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

S.S. Diarra1 and B.A. Usman2

1Department of Animal Health and Production, Yobe College of Agriculture Gujba, 
P.M.B. 1104, Damaturu, Nigeria
2Department of Animal Health and Production, Mohamet Lawan College of Agriculture, 
P.M.B. 1427, Maiduguri, Nigeria

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; Mampu and Buhr, 1991). The amino acid 
composition of the protein is similar to that of soyabean 
meal with the exception of lower lysine (Mampu 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 
(NA) 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 mash

<table>
<thead>
<tr>
<th>Ingredients (%)</th>
<th>Replacement level of sesame seed for full-fat soyabean meal (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>Maize</td>
<td>37.89</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>25.25</td>
</tr>
<tr>
<td>Soyabean meal</td>
<td></td>
</tr>
<tr>
<td>(full-fat)</td>
<td>23.60</td>
</tr>
<tr>
<td>Sesame seed meal</td>
<td>-</td>
</tr>
<tr>
<td>Fish meal</td>
<td>2.50</td>
</tr>
<tr>
<td>Oyster shell</td>
<td>6.00</td>
</tr>
<tr>
<td>Bone meal</td>
<td>2.40</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.10</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.10</td>
</tr>
<tr>
<td>*Premix</td>
<td>0.25</td>
</tr>
<tr>
<td>Salt</td>
<td>0.25</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Calculated analysis

|               |              |              |              |              |              |
|---------------|--------------|--------------|--------------|--------------|
| Crude protein (%) | 18.92 | 16.67 | 16.55 | 16.87 | 18.70 |
| ME (Kcal/kg)   | 2653.43 | 2619.52 | 2678.68 | 2738.22 | 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 D₃ = 600,000.00 IU; Vit E = 4,000.00mg; Niacin = 6,000.00mg; B₁₂ = 600.00mg; B₁₂ = 1,800.00mg; B₂ = 1,200.00mg; B₃ = 6.00mg; K₃ = 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 1.95m² with the floor covered with wood shavings as litter material. Two (2) wooden laying nests measuring 25cm x 30cm x 30cm (width x height x depth) were provided in each pen.

Experimental diets: Five iso nitrogenous layer mash 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.
Diarra and Usman: Soaked Sesame (Sesamum indicum) Seed Meal

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

<table>
<thead>
<tr>
<th>Nutrients (%)</th>
<th>Replacement levels of sesame seed mash for full-fat soybean meal (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>Dry matter (DM)</td>
<td>97.07</td>
</tr>
<tr>
<td>Crude protein (CP)</td>
<td>16.98</td>
</tr>
<tr>
<td>Crude fibre (CF)</td>
<td>4.92</td>
</tr>
<tr>
<td>Ether extract (EE)</td>
<td>5.19</td>
</tr>
<tr>
<td>Nitrogen free</td>
<td>59.51</td>
</tr>
<tr>
<td>extract (NFE)</td>
<td>59.51</td>
</tr>
<tr>
<td>Lysine</td>
<td>1.13</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.39</td>
</tr>
</tbody>
</table>

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

Table 3: Performance of the laying hens

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Replacement levels of sesame seed mash for full-fat soybean meal (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight (g/bird)</td>
<td>1,487.68</td>
</tr>
<tr>
<td>Final weight (g/bird)</td>
<td>1,684.08</td>
</tr>
<tr>
<td>Weight change (g/bird)</td>
<td>186.40</td>
</tr>
<tr>
<td>Daily feed intake (g/bird)</td>
<td>123.10</td>
</tr>
<tr>
<td>Hen-Day (%)</td>
<td>77.70</td>
</tr>
<tr>
<td>Egg weight (g)</td>
<td>60.65</td>
</tr>
<tr>
<td>FCR (g feed: g egg)</td>
<td>2.02</td>
</tr>
<tr>
<td>Shell thickness (mm)</td>
<td>0.38</td>
</tr>
<tr>
<td>Percent shell (%)</td>
<td>8.23</td>
</tr>
<tr>
<td>1Cost of feed (N/Kg)</td>
<td>34.85</td>
</tr>
<tr>
<td>Feed Cost per egg (N)</td>
<td>5.53</td>
</tr>
<tr>
<td>Mortality (number)</td>
<td>1</td>
</tr>
</tbody>
</table>

SEM = Standard Error of the Mean, NS = Not significant (P>0.05), *= Significant (P<0.05), **= 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; soybean = 50.00; sesame seed = 28.50; fish meal = 45.00; bone meal = 20.00; oyster shell = 28.50; premix = 375.00; methionine = 700.00; 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. (1956) 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 mashers 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 soybean, 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 (1984) 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 soybean meal by SSM. Feed intake on all the diets was however, within the range of 120g (Say, 1992) and 125g (Jourdan, 1980) for dual purpose hybrid layers. Inclusion of SSM above 25.00% of dietary soybean 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 soybean 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 45-53% reported by Ormeje (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
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 (1983) 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 reduced (P<0.05) 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**


