximate composition of Heat-treated Sheep manure (HSM) used for diet formulation.

Nutrients	
DM (%)	86.95
Crude Protein (%)	16.88
Crude Fibre (%)	24.42
Ether Extract(%)	2.95
Ash (%)	26.31
Calcium (%)	1.32
Phosphorus (%)	0.50
ME (kcal/kg)	1088

Table 2b. Effect of dietary levels of heat-treated sheep manure on the performance of layers.

Dietary level of HSM	Feed intake g/bird/day	Feed/10 eggs (kg)	Feed cost N/10eggs	% Hen-day egg prod.	% Hen housed egg Prod.	% peak egg Prod.
Control (0.0%)	120.43[f]	2.59[c]	16.76[ab]	50.99[ab]	50.99[ab]	85.5[a]
7.5%	130.26[e]	2.53[c]	15.36[a]	56.25[a]	56.25[a]	74.8[b]
15%	158.49[d]	3.33[b]	18.79[b]	51.62[ab]	51.62[ab]	73.8[b]
22.5%	164.57[c]	3.64[b]	19.04[b]	49.58[b]	49.58[b]	0.72[b]
30%	175.17[b]	3.98[b]	19.13[b]	48.19[b]	48.19[b]	67.87[c]
37.5%	185.19[a]	5.49[a]	24.12[c]	37.34[c]	37.34[c]	51.12[d]
SEM	5.47	0.25	0.72	1.53	1.53	1.93

Means within the same column bearing similar superscripts are not significantly different (P>0.05).
SEM = Standard error of means.

Table 3. Effect of dietary levels of heat treated sheep manure on the performance of layers, egg quality measurements and body condition.

Dietary Level of HSM	RYCF score	% Change in body weight	Yolk index	Haugh Unit	Mean egg wt (g)	% Mortality
Control (0.00%)	1.10[f]	5.47[a]	0.45	90.38	60.89	0.00[b]
7.5%	9.13[e]	4.08[a]	0.44	90.59	60.99	0.00[b]
15%	11.13[d]	-1.42[b]	0.45	90.69	61.48	2.07[a]
22.5%	12.1[c]	-2.21[b]	0.44	89.97	61.54	0.00[b]
30%	13.03[b]	- 9.88[c]	0.44	90.25	62.41	0.00b
37.5%	14.1[a]	-11.81[d]	0.45	90.48	62.09	0.00[b]
SEM	1.02	1.55	0.002	0.20	0.43	0.0011

Means in the same column bearing similar superscripts are not significantly different (P>0.05),
SEM = Standard of error of mean

Results and Discussion

The proximate composition of HSM and the performance of the laying hens used in this experiment are presented in tables 2a, 2b and 3 respectively. The metabolizble energy for H.SM was determined using the formula of Hill and Anderson (14). The results showed that HSM had a significant (P<0.05) effect of feed intake. It was observed that as the HSM level in the diet increased, there was a corresponding increase in feed intake. The reason for this is very clear. The analysis of the H.SM showed that it contained a high percentage of crude fibre (24.42%) and low metabolisable energy (1088 kcal/kg) (Table 2a). Therefore as more and more of the HSM is included in the diet, there will be a corresponding increase in the fibre content while the metabolizable energy will decrease.

Since chicken s are known to consume feed to satisfy primarily their energy requirement (8, 13) the increase in feed consumption in diet containing H.SM was possibly due to an attempt by the birds to satisfy their energy requirement. Also, dietary fibre has a laxative effect and therefore increases the rate of passage of feed through the gastro intestinal tract (1,2,3). This increase in passage of feed can only be compensated for by increasing intake. Fibre tend to open up the feed in the gastrointestinal tract for enzymatic activities and this is said to increase digestion and rate of passage of feed (5).

Feed consumed per ten eggs and feed cost (x) per ten eggs dropped slightly at the 7.5% H.SM diet before rising continuously as the H.SM level in the diet increased. The reason for this is very clear. As earlier stated the birds ate more as the HSM content of the diet increased but due to the high fibre content and low metabolisable energy value, much of the extra nutrient derived from increased feed intake were channeled towards meeting the maintenance requirement of the chicken. According to some earlier reports, energy requirement for body maintenance takes priority over energy requirement for production (8, 13). Therefore, when the available energy cannot meet the body requirement, production of eggs will drop as birds wills stay alive first before they can produce eggs (6).

Percent hen-day and hen housed egg production were observed to be generally low possibly due to the fact that the birds used were still young in lay when most of the data were collected. However, diet 2 with 7.5% H.SM resulted in better performance with respect to hen-day and hen-housed egg production than other dietary treatments.

Percent egg production at peak was significantly ($P<0.05$) better for the control diet than for all other diets. The reason for this is not far fetched. Laying hens require between 2400 and 2600 kcal/kg of energy in their diets for optimum production (1). It is only the control diet (0.0% H.SM) that met this energy requirement. It had been observed that egg production will continue to decrease and may even cease completely with decrease in the energy levels of diet (11).

For the Roche Yok Colour Fan (RYCF) scores, there was a significant ($P<0.05$) increase in egg yolk colour with each higher level of H.SM in the diet. It rose sharply from 1.10 for the control diet without H.SM to 9.13 for the 7.5% H.SM dit and peaked at 14.1 for the 37.5% H.SM diet. Ruminant manure has been reported to contain a high level of xanthophyll, a precursor for carotene (8), which is an effective pigmenter for egg yolk. In a survey carried out by the authors, a minimum RYCF scores of 7 was preferred by the pastry industry. These two minimum levels were exceeded by the diet containing 7.5% H.SM.

Percent change in body weight was significantly ($P>0.05$) decreased as the H.SM levels increased in diet; Beyond the 7.5% HSM diet, birds were found to lose weight. This could be due to the fact that the birds mobilised body store of nutrient for maintenance and production as the energy levels of the diet continued to decrease with increase in the dietary level of H.SM. Earlier observation that when birds were starved or when energy levels fall below body requirement, birds tend to mobilize body reserves of energy first for maintenance and then for production has been documented (3,7).

In terms of mortality, only one bird died in treatment 3 with 15.0% H.SM. The cause of death could not be traced to diet as no other birds died even at a higher level of H.SM.

Other parameters such as Yolk index, Haugh Unit value and mean egg weight were not significantly affected by the diets. It was however observed that treatment 5 with 30% H.SM had the highest mean egg weights but this was not significantly different from others.

Conclusion And Application

1. H.SM fed at 7.5% dietary level had no adverse effect on egg production but beyond this level adverse effects may set in.
2. H.SM has the added advantage as an egg yolk pigmenter.

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