

## Effects of dietary levels of heat-treated sheep manure (HSM) on the performance and egg quality parameters of laying hens

Abeke, F.O.; Ogundipe, S.O.; Sekoni, A.A.; Bale, J.O.; Adeyinka, I.A.; Oni, O.O.

National Animal Production Research Institute, Ahmadu Bello University, P.M.B. 1096 Shika Zaria, Nigeria.

### Abstract

A 6-month feeding trial was conducted to determine the effect of dietary inclusion of heat-treated sheep manure (HSM) on the performance and egg quality parameters of Shika brown layers. The HSM was analysed and found to contain 85.95% 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 biologically assayed and found to be 1088kcal/kg. Five isonitrogenous diets were formulated to contain HSM at 0.0, 2.5, 5.0, 7.5 and 10.0 percent. Each of the dietary treatment was replicated three times with seven birds per replicate (making a total of 105 birds for the experiment) in a completely randomised design. Diet 1, which had no sheep manure, served as the control. White maize was used for the formulation of the diets. The birds were housed singly in cages. The laying hens were first maintained on the control diet which contained very little or no yolk pigmentation factor for a depigmentation period of twenty-one days. During this period, samples of eggs were broken out and yolk colour scores were determined using the Roche Yolk Colour Fan (RYCF). By the twenty-first day, the (RYCF) scores had dropped to the lowest value of one. The hens were then placed on the experimental diets for the study, which covered a period of 6 months. Parameters measured for the egg quality included egg yolk colour, Haugh unit value, yolk index and shell thickness. For the performance characteristics, parameters measured included percent hen day and hen housed egg production, percent peak egg production, feed intake, feed conversion efficiency (kg feed/12 eggs) and feed cost per 12 eggs produced. Results obtained indicate that the higher the dietary level of HSM, the lower the feed intake, efficiency of feed utilization, percent hen day and hen housed egg production and final body weight. However the Roche Yolk Colour Fan scores (RYCF) increased with increase in dietary levels of HSM. This indicates that HSM can be fed in laying hens diet up to 5% inclusion level to obtain good performance and an acceptable RYCF score of 4 in egg yolk colour but beyond this level performance may be adversely affected.

**Keywords:** Heat treated sheep manure, egg yolk, laying hens, hen day, dietary levels, performance

### Introduction

There is the need to explore and provide information on many unconventional feed ingredients that abound in our environment, with a view to ascertaining their suitability or otherwise in poultry rations. This need has arisen because of the high cost of the conventional feed ingredients such as soybean cake, groundnut cake, maize, fishmeal etc, as well as the desire to diversify and expand the feed raw material resource base for poultry ration formulation. Feed alone contributes over 70 percent of the cost of producing

poultry meat and egg (Ikani, *et al* 2001). This has resulted in the high cost of these products, thus making them unaffordable to many. To tackle this problem, alternative sources of cheap, but good quality, feed ingredients that will not elicit competition from humans, need to be investigated. Indeed, the expansion of the poultry industry depends to a large extent on the availability of good quality feeds in sufficient quantities and at prices that poultry farmers can afford. This is particularly true for the intensive poultry enterprises in which performance depends almost en-

tirely on the use of balanced rations (Babatunde and Fetuga, 1976).

For the past two decades, animal nutritionists have been engaged in exploring other areas hitherto neglected such as the use of palm kernel cake, cotton seed cake, sunflower seed meal, leaves of different crop plants, roots and tubers, industrial by-products and animal manure. This is to ascertain their suitability in poultry diets so as to lower feed cost. The thrust is to shift to other ingredients for which there is no competition from humans as food.

Sheep manure is one of such animal waste that has a good potential as a feed ingredient in poultry diets. Although it is presently being used as organic manure in the soil for crop production, it can be processed and incorporated into poultry rations to replace part of the more expensive conventional feed ingredients (Abeke, 1997). Sheep manure is very abundant in Nigeria. It is cheap, easy to handle and processed into safe and useful products. Thus the objective of this study was to determine the effects of dietary levels of heat-treated sheep manure on the productive performance and egg quality parameters of laying hens.

### Materials and Methods

This experiment was conducted at the Poultry research farms of the National Animal Production Research Institute (NAPRI) Shika Zaria from February to June 2000. The sheep manure used for this experiment was also obtained from NAPRI sheep farm in Shika, Zaria. The manure was swept from the concrete floor of the sheep pen and debris such as straw, feed and sand were removed. The HSM was prepared by heating approximately three kilogrammes of the fresh manure each time in an open pan for three minutes with constant stirring to prevent charring until the temperature reached about 70°C as recorded by a thermo-

couple. Firewood was used as a source of heat. One hundred and five, laying Shika brown layers at 32 weeks of age housed in single cage units were used for this trial. There were five dietary treatments with three replicates per treatment and seven birds per replicate. A complete randomised design was used. Ration 1, which had no sheep manure, served as the control. Rations 2 to 5 contained HSM at 2.5, 5.0, 7.5 and 10.0 percent respectively (Table 1). All rations were isonitrogenous. Proximate analysis was carried out on the HSM according to the A.O.A.C (1990) procedure. The metabolisable energy was determined experimentally using mature cocks according to the method of Hill and Anderson (1958).

$$\text{A.M.E/g of feed} = \frac{(F^1 \times Ge^f) - (E \times GE^e)}{F^1}$$

**Table 1:** Proximate composition of heat-treated sheep manure (HSM) used for diet formulation.

Nutrients	Composition
DM (%)	86.95
Crude protein (%)	16.88
Crude fibre (%)	24.42
Ether extract (%)	2.95
Ash (%)	26.31
NFE (%)	16.39
Calcium (%)	1.32
Phosphorus (%)	0.50
ME (kcal/kg)	1088

The values in the table are means of three determinations.

Where  $F^1$  = Feed intake (g)

$E$  = Excreta output (g)

$Ge^f$  = Gross energy of feed (kcal/g)

$GE^e$  = Gross energy of excreta (kcal/g)

The ME of the test ingredient was then calculated using simple algebraic equation

If ME of the basal diet (control diet) 'X' is 'a' kcal/g and that of the 20% substituted ration 'Y' was

'b' kcal/g, then the equation becomes

$$1X = \frac{a \text{ kcal}}{1}$$

$$0.8X + 0.2Y = b \text{ kcal}$$

$$0.8a \text{ kcal} + 0.2Y = b \text{ kcal}$$

$$0.2Y = b - 0.8a$$

$$Y = \frac{b - 0.8a}{0.2}$$

Total phosphorus was determined as described by Yoshida *et al* (1976). Calcium content was determined with an atomic adsorption spectrophotometer (Pye Unicam Sp9). The diets and water were given *ad-libitum* to the birds for the 6 months the experiment lasted. The initial and final weights of the birds per replicate were taken at the beginning and at the end of the experiment, respectively. Feed intake was measured weekly while egg production records were taken daily.

All eggs collected from each replicate group for three consecutive days towards the end of every twenty-eight day period (6 periods) were used in estimating the average egg weight of the eggs using the mettler<sup>®</sup> 1400 electronic platform scale. After weighing, three eggs representing the average weight of the eggs from each replicate were broken out into a flat, white plate and with the aid of vernier callipers, the albumin heights were measured for the calculation of Haugh unit values according to the formula of Oluyemi and Roberts (1985):

$$HU = 100 \log_{10}(h - 1.7W^{0.37} + 7.6)$$

Where:

HU = Haugh unit;

h = observed height of the albumin in millimetres

W = weight of the eggs in grammes

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. The shells were dried for three days and weighed per replicate. The shell thickness was measured using the vernier callipers.

From the primary data collected other data such as feed conversion efficiency, feed cost per ten eggs and percent hen-day and hen-housed egg production were generated. All data were subjected to the analysis of variance and significance between treatments means were separated using Duncan's multiple range test (Steel and Torrie 1980).

## Results and discussion

The results of the chemical composition of the HSM, the ingredients and nutrient composition of the diets fed, the performance of the laying hens and the egg quality parameters measured are presented in tables 1, 2, 3 and 4 respectively.

The result of the chemical composition showed that HSM has a fairly high level of crude protein (16.88%), moderate levels of calcium (1.32%) and phosphorus (0.50%), which can be harnessed for poultry ration formulation (Abeke, *et al* 2003). Although the high fibre content (24.42%) and low metabolisable energy (1088) may limit its use, these values are similar to values often reported for rice offal, which is being presently used in poultry diets. (Ogundipe, *et al* 1992).

Feed intake decreased as the level of HSM in the diets increased. This can be explained as being due to poor palatability and dustiness of the feed as the HSM level increased. According to Sekoni (1997), chickens tend to eat less if their ration is dusty irrespective of the energy level. According to the author, acceptability of the feed has more influence on the feed intake than energy level per se. Also some levels of charring may have taken place in the course of frying which would have adversely affected the aroma and palatability of the feed. Dustiness is also associated with poor palatability and palatability is an important factor in feed intake (Aletor, 1986). The increase in the fibre content of the diet as a result of increase in the HSM level may have also resulted in the re-

### Effect of sheep manure on performance of layers

Table 2: Composition of experimental layer rations with graded level of HSM

Ingredients	DIETS				
	1	2	3	4	5
Maize	52.25	50.63	48.70	46.75	44.84
Groundnut cake	14.50	13.62	13.05	12.50	11.91
HSM	0.00	2.50	5.00	7.50	10.00
Soya cake	12.00	12.00	12.00	12.00	12.00
Rice offal	10.00	10.00	10.00	10.00	10.00
Limestone	7.50	7.50	7.50	7.50	7.50
Bonemeal	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100.0	100.0	100.0	100.0	100.0
Calculated composition					
ME(kcal/kg)	2615	2565	2512	2459	2405
Protein (%)	17.08	17.08	17.07	17.06	17.06
Fibre (%)	8.25	8.68	9.46	9.94	10.87
Calcium (%)	2.72	2.81	2.86	2.94	2.96
Avail. P (%)	0.68	0.66	0.63	0.58	0.56
Available P %	0.50	0.50	0.49	0.47	0.47
Lysine (%)	0.84	0.81	0.78	0.76	0.73
Methionine(%)	0.44	0.42	0.40	0.39	0.36
Cystine(%)	0.38	0.36	0.37	0.35	0.36
Feed cost(N/kg feed)	20.11	18.26	17.34	15.62	13.78

Premix supplied per kg ration: vitamin A 10,000 I.U., Vit. B1 1500 I.U., Vit. K 0.002gm, Vit. B12 0.001gm, Vit. B2 0.0045gm, Vit. B6 0.003gm, Nicotinic acid 0.025gm, Calcium D pantothenate 0.01gm, Vit. B12 0.01gm, Folic acid 0.0003gm, Vit. C 0.05GM, Chlorine chloride 0.1gm, Manganese 0.1gm, Iron 0.05gm, Zinc 0.045gm, Copper 0.002gm, Iodine 0.001gm, Cobalt 0.000225gm, Selenium 0.0001gm.

duced feed intake. This is because fibre tends to absorb water and swell in the crop of the birds thereby reducing space for further feed intake (Ajaja, *et al* 2002). High fibre diets also tend to increase water intake thereby reducing feed intake (Fadugba, 1987).

The efficiency of feed utilization (kg feed/ 12 eggs produced), was observed to decrease as the level of HSM increased in the diet (table 3) indicating poor feed utilisation. Bawa *et al* (2003) had argued that it is not the absolute value of protein and energy in the diets of laying hens that is important but the quality and bioavailability of the protein and energy that is of paramount importance. The amino acid profile of any protein ingredient is more important than the crude protein value of the ingredient because this will determine ultimately the performance of the birds (Abeke *et al* 2003). The amino acid profile of

groundnut cake is better than that of sheep manure hence better feed conversion efficiency is expected from the diets that have more groundnut cake than those containing more sheep manure (Ogundipe *et al* 1992).

Feed cost (N/12 eggs) decreased slightly as the level of HSM increased in the diets. Similar observation was made by Fadugba (1987) who reported decrease in feed cost per dozen eggs produced when maize offal was fed as replacement for maize in the diets of laying hens. The main thrust in the utilization of unconventional feed ingredients is to lower the cost of production (Ani and Okeke 2003; Bawa *et al* 2003 and Etuk 2001). The feed became cheaper as the level of HSM in the diets increased.

Percent hen-day and hen-housed egg production decreased with increasing level of HSM.

**Table 3:** Effects of dietary levels of HSM on the productive performance of laying hens.

Dietary Treatment %HSM	Feed intake (g/b/day)	Feed conversion efficiency (kg feed/12 eggs)	Feed cost (N/12 eggs)	Hen-day egg production (%)	Final body weight (%)
0.	115.30 <sup>a</sup>	3.60	72.40 <sup>b</sup>	76.94 <sup>a</sup>	2.20
2.5	103.10 <sup>b</sup>	3.75	68.48 <sup>ab</sup>	69.15 <sup>b</sup>	2.10
5.0	95.70 <sup>c</sup>	3.85	66.76 <sup>ab</sup>	59.99 <sup>c</sup>	2.01
7.5	93.20 <sup>c</sup>	3.92	61.23 <sup>a</sup>	54.70 <sup>d</sup>	1.89
10.	91.30 <sup>d</sup>	4.08	56.22 <sup>a</sup>	52.53 <sup>d</sup>	1.87
SEM	3.25	0.18	3.18	1.84	0.24

a,b,c,d. Means within the same column with different letter superscripts are significantly different (P<0.05).

HSM= Heat-treated sheep manure.

SEM= Standard error of the means.

**Table 4:** Egg quality parameters of laying hens fed graded dietary levels of HSM.

Dietary treatment %HSM	RYCF Score	Haugh unit	Yolk index	Mean egg weight (g)	Shell weight (g)	Shell thickness (mm)	Percent shell
0.	1.00 <sup>e</sup>	95.50	0.42	61.10	6.09	0.40	9.97
2.5	2.64 <sup>d</sup>	96.80	0.44	60.20	6.01	0.45	9.98
5.0	4.33 <sup>c</sup>	97.50	0.43	60.40	6.03	0.42	9.98
7.5	4.41 <sup>b</sup>	95.80	0.46	60.31	6.01	0.50	9.97
10.	5.25 <sup>a</sup>	97.20	0.45	61.30	6.05	0.48	9.87
SEM	0.18	0.14	0.11	0.12	0.10	0.18	0.14

<sup>a,b,c,d,e</sup> Means within the same column with different letter superscripts are significantly different (P<0.05).

SEM= Standard error of the means.

RYCF= Roche Yolk Colour Fan.

However it was observed that up to 5.0% inclusion level, the birds were able to utilize the feed efficiently. According to Ogundipe *et al* (2003) and Najime (2003) inclusion of unconventional feed ingredients in poultry diets should not exceed 10% because of certain intrinsic negative anti-nutritional factors present in them, which tend to lower production when their levels in feed become high. Likewise, Abeke, *et al* (2003) had earlier observed that laying hens could only tolerate up to 7.5% HSM in their diets.

There was no mortality throughout the experimental period, which shows that the HSM was safe at the levels included in the diets. The final weight of the birds decreased as the levels of HSM increased in the diets. The reason for this may be as a result of mobilization of body store of nutrient for production. However this could be as a result of feed intake, which was found to reduce as the HSM increased in the diets.

The Roche Yolk Colour Fan (RYCF) score increased as the levels of HSM increased in the

diets. The yolk colour was significantly ( $P < 0.05$ ) deeper with each level of HSM. This shows that sheep manure is a powerful egg yolk pigmenter because of its high level of xanthophylls and carotene (Abeke *et al* 2003). However the RYCF score of 4 which is the minimum score acceptable by consumers and the pastery industries (Ogundipe *et al* 1992), was obtained at the 5.0% dietary level of HSM. Haugh unit, yolk-index, shell thickness, shell weight, percent shell and mean egg weights were not significantly ( $P > 0.05$ ) affected by the HSM levels in the diets.

### Conclusion and Application

From the result of the experiment it can be concluded that HSM can be fed up to 5.0% in the diets of laying hens for optimum performance in terms of production and egg quality parameters. Also HSM is a cheap source of egg yolk pigmentation.

### References

**Abeke, F.O. (1997).** Response of laying hens to dietary levels of sheep manure M.Sc Thesis Ahmadu Bello University Zaria. Nigeria.

**Abeke, F.O.; Ogundipe, S.O.; Sekoni, A.A.; Adeyinka, I.A.; Abubakar, B.Y.; Oni, O.O. and Nwagu, B.I. (2003).** Response of laying hens to dietary levels of heat-treated sheep manure (HSM). *Trop. J. Anim. Sci.* 6(2): 111-116.

**Ajaja, K.; Agbede, J.O. and Aletor, V.A. (2002).** Replacement value of sorghum dust for maize in the diets for broiler chicks. *Proc. 27<sup>th</sup> NSAP Conf.* Akure, Nigeria.

**Aletor, V.A. (1986).** Some agro-industrial by-products and waste in livestock feeding. A review of prospects and problems. *World Rev. of Anim. Prod.* XXII(4): 35-41

**Ani, A.O. and Okeke, G.C. (2003).** The nutritive value of dehulled and cooked castor oil beans (*Ricinus communis*. L) meal to broiler finishers. *Proc. 27<sup>th</sup> NSAP Conf.* Akure, Nigeria. Pp 141-143.

**Association of Official Analytical Chemists (1990).** Official methods of analysis (13<sup>th</sup> Ed). Washington D.C, U.S.A

**Babatunde, G.M. and Fetuga, B.L. (1976).** Determination of the minimum crude protein requirement of broiler starter and finisher in the tropics. *J. Anim. Sci.* 31: 126-138.

**Bawa, G.S.; Tegbe, T.S.B. and Ogundipe, S.O. (2003).** Effects of feeding graded levels of lablab seeds as a replacement for soyabeans on the performance characteristics of young pigs. *Proc. 28<sup>th</sup> NSAP conf.* Ibadan, Nigeria. Vol. 28 pp 230-232.

**Etuk, E.B. (2001).** Determination of the optimal replacement level (s) of soyabean meal and maize with toasted and cooked pigeon pea (*Cajanus cajan*) seed meal for broilers. *M.Sc Thesis Dept of Animal Production, Fed. Uni. Tech. Owerri, Nigeria.*

**Fadugba, A.A. (1987).** Evaluation of the nutritive value of maize offal in poultry diets. M.Sc Thesis, Ahmadu Bello University Zaria pp 1-88.

**Hill, F.W. and Anderson, D.L. (1958)** Comparison of metabolizable energy and productive energy determinations with growing chicks. *J. Nutri.* 64:587

**Ibani, E.I.; Dafwang, I.I.; Chikwendu, D.O. and Iwuanyanwu, I.E. (2001).** Socio economic characteristics of and sources of poultry feeds for poultry and pig farmers in Nigeria. *Proc. 26<sup>th</sup> NSAP Conf.* Zaria, Nigeria

**Najime, D. (2003).** Effect of processing on the

utilisation of soya beans by broiler chickens. M. Sc Thesis, Dept of Animal Production, A.T.B.U, Bauchi, Nigeria

**Ogundipe, S.O, Sa'adu, G.; Bale, J.O.; Aduku, A.O. and Balogun T.F. (1992).** Utilization of Animal manure in poultry diets. A seminar paper presented at NAPRI, Shika Zaria, Nigeria

**Ogundipe, S.O.; Abeke, F.O.; Sekoni, A.A.; Dafwang, I.I. and Adeyinka, L.A. (2003).** Effects of duration of cooking on the utilisation of *Lablab purpureus* beans by pullet chicks. Proc. Of the 28<sup>th</sup> Annual conference of NSAP, Ibadan, Nigeria Vol. 28 pp233-235

**Oluyemi, J.A. and Roberts, F.A. (1985)** Poultry production in warm wet climates. Macmillan press Ltd. Nigeria.

**Sekoni, A. A. (1997).** Utilisation of cassava peels as energy source for chicks. A PhD Thesis, Ahmadu Bello University Zaria, Nigeria

**Steel, R.G.D and Torrie, J.H. (1980)** Principles and practice of statistics. A biometric approach, 2<sup>nd</sup> Ed. McGraw-Hill book company Inc. New-York.

*(Received 18th Sept. 2006; Accepted 2nd Feb. 2008).*