# BAMBARA SEED OFFAL MEAL AS A REPLACEMENT FOR SOYA BEAN MEAL ON THE HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF LAYING HENS.

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**Abstract**
A total of seventy two (72), 24 weeks (168days) old Nera black pullets breed were used in eight weeks (two months) feeding trial to assess the effect of Bambara seed offal meal (BSOM) as protein source on the blood indices of laying hens. Four experimental diets were formulated in which T1, T2, T3, and T4 contained 0%, 10%, 15% and 20% BSOM, respectively. The birds were divided into four treatment groups of 18 birds each. Each group was replicated three times in a completely randomized design of 6 hens per replicate. Routine management practices were adequately carried out. At the end of the eight weeks feeding trial, two hens were randomly selected from each replicate and their blood samples were collected by puncturing their webal sub-clavicle vein with 5ml scalp vein needle and syringe. The blood samples collected were used for determination of haematological and blood biochemical indices. Results showed that blood clothing time (CT) increased as the levels of BSOM increased in the diets. T1 (0%) recorded the shortest ($p < 0.05$) blood clothing time while T4 (20%) recorded the longest ($p < 0.05$). Other haematological parameters such as haemoglobin (HB), red blood cell (RBC), packed cell volume (PCV), mean cell volume (MCV), mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC) and white blood cell (WBC) decreased significantly ($P < 0.05$) as the dietary levels of BSOM increased. The serum biochemical indices such as urea, total proteins, albumin, globulin, and glucose were significantly decreased ($p < 0.05$) as the dietary levels of BSOM increased. Creatinine increased significantly ($P < 0.05$) at T3 (15%) and T4(20%) dietary levels of BSOM. The results indicated that 10% inclusion levels of BSOM in the laying hens diet appears to be the optimum level for haematological and serum biochemical values for laying hens since beyond this level, the blood parameters of the experimental birds were negatively affected.
**Keywords:** bambara seed offal meal, haematological, serum biochemical indices, laying Hens.

## Introduction

In Nigeria, poultry industry has not been able to fulfill the protein demand and supply challenges due to high cost of poultry feed ingredients, especially soya bean meal, fish meal and groundnut cake meal including energy sources such as maize, wheat, barley and oat. .Ekenyem and Madubuike (2006) observed that poultry products (meat and egg) and pork offer considerable potential for bridging the animal protein of pig and poultry (mongastrics) that are adaptable to different environment in the world. Monogastrics are the most efficient in converting protein feedstuffs and their by-products into high quality protein, compared to other livestock species (Mukhtar, 2007). In Nigeria, animal protein products have been in short supply due to the ever increasing cost of livestock feedstuffs. However, the high cost of poultry feedstuffs especially protein feedstuffs has caused many feed manufacturers to go out of business by producing feed of poor quality which made farmers to produce below standard and capacity (Nza *et al*., 2007). Obih (2009) suggested that greater emphasis should be placed on the use of unorthodox feed ingredients which are unfit for human consumption. However, Obidinma, (2009) stated that feed consumed by an animal could be used to determine its effects on the blood indices of the animals. This could also be used to interprete the health status of the animal and the quality of their blood profile.

Haematology includes the study of the numbers and morphology of the cellular elements of the blood – the red cells (erythrocytes), white cells (leucocytes) and the platelets (thrombocytes) and the use of these results in the diagnosis and monitoring of disease (Merck, 2012). The effect of a particular feedstuff on the blood profile of an animal will determine whether such a feedstuff is healthy or unhealthy for an animal to consume. Blood reflects the extent to which an animal is exposed to toxicant feedstuffs and this invariably affects the overall performance of the animal.The performance of an animal is a function of the feed consumed, the environment and the genetic constitution. Therefore, it becomes necessary to understand the effect of any feed stuff on the haematological and biochemical indices of the animal to improve performance and reduce toxic effects. Animals with good blood profile composition are likely to show good performance (Isaac *et al*., 2013).

This study therefore, evaluated the effect of BSOM as unorthodox feed ingredients on the haematological and blood biochemical profile of laying hens.

## Materials and Methods

This experiment was carried out at the poultry unit of teaching and research farm, Imo State University

Owerri, which is located within the South-Eastern agro-ecological zone of Nigeria. Owerri lies between latitude $5^0$29'North and longitude $7^0$20'East. It is about 91m above sea level with annual rainfall, temperature and humidity ranging from 1,500mm to 2,200mm, 20.0 – 27.5$^0$C and 75 – 90%, respectively (Accuweather, 2015).

**Procuring and processing of the experimental material**

The Bambara seeds were procured from Ogbete market, Enugu state. They were soaked in water for three days, air-dried, and milled in a hammer mill; thereafter, the flour was sieved to separate the offal from the flour. Other ingredients were also sourced from reputable dealers. The sample of Bambara seed offal meal was subjected to proximate analysis according to (AOAC, 2010). The proximate composition analysis result is shown in Table 1 below.

**Experimental diets**

The BSOM was used to formulate four layers ration designated as T1, T2, T3 and T4 containing 0%, 10%, 15% and 20% BSOM, respectively, to replace soya bean meal. The diet was isonitrogenous and isocaloric which contained 16% CP (crude protein) and 2800kcal/kg ME. The ingredient composition and calculated nutrient composition of the experimental diets are presented in Table 2.

**Experimental birds and design**

Seventy two (72) 24-weeks (168 days) old Nera black pullets were randomly divided into four groups of eighteen birds and each group randomly assigned to one of the four treatments diets in a completely randomized design (CRD).

Each group was further replicated three times with 6 pullets per replicate and placed in a deep litter compartment measuring 1m by 1m. Water was provided *ad libitum*.The trial lasted for eight weeks (56 days)

**Haematology and blood biochemistry**

At the last day of the feeding trial, three layers per treatment were randomly selected to determine the haematological and serum biochemical indices of the birds. Blood samples were collected from the wing web of the birds using syring and needle and placed in the specimen bottles with EDTA (Ethylene Diamine Tetra Acetate) for haematological studies. Blood was analysed within three hours of collection for haemoglobin(HB), packed cell volume(PCV), red blood cell(RBC), mean cell volume(MCV), mean cell haemoglobin(MCH), mean cell haemoglobin concenteration(MCHC), clothing time(CT) and white blood cell(WBC) as outlined by Ochei and Kolhatkar (2000). Blood samples placed in the specimen bottles without EDTA were used to analyse the serum biochemical parameters such as urea, total protein, creatinine, cholesterol and glucose as outlined by Ochie and Kolhatkar (2000).

**Statistical Analysis**

Data collected were subjected to analysis of variance using the SPSS software (2012). Where analysis of variance indicated significant treatment effects, means were compared using Duncan's New Multiple Range Test (DNMRT) (SPSS, 2012)

**Results and Discussion**

The results of the haematological and blood biochemical indices of laying birds fed graded levels of BSOM as a replacement for soya bean meal are shown in Tables 3 and 4, respectively. The results showed that blood clothing time obtained in this study were, 161, 183, 213 and 223 seconds for T1(0%), T2(10%), T3(15%) and T4(20%) respectively. However, T4(20%) had the longest ($p < 0.05$) clothing time even though it is still within the range for avian specie (2 to 10 minutes) as recommended by Obidinma (2009). Baker *et al.* (2001), observed that short clothing time is very important in farm animal management practices such as castration, tattooing, ear notching and nose piercing.The longest clothing time observed in birds placed on diet four as observed by Oso *et al.*(2011), showed that BSOM contain anti-coagulants (agents that prevents blood clothing in farm animals) and this however, caused reduction of thromboplastin that helps blood clothing (Thrombosis).

**Table 1: Proximate composition of Bambara seed offal meal (BSOM)**

| Nutrients | Quantity (%DM) |
|---|---|
| Crude protein | 18.90 |
| Ash | 3.50 |
| Ether Extract | 3.50 |
| Moisture | 11.37 |
| Crude Fibre | 12.50 |
| Nitrogen Free Extract | 51.41 |
| ME (kcal/kg) | 2810.65 |

ME= metabolizable energy, DM= dry matter

**Table 2: Ingredient and calculated nutrient composition of the experimental diets**

| Ingredients | T1(0%) | T2(10%) | T3(15%) | T4(20%) |
|---|---|---|---|---|
| Maize | 48 | 48 | 48 | 48 |
| Bambara seed Offal meal | 0 | 10 | 15 | 20 |
| Soya bean meal | 24 | 14 | 9 | 4 |
| Wheat offal | 5 | 5 | 5 | 5 |
| Fish meal | 3 | 3 | 3 | 3 |
| Palm kernel cake | 7 | 7 | 7 | 7 |
| Bone meal | 10 | 10 | 10 | 10 |
| Vit/min. premix | 0.25 | 0.25 | 0.25 | 0.25 |
| L-Lysine | 0.25 | 0.25 | 0.25 | 0.25 |
| DL-Methionine | 0.25 | 0.25 | 0.25 | 0.25 |
| Common salt | 0.25 | 0.25 | 0.25 | 0.25 |
| **Calculated nutrient composition** | | | | |
| Crude Protein % | 20.39 | 17.86 | 16.61 | 15.35 |
| Crude fiber % | 4.20 | 4.80 | 5.10 | 5.40 |
| L-Lysine % | 1.34 | 1.22 | 1.25 | 1.33 |
| DL-Methionine % | 0.65 | 0.59 | 0.58 | 0.57 |
| Calcium % | 3.79 | 3.77 | 3.76 | 3.75 |
| Phosphorus % | 2.13 | 2.07 | 2.04 | 2.01 |
| ME (kcal/kg) | 2623.32 | 2662.32 | 2681.82 | 2701.32 |

However, for other erythrocyte indices such as PCV, RBC, MCV, HB etc. the values obtained decreased significantly ($p < 0.05$) among the treatment means. The haemoglobin ranged from 13.35g/dl to 11.39g/dl decreasing ($P < 0.05$) as the dietary levels of BSOM increased. However, the values were within the normal ranges (11.60 – 13.68) reported by Wikivet (2013). The red blood cell count (11.30 – $12.50x10^{12}$/l) decreased ($P < 0.05$) as the dietary inclusion of BSOM increased. Low values of RBC and HB was an indicator of emerging anaemia (Mohammed and Oloyede, 2009). The values obtained from this study (11.30 – $12.50x10^{12}$/l) fell within the normal range (Wikivet, 2013). The implication is that the test feed ingredient had no deleterious effect on the blood profile of the birds. The packed cell volume (%) ranged from 23.0 to 25.7. It decreased significantly ($P < 0.05$) as the dietary levels of BSOM increased. A decrease in packed cell volume was a sign of liver and kidney disease (Demoranvilles and Best, 2013). The values obtained from this study were within the range (21.25 - 30.45) reported by Aguihe, *et al*., (2014) and lower than the values (26.33 – 36.00) reported by Odetola, *et al*. (2016) and fell below the normal range (35.9 – 41.0%) (Wikivet, 2013). The mean cell haemoglobin (MCH), mean cell volume (MCV) and mean cell haemoglobin concenteration (MCHC) decreased significantly ($P < 0.05$) as the dietary inclusion of BSOM increased. Aster (2004) reported that a low level of mean cell haemoglobin is an indication of anaemia. Chineke *et al*. (2006) reported that packed cell volume, haemoglobin and mean cell haemoglobin are major indices for evaluating circulatory erythrocytes and are significant in the diagnosis of anaemia and also serve as useful indices of the bone marrow capacity to produce red blood cells as in mammals. The mean cell volume (fl) 21.30 -18.30 and the mean cell haemoglobin(pg) 9.12 – 7.56 fell below the normal range 81.60 – 89.10fl and 27.20 – 28.90pg respectively, (Wikivet, 2013).

The serum biochemical indices such as urea, total proteins, albumin, globulin, and glucose were significantly decreased ($p < 0.05$) as the dietary levels of BSOM increased. However, creatinine increased significantly ($P < 0.05$) at T3(15%)and T4(20%) dietary levels of BSOM**.** The results obtained from the serum.

**TABLE 3: Effect of Bambara seed offal meal on haematological parameters of the experimental laying birds**

| Parameters | T1(0%) | T2(10%) | T3(15%) | T4(20%) | SEM |
|---|---|---|---|---|---|
| BC (seconds) | $161^{a}$ | $183^{b}$ | $213^{c}$ | $223^{d}$ | 0.34 |
| PCV % | $25.7^{a}$ | $24.0^{b}$ | $23.3^{c}$ | $23.0^{d}$ | 0.01 |
| RBC($X10^{12}$/L) | $12.50^{a}$ | $12.35^{b}$ | $12.30^{b}$ | $11.30^{c}$ | 0.02 |
| MCV (fl) | $21.30^{a}$ | $19.30^{b}$ | $19.30^{b}$ | 18.30c | 0.04 |
| HB (g/dl) | $88.3^{a}$ | $82.0^{b}$ | $77.0^{c}$ | $73.6^{d}$ | 0.04 |
| MCH(pg) | $9.12^{a}$ | $8.57^{b}$ | $8.38^{b}$ | $7.56^{c}$ | 0.09 |
| WBC( $X10^{9}$/L) | $10.35^{c}$ | $10.53^{a}$ | $10.45^{b}$ | $9.35^{d}$ | 0.01 |
| MCHC( g/dl) | $34.50^{a}$ | $34.53^{a}$ | $33.23^{a}$ | $29.50^{b}$ | 0.8 |

* abcd: means in the same row not having the same superscripts are significantly different ($p < 0.05$)

**Table 4: Effect of Bambara seed offal meal on serum biochemical indices of the experimental laying birds**

| Parameters | T1(0%) | T2(10%) | T3(15%) | T4(20%) | SEM |
|---|---|---|---|---|---|
| Urea conc. mg/dl | 3.53[a] | 3.48[b] | 3.23[c] | 3.13[d] | 0.01 |
| Total protein g/dl | 78.40[b] | 80.30[a] | 76.38[c] | 74.40[d] | 0.06 |
| Albumin g/dl | 18.15[a] | 18.05[b] | 17.50[a] | 17.30[d] | 0.01 |
| Globulin g/dl | 40.57[a] | 36.65[b] | 34.66[d] | 33.00[d] | 0.61 |
| Creatinine mg/dl | 24.75[c] | 24.82[c] | 25.68[b] | 26.00[a] | 0.06 |
| Glucose mg/dl | 43.20[a] | 40.20[b] | 40.20[b] | 39.10[b] | 0.68 |
| Cholesterol mg/dl | 38.60[a] | 37.40[c] | 38.42[b] | 37.20[d] | 0.03 |

*abcd: means in the same row, having the same superscripts are not significantly different ($p > 0.05$).

biochemical indices of the laying birds indicated that urea concentration decreased significantly ($P < 0.05$) as dietary levels of BSOM increased. This is similar to the findings of Agbabiaka *et al*., (2013) who reported a decrease in urea content of the blood of broiler finishers fed raw tiger nut based diets. High level of serum urea was an indication of low protein quality as a result of imbalance of amino acids (Nworgu *et al*., 2007). Significant reduction in serum urea as the dietary levels of BSOM increases was an indication that the diet had no negative effect on the serum protein quality as the dietary levels of BSOM increased. The serum protein decreased significantly at T3(15%) and T4(20%) dietary levels. A decrease in serum protein concentration could be due to interference on normal protein metabolism (Bolu and Balogun, 2009). The albumin and globulin decreased significantly ($P < 0.05$) as BSOM increased. Serum albumin will increase when protein intake exceeds the amount required for maintenance and growth compared with the control diet (Ogunbode, *et al*., 2016). Serum albumin is a strong predictor of health, a low albumin concentration is a sign of poor health (Kastow, 2009). Sanchez-Monge (2004) reported that increased globulins are seen in chronic infections, liver damage and kidney dysfunctions. Serum creatinine increased significantly as the dietary inclusion of BSOM increased. Excess creatinine in the blood is from muscle when wasting occurs and creatinine phosphate is catabolized (Yuegang *et al*., 2008). This implies that the animal was using body reserves to survive. High serum creatinine concentration indicated protein insufficiency; however the values obtained were within the tolerable range as observed by Ahaotu *et al.* (2016). Serum glucose decreased significantly ($P < 0.05$) as the levels of BSOM increased. This could be attributed to the fiber level present in the feed as the BSOM increased. Dietary fiber from BSOM has some noble effect on their blood components; this can be used as diluents in an effort to reduce too much protein and glucose which invariably helps to reduce too much fat and also to increase hen-day percentage.

## CONCLUSION AND RECOMMENDATION

Bambara seed offal meal did not impact negatively on the blood of the laying birds at this dietary level of inclusion and so was not toxic to the blood of the birds. Most of the indices were within the normal ranges for optimal performance of laying hens and the birds tolerated the meal (BSOM) up to 20% inclusion level.

It is therefore, concluded that for optimal performance and for cost effectiveness 20% inclusion level of Bambara seed offal meal is recommended.

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