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Performance of Laying Hens Fed Graded Levels of Soaked Sesame (*Sesamum indicum)* Seed Meal as a Source of Methionine

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Abstract: In a 12 week experiment the effect of graded levels of soaked sesame seed meal (SSM) as a source of methionine on the performance of laying hens was investigated. In a completely randomized design, 200 black Australorp pullets aged 20 weeks were allotted to 5 isonitrogenous diets with 4 replicates of 10 birds per diet. Sesame seed meal (SSM) replaced soyabean meal (SBM) weight for weight at 0.00, 12.50, 37.50 and 50.00% in diet 1 (control), 2, 3, 4 and 5 respectively. The control diet contained synthetic methionine which was removed with the introduction of SSM in the other diets. The results showed a significant (P<0.05) reduction in the hen-day egg production above 25.00% and egg weight above 12.50% levels of replacement. Shell quality was not affected by dietary treatment. Feed cost (N/egg) was significantly (P<0.05) reduced on the 12.50% replacement compared to the 37.50%. There was no treatment effect (P>0.05) on the while blood cell count, but packed cell volume was significantly (P<0.05) lowered on the 50.00% and haemoglobin concentration, serum protein, albumin and globulin above 12.50% levels of replacement. These results suggest that replacing SBM with SSM at 12.50% in the diet of laying hens will meet their methionine requirement without adverse effects on performance and health status.

Key words: Sesame seed, methionine, laying hens, poultry diets

Introduction

Although an essential amino acid in poultry diets, methionine is in poor supply in most feed ingredients used in the formulations. This situation calls for the supplementation of diets with synthetic methionine. In recent years however, the cost of synthetic methionine has kept increasing in Nigeria with a resultant increase in the cost of the finished feed. According to Essien *et al.* (2005) a 0.5% supplementation of the diet with synthetic methionine represents up to 10.26% of the total cost of producing feed in Nigeria. There is therefore the need to explore alternative sources of methionine for poultry feeding.

Sesame (*Sesamum indicum L)* is a drought-tolerant crop adapted to many soil types (Ram *et al.,* 1990). According to Ahmed (2005) there are about 335,000 hectares of land under sesame cultivation in Nigeria with yields of between 1.5-2.0 tonnes / hectare. Full-fat sesame seed contains 22% crude protein and the meal after oil extraction about 44% crude proteins (Peace Corps, 1990; Mamputu and Buhr, 1991). The amino acid composition of the protein is similar to that of soyabean meal with the exception of lower lysine (Mamputu and Buhr, 1991) and higher methionine in sesame (Olomu, 1995; Dipasa, 2003). The seed contains 50-60% oil compared to 20% in soyabean (Kato *et al.,* 1998; Ahmed, 2005). The fibre content of the seed ranges from 2.7 to 6.7% (Beckstrom-Sternberg and Duke, 1994). However, the seed contains up to 50 µg/g phytic acid (PA) which reduces the biological availability of zinc, calcium, magnesium and iron (Nahm, 2007). Diarra *et al.* (2007) reported that soaking is one of the most effective methods of lowering the phytic acid (PA) content of the seed.

Although there are reports on the inclusion of sesame seed meal (SSM) as a source of crude protein in poultry diets there is little or no documented information on its use as a source of dietary methionine. This study reports the effect of graded levels of soaked sesame seed meal as a source of dietary methionine on the performance of laying hens.

Materials and Methods

Processing of sesame seed: The seed purchased from the market was screened and winnowed to remove sand, chaff and other foreign particles. The cleaned seed was soaked in tap water for 24 hours, sun-dried for 72 hours, analyzed for chemical composition and used in the formulations.

The soaked sesame seed meal (SSM) had the following composition: Dry matter (DM) = 93.10%; crude protein (CP) = 26.21%; ether extract (EE) = 57.49%; crude fibre (CF) = 7.10%; total ash = 6.06%; lysine = 1.40%; methionine = 1.63%; phytic acid (PA) = 19.98 µg/g.

Table 1: Composition of the layer mashes

	Replacement level of sesame seed for full-fat soyabean meal (%)				
Ingredients (%)	0.00	12.50	25.00	37.50	50.00
Maize	37.89	37.60	36.80	35.50	34.20
Wheat bran	25.25	25.35	25.60	25.95	34.20
Soyabean meal (full-fat)	23.60	20.65	17.70	14.75	11.80
Sesame seed meal	-	2.95	5.90	8.85	11.80
Fish meal	2.50	2.80	3.35	4.30	5.25
Oyster shell	6.00	6.00	6.00	6.00	6.00
Bone meal	2.40	2.40	2.40	2.40	2.40
Methionine	0.10	-	-	-	-
Lysine	0.10	0.10	0.10	0.10	0.10
*Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	16.92	16.67	16.55	16.67	16.79
ME (Kcal/kg)	2553.43	2619.52	2678.88	2736.22	2793.56
Calcium (%)	3.92	4.53	4.61	4.68	4.74
Phosphorus (%)	1.08	1.21	1.24	1.27	1.31
Lysine (%)	1.18	1.11	1.12	1.13	1.15
Methionine (%)	0.49	0.43	0.46	0.50	0.52

*Bio-mix Layer supplied/kg: Vit A = 3,400,000.00 IU; Vit D_3 = 600,000.00 IU; Vit E = 4,000.00mg; Niacin = 6,000.00mg; B_1 = 600.00mg; B_2 = 1,800.00mg; B_6 = 1,200.00mg; B_{12} = 6.00mg; K_3 = 400.00mg; Pantothenic acid = 1,600.00mg; Biotin = 200.00mg; Folic acid = 240.00mg; Choline Chloride = 70,000.00mg; Cobalt = 80.00mg; Copper = 1,200.00mg; Iodine = 400.00mg; Iron = 8,000.00mg; Manganese = 16,000.00mg; Selenium = 80.00mg; Zinc = 12,000.00mg; Anti oxidant = 500.00mg.

Experimental birds: Two hundred (200) 20 week- old black Australorp pullets were used in a 15-week experiment. The birds were purchased from a commercial farm at the age of 19 weeks and kept together for one week of adaptation on a commercial grower mash. At 20 weeks of age they were individually weighed and randomly assigned to 5 groups (treatments) with 4 replicates of 10 birds each. Each replicate was housed in a floor pen measuring 1.95m^2 with the floor covered with wood shavings as litter material. Two (2) wooden laying nests measuring 25cm×30cm×30cm (width × height × depth) were provided in each pen.

Experimental diets: Five iso nitrogenous layer mashes in which sesame seed meal (SSM) replaced soyabean meal at 0.00, 12.50, 25.00, 37.50 and 50.00% in diets 1 (control), 2, 3, 4 and 5 respectively were formulated (Table 1). The control diet contained synthetic methionine which was removed with the introduction of SSM in the other diets. The diets were analyzed for proximate composition and amino acid (lysine and methionine) content. The diets and clean drinking water were supplied *ad-libitum* throughout the duration of the experiment.

Data collection: Data were collected on feed intake, egg production and blood parameters. Feed intake was determined as the difference between the left over and the quantity fed the previous day. Hen day egg production (HDP) was calculated as;

$$\text{HDP (\%)} = \frac{\text{Number eggs production}}{\text{Number of hens present}} \times 100$$

Eggs collected from each replicate were weighed and feed conversion ratio (FCR) calculated as;

$$\text{FCR} = \frac{\text{Feed consumed (g)}}{\text{Weight of eggs laid (g)}}$$

Five eggs collected from each replicate per week were used for shell quality measurements. Shell thickness was measured using a paper thickness micro meter sensitive to 0.01mm. Shell weight was determined according to procedures described by Kul and Seker (2004) and percent shell calculated by dividing the shell weight by the weight of the egg and multiplying by 100 (Chowdhury and Smith, 2001). At the end of the experiment blood samples were collected from 4 birds per treatment for haematological and serum biochemical analysis. Haematological samples were collected into sample tubes containing ethylene diaminetetraacetic acid (EDTA) as anticoagulant while samples for serology were collected into anticoagulant free tubes. The birds were weighted at the end of the experiment to determine the weight change during the experimental period.

Table 2: Proximate composition and amino acid content of the layer mashes

	Replacement levels of sesame seed meal for full-fat soyabean meal (%)				
Nutrients (%)	0.00	12.50	25.00	37.50	50.00
Dry matter (DM)	97.07	96.95	96.89	96.98	95.53
Crude protein (CP)	16.98	16.97	16.89	16.61	16.70
Crude fibre (CF)	4.92	5.53	5.61	5.30	5.44
Ether extract (EE)	5.19	5.79	5.82	6.50	6.72
Ash	13.40	13.82	13.97	13.93	13.97
Nitrogen free extract (NFE)	59.51	57.89	57.71	57.66	57.12
Lysine	1.13	1.01	1.02	1.03	1.05
Methionine	0.39	0.33	0.36	0.40	0.45
*ME (KCal/Kg)	2,892.75	2,910.05	2,910.97	2,913.06	2,914.32

*Metabolizable energy Calculated using the formula of Ichaponani (1980). ME(Kcal/Kg) = 432 + 27.91 (CP + NFE + 2.25 x EE) .

Table 3: Performance of the laying hens

	Replacement levels of sesame seed meal for full-fat soyabean meal (%)					
Parameters	0.00	12.50	25.00	37.50	50.00	SEM
Initial weight (g/bird)	1,487.68	1,487.60	1,486.48	1,487.68	1,485.08	8.04[NS]
Final weight (g/bird)	1,694.08	1,682.70	1,705.30	1,715.30	1,735.13	6.04[NS]
Weight change (g/bird)	186.40	195.10	218.83	227.63	250.05	10.07[NS]
Daily feed intake (g/bird)	123.10	123.48	123.73	120.25	120.63	0.86[NS]
Hen-Day (%)	77.70[a]	79.21[a]	75.76[a]	66.96[b]	66.03[b]	0.64 *
Egg weight (g)	60.85[a]	61.12[a]	55.61[b]	53.65[bc]	52.43[c]	0.34 *
FCR (g feed: g egg)	2.02[b]	2.02[b]	2.22[a]	2.25[a]	2.31[a]	0.02 *
Shell thickness (mm)	0.38	0.38	0.38	0.36	0.35	0.00[NS]
Percent shell (%)	8.23	8.47	8.50	8.18	8.22	0.03[NS]
1Cost of feed (N/Kg)	34.85	33.59	33.04	32.49	31.98	-
Feed Cost per egg (N)	5.53[ab]	5.24[b]	5.40[ab]	5.89[a]	5.73[ab]	0.07 *
Mortality (number	1	2	0	0	1	-

SEM = Standard Error of the Mean, NS = Not significant (P>0.05), * = Significant (P<0.05). [a,b,c] = Means within the row bearing different superscripts differ significantly (P<0.05). 1 = Calculated based on the market price of ingredients (N/Kg) at the time of the experiment (maize = 32.00; wheat bran = 18.00; soyabean = 50.00; sesame seed = 29.50; fishmeal = 45.00; bone meal = 20.00; oyster shell = 28.50; premix = 375.00; methionine = 700; lysine = 600.00; salt = 53.33). NB; at the time of the experiment N1 = $0.008.

Data analysis: Proximate analysis was carried out according to the AOAC (1990). The amino acid was analyzed using methods described by Spackman *et al.* (1958) and the phytic acid according to Stewart (1974). Analysis of variance (Steel and Torrie, 1980) was carried out on data using the SPSS package (SPSS, 2001).

Results and Discussion

Chemical analysis: The results of proximate composition and amino acid (lysine and methionine) content of the layer mashes are presented in Table 2. Dietary metabolizable energy (ME) and ether extract (EE) increased with increasing SSM. The increase in EE was attributed to the higher oil content of SSM (57.49%) compared to soyabean, and this was used to explain the increase in dietary ME with increasing SSM as fat is a more concentrated form of energy. The crude protein, ME, lysine and methionine of all the diets met the NRC (1994) recommendations for laying hens.

Egg performance: Data on egg production and egg quality are presented in Table 3. Feed intake was slightly but not significantly (P > 0.05) reduced on the 37.50% and 50.00% levels of replacement of soyabean meal by SSM. Feed intake on all the diets was however, within the range of 120g (Say, 1992) and 125g (Jourdian, 1980) for dual purpose hybrid layers.

Inclusion of SSM above 25.00% of dietary soyabean meal adversely (P<0.05) affected hen-day production (HDP) while egg weight and feed conversion ratio (FCR) were affected when the level of SSM exceeded 12.50% of the soyabean meal. Egg shell thickness and percent shell were not affected (P>0.05) by dietary treatment. Hen-day production in this study was higher than the 48-53% reported by Omeje (1993) and 61-70% reported by Chineke (2001) for most hybrid layers in the tropics. In the present study, data collection ended at 35 weeks which is about the age hens reach peak production (Ryan and Mickay, 2005). This may be a reason behind the higher HDP observed. Even a slight reduction in feed intake is reported to have adverse effects on egg production (Say, 1992; Smith, 2001). This could be a reason behind the significant reduction in HDP observed from 37.50% level of replacement. The poorer values of FCR above 12.50% replacement were attributed to the significant reduction in egg weight from this level of

Table 4: Some haematological and serum biochemical variables of laying hens fed graded levels of sesame seed meal as a source of methionine

	Replacement Levels of Sesame Seed Meal for full-fat Soyabean Meal (%)					
Parameter	0.00	12.50	25.00	37.50	50.00	SEM
PCV (%)	35.30[ab]	35.94[a]	34.96[ab]	33.25[ab]	32.96[b]	0.20 *
Hb conc (g/dl)	10.21[a]	10.38[a]	10.10[a]	8.93[b]	9.21[ab]	0.12 *
WBC count (10^3/m^3)	34.25	34.63	34.32	34.47	34.44	0.1 [NS]
Serum protein (g/dl)	5.27[a]	5.36[a]	5.34[a]	4.16[b]	4.10[b]	0.09 *
Serum albumin (g/dl)	2.48[a]	2.53[a]	2.58[a]	1.95[b]	1.63[b]	0.05 *
Serum globulin (g/dl)	2.79[a]	2.81[a]	2.76[a]	2.21[b]	2.47[ab]	0.06 *

SEM = Standard Error of the Mean, NS = Not significant (P>0.05), * = Significant (P<0.05). [a,b] = Means within the row bearing different superscripts differ significantly (P<0.05).

replacement. Except on the 50.00% replacement, mean shell thickness on all the diets was above the range of 0.34-0.34mm reported by Oluyemi and Roberts (1988) and Smith (2001). The percent shell on all the diets fell within the 7-10% reported in literature (Usman and Tion, 2001; Moreki *et al.*, 2005). Feed cost of egg production (N/egg) was significantly (P<0.05) reduced on the 12.50% replacement diet, but did not differ (P>0.05) amongst the control, 25.00, 37.50 and 50.00% replacement diets.

Blood parameters: Results of haematological and serum biochemical analysis (Table 4) showed no dietary effect on white blood cell (WBC) count. Birds fed the 12.50% replacement diet had a higher (P<0.05) packed cell volume (PCV) compared to the 50.00% group, but the differences in PCV amongst the control, 12.50, 25.00 and 37.50% replacement diets were not significant (P>0.05). Haemoglobin concentration, serum total protein, albumin and globulin were reduced (P<0.05) above 25.00% level of replacement of soyabean meal by SSM. The reduction in the values of most blood parameters above 25.00% replacement was not understood, but this may be used to explain the drop in HDP above this level. Since nutrients are transported through the blood to the oviduct during egg formation changes in blood composition would affect egg production. The results suggest poor protein utilization by laying hens above 25.00% replacement of soyabean meal by SSM.

From the results of this study it is concluded that up to 12.50% of dietary soyabean meal can be replaced by soaked sesame seed meal in the diet of laying hens without adverse effects on egg production, egg quality traits and blood variables. The substitution will equally meet the methionine need of the hens.

References

Ahmed, M.F., 2005. Sesame production technology and strategies to increase production in Nigeria. A paper presented at the National Sesame Seed Forum Stakeholders Meeting, Le Meridien, Abuja, Nigeria, 29-30 August 2005.

A.O.A.C. (Association of Official Analytical Chemist), 1990. Official Methods of Analysis 19th Edn. Washington D.C.

Beckstrom - Sternberg, S.M. and J.A. Duke, 1994 "The Phytochemical database". http://genome.cornell.edu /cgibin/WebAce/Webace?db=phytochemdb.

Chineke, C.A., 2001. Inter-relationship existing between body weight and egg production traits in Olympia Black layers. Nig. J. Anim. Prod., 28: 1-8.

Chowdhury, S.R. and T.K. Smith, 2001. Effects of dietary 1, 4 - Diaminobutane (putresience) on egg shell quality and laying performance of older hens'. Poult. Sci., 80: 1209.

Diarra, S.S., E.O. Oyawoye and J.U. Igwebuike, 2007. Growth performance and some blood parameters of broilers fed differently processed sesame (Sesamum indicum) seed as a source of methionine. Afr. J. Bioscience, In press.

Dipasa, 2003. Sesame honey bits. www.dipasa. nl/seshobit.htm.

Essien, A., A.D. Ologhobo, S.O. Akpet, E.A. Ayuk and L.A. Ibom, 2005. Efficiency of feed utilization of broiler chicks fed maize-soyabean diets supplemented with synthetic methionine and inorganic sulphur sources. In: A.O. Fanimo, S.O. Petters, O.M.O. Idowu, S.I. Ola and E.B Sonaya (Eds.). The Emerging Opportunities for Poultry Production in West Africa Proceedings 1st Nigeria International Poultry Summit, February 20 - 25, 2005 Ota, Ogun State, Nigeria, pp: 106-108.

Ichaponani, J., 1980. Developing, availability and reliable test to predict biological availability of nutrients in poultry feeds. Report of the Indian Council for Agricultural Research, India.

Jourdain, R., 1980. Aviculture en Milieu Tropical, imprime par Beaudoin Sa. 77120 boissy-le-chatel, France.

Kato, M.J., A. Chu, L.B. Davin and N.G. Lewis, 1998. Biosynthesis of antioxidant lignans in *Sesamum indicum* seeds. Phytochemistry, 47: 583-591.

Kul, S. and I. Seker, 2004. Phenotypic correlations between some external quality tracts in the Japanese quail (*Coturnix coturnix japonica*). Int. J. Poult. Sci., 3: 400-405.

Mamputu, M. and R.J. Buhr, 1991. Effects of substituting sesame meal for soyabean meal on layer performance. Poult. Sci., 70: 77.

Moreki, J.C., H.J. Van der Merwe and J.P. Hayes, 2005. Effect of dietary calcium level on egg weight, eggshell percentage and egg production in broiler breeder hens at peak production In: A.O. Fanimo, S.O. Petters, O.M.O. Idowu, S.I. Ola and E.B. Sonaya (Eds.). The Emerging Opportunities for Poultry Production in West Africa. Proceedings of the 1st Nigeria International Poultry Summit February 20-25, 2005, Ota Ogun State, Nigeria, pp: 79-84.

Nahm, K.H., 2007. Efficient phosphorus utilization in poultry feeding to lessen the environmental impact of excreta. World's Poult. Sci., 63: 625-654.

N.R.C. (National Research Council), 1994. Nutrient Requirement of Poultry, 9th Revised Edn. National Academy Press, Washington, D.C.

Olomu, J.M., 1995. Monogastric Animal Nutrition. A. Jachem Publications, Benin City, Nigeria, pp: 146-154.

Oluyemi, J.A. and F.A. Roberts, 1988. Poultry Production in Warm Wet Climates. Low cost Editions. Published by McMillan Education Limited, London and Bashingstoke.

Omeje, S.S.I., 1983. Heterosis of body weight and short-term egg production in crosses between parent stock Gold-Link and Local chickens of Nigeria. Unpublished M.Sc. thesis, University of Nigeria, Nsukka.

Peace Corps, 1990. New Crop Production Handbook, Information Collection and Exchange, Yermanos, D.M. (Eds.). Washington, DC 20526, USA.

Ram, R., D. Catlin, J. Romero, and C. Cowley, 1990. Sesame: New approaches for crop improvement. In: J. Janick and J.E. Simon (Eds.), Advances in New Crops. Timber Press, Portland, OR, pp: 225-228.

Ryan, A. Meunier and Mickey, A. Latour, 2005. Commercial Egg Production and Processing. http://ag.ansc.purdue.edu/Poultry/Publication/com egg/.

Say, R.R., 1992. Manual of Poultry Production in the Tropics, English Edn., Published by CB International 118 Pages.

Smith, A.J., 2001. Poultry; The Tropical Agriculturalist, Revised Edition, Published by Macmillan Education, Ltd. London and Oxford.

Spackman, D.H., W.H. Stein and S. Moore, 1958. Automatic recording apparatus for use in the chromatography of amino acids. Analytical Chem, 30: 1990-1991.

SPSS., 2001. Statistical Package for Social Science. Pc Version, SPSS Inc. 444 N. Michigan Avenue Chicago, United States of America.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedures of Statistics, A biometrical Approach, 2nd Edn. McGraw Hills Book Co., New York, U.S.A.

Stewart, E., 1974. Chemical Analysis of Ecological Materials. Oxford (UK) Blackwell Scientific, pp: 298-312.

Usman, R. and M.A. Tion, 2001. The Effect of Age and Time of Oviposition on Laying Hen Performance and Shell Quality. PGD Unpublished Project. University of Agriculture, Makurdi.