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# Growth performance, carcass characteristics and blood parameters of broiler chickens fed differently processed sickle pod (*Senna obtusifolia*) seed meal in a Sahelian environment

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***Target Audience:*** Poultry Farmers, Animal Scientists, Monogastric Nutritionists, Researchers

## Abstract

*A feeding trial was conducted using one hundred and eighty (180) day-old broiler chicks for eight (8) weeks to investigate growth performance, carcass characteristics and blood parameters of broiler chickens fed 20% level of differently processed Senna obtusifolia seed meal (SOSM) as a replacement for full fat soya bean. The chicks were randomly allotted to six dietary treatments with 30 birds per treatmentand each treatment was replicated three times with 10 birds per replicate in a CompletelyRandomized Design (CRD). The diets were designated as T1 (control) 0% Senna obtusifolia seed meal (SOSM), T2 (boiled Senna obtusifolia seed meal) (BSOSM), T3 (soaked and boiled Senna obtusifolia seed meal) (SBSOM), T4 (toasted Senna obtusifolia seed meal) (TSOSM), T5 (Sprouted Senna obtusifolia seed meal) (SPSOSM) and T6 (fermented Sennaobtusifolia seed meal) (FSOSM). Results of the growth performance indicated that there were significant (P<0.05) variations among treatment groups. Chickens fed FSOSM (T6) recorded superior final live weight, overall weight gain, daily feed intake and Feed Conversion Ratio (FCR) compared to T1 (control) followed by T2 (BSOSM). Carcass characteristics and organs weight also showed significant (P<0.05) differences among treatment groups. Results of haematological parameters and serum biochemical indices showed no significant (P>0.05) differences among treatments. Results obtained in this study showed that 20% of soya bean can be replaced with fermented or boiled Senna obtusifolia seed meal in broiler chickens diets without adverse effects on performance, carcass characteristics and blood parameters as source of protein.*

***Keywords:*** *Senna obtusifolia* seed, broiler chickens, performance, carcass characteristics, blood parameters

## Description of Problem

The demand for protein of animal origin in Nigeria is greater than the supply (1). The average animal protein intake of Nigerians is less than 10g / head / day (2) which is less than 25% of the updated recommended dietary protein intake of 46 to 56g / head / day (3).Poultry which offers meat and egg (protein of animal origin) on account of its short gestation period, short generation interval and handy size, is expected to play a major role in this bid to provide protein of animal source (4).

Nigeria is currently faced with short supply and high cost of conventional feed ingredients for poultry rations. Over the years, there has been much effort directed towards

the exploitation and the use of non-conventional ingredients in feed production (5). One of such non-conventional feed ingredient is *Senna obtusifolia* seed "tafasa" in Hausa. (6) suggested that animal nutritionists should intensify research on the utilization of under-utilized legumes of the wild such as *Senna obtusifolia* seed meal as feed ingredients for feeding poultry in Nigeria. *Senna obtusifolia* is an annual or biennial shrub growing up to 2.5mtall; the leaves are pinnate and alternately arranged along the stem, born on petioles 15 – 20mm long. The flowers are yellow (10 – 15mm across) while the fruit is slender, strongly curved downward (sickle shape), (pod 6 – 18cm long and 2 – 6 mm wide). The seeds (3 – 6mm long) are dark brown in colour, shiny in appearance with rhomboid or irregular shape (7). (6, 8) indicated that it has good nutritional value (29.54 and 25.33%) crude protein, but also contain some anti-nutritional factors such as tannins, phytate, saponin and oxalate which could adversely affect nutrient utilization in poultry. It is in view of the above, that this study was carried out to investigate the effects of feeding differently processed *Senna obtusifoliai seed* meal on growth performance, carcass characteristics and blood parameters of broiler chickens.

## Materials and Methods

### Study Area

The study was conducted at the Poultry Unit of the Livestock Teaching and Research Farm, Department of Animal Science, University of Maiduguri, Borno State, Nigeria. Maiduguri is located between latitude $11^{o}05'$ and $12^{o}$ North and longitude $13^{o}$ $05'$ and $14^{o}$ East and at an altitude of 354m above sea level (9). Maiduguri falls within the sahelian region which is noted for its harsh climate and seasonal rainfall variations. It has short period of rainfall (3 to 4 months) which varies from minimum of 478 to 500mm to a maximum of 600 to 621mm with a long dry season of 8 to 9 months (10). The ambient temperatures could be as low as $20^{o}$Cduring the dry cold season (October to February) and as high as $44^{o}$C during the dry hot season (March to May) and relative humidity is about 5% during April and May and day length varies from 11 to 12 hours (11).

### Experimental Stock and Management

One hundred and eighty (180) day-old Abor Acre breed of broiler chicks were used for the study. The chicks were weighed individually and allotted to six (6) experimental diets. The chicks were assigned to the six dietary treatments in groups of thirty (30) and replicated thrice in groups of ten (10) chicks per replicate in a Completely Randomized Design (CRD). Six (6) diets were formulated and designated as treatments T1 (0% *Senna obtusifolia* seed meal)(SOSM) as control, T2 (boiled *Senna obtusifolia* seed meal) (BSOSM), T3 (toasted *Senna obtusifolia* seed meal) (TSOSM), T4 (Soaked and boiled *Senna obtusifolia* seed meal) (SBSOSM), T5 (sprouted *Senna obtusifolia* seed meal) (SPSOSM) and T6 (fermented *Senna obtusifolia* seed meal) (FSOSM). The differently processed *Senna obtusifolia*seed meal replaced soya bean at 20% level of inclusion in treatments T2 to T6. The chicks were provided with the experimental diets and drinking water *ad libitum* and other management practices including vaccination against Gumboro and Newcastle diseases. The study lasted for 56 days. The ingredient composition and calculated analysis of broiler starter and finisher diets are presented in Tables 1 and 2.

**Table 1: Ingredient Composition and Calculated Analysis of the Experimental Broiler Starter Diets**

| Ingredient (%) | Diets (Treatments) | | | | | |
|---|---|---|---|---|---|---|
| | T1 (SOSM) | T2 (BSOSM) | T3 (TSOSM) | T4 (SBSOSM) | T5 (SPSOSM) | T6 (FSOSM) |
| Maize | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 | 52.00 |
| SBM (full fat) | 30.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| SOSM | 0.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| Wheat bran | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| Fish meal | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 |
| Bone meal | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Premix | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Lysine | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Methionine | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Salt | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |
| **Calculated Analysis (%)** | | | | | | |
| Energy (kcal/kg) | 2933.01 | 2905.08 | 2906.08 | 2903.40 | 2907.40 | 2901.10 |
| Crude protein | 23.15 | 22.55 | 22.32 | 22.78 | 22.48 | 22.65 |
| Crude fibre | 2.88 | 3.12 | 3.13 | 3.11 | 3.08 | 2.98 |
| Methionine | 0.76 | 0.77 | 0.75 | 0.77 | 0.73 | 0.70 |
| Lysine | 1.38 | 1.37 | 1.39 | 1.32 | 1.29 | 0.75 |
| Calcium | 1.31 | 1.32 | 1.30 | 1.29 | 1.30 | 1.33 |
| Phosphorus | 0.73 | 0.74 | 0.73 | 0.72 | 0.71 | 0.75 |

SBM = Soya bean meal, SOSM = *Senna obtusifolia* seed meal

**Table 2: Ingredient Composition and Calculated Analysis of the Experimental Broiler Finisher Diets**

| Ingredient (%) | Diets (Treatments) | | | | | |
|---|---|---|---|---|---|---|
| | T1 (SOSM) | T2 (BSOSM) | T3 (TSOSM) | T4 (SPSOSM) | T5 (SPSOSM) | T6 (FSOSM) |
| Maize | 54.00 | 54.00 | 54.00 | 54.00 | 54.00 | 54.00 |
| SBM (full fat) | 27.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 |
| SOSM | 0.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 |
| Wheat bran | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Fish meal | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Bone meal | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Premix | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Lysine | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Methionine | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Salt | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |
| **Calculated Analysis (%)** | | | | | | |
| Energy (kcal/kg) | 3119.39 | 2910.50 | 2930.39 | 2903.02 | 3931.98 | 2922.11 |
| Crude protein | 21.01 | 20.61 | 19.85 | 20.21 | 19.76 | 19.45 |
| Crude fibre | 3.69 | 4.26 | 4.11 | 4.38 | 4.49 | 4.51 |
| Methionine | 0.70 | 0.72 | 0.73 | 0.72 | 0.75 | 0.77 |
| Lysine | 1.04 | 1.38 | 1.13 | 1.41 | 1.44 | 1.65 |
| Calcium | 1.14 | 1.16 | 1.14 | 1.18 | 1.21 | 1.23 |
| Phosphorus | 0.68 | 0.59 | 0.61 | 0.51 | 0.49 | 0.45 |

SBM = Soya bean meal, SOSM = *Senna obtusifolia* seed meal

**Parameters Measured**. The parameters measured were:

**Feed Intake:** This was determined by the difference between the daily feed offered and daily feed left over.

**Body Weight Gain:** The weekly weight gain and final weight was taken at the end of the experiment and the overall weight gain was obtained by the difference between the initial weight and the final weight.

**Carcass Evaluation:** At the end of the experiment, three (3) chickens were randomly selected from each treatment (one from each replicate) and were deprived of feed overnight. The fasted live weights of the chickens were recorded before the birds were slaughtered and bled by severing the jugular vein. The slaughtered chickens were plucked after immersing in warm water. The plucked weights were recorded before the chickens were eviscerated. The dressed weight and cut-up parts (head, neck, wings, breast, shanks, drumsticks, thighs and back) and the visceral organs (heart, liver, gizzard, proventriculus, caeca and intestine) as well as the abdominal fats were weighed and recorded. Dressing percentage was determined and expressed as follows:

$$\text{Dressing percentage (DP\%)} = \frac{\text{Carcass weight}}{\text{Live weight}} X \frac{100}{1}$$

**Haematological Parameters.** At the end of the 56 days feeding trial, blood samples were collected from each replicate into a labeled ethylene Diamine Tetra-acetic Acid (EDTA) bottles and lithium heparin bottles for haematological and serological analysis using the micro – haematocrit method. Haematological parameters evaluated include erythrocyte (RBC) count, leucocytes (WBC) count, packed cell volume (PCV) and Haemoglobin (Hb) concentration while the Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated as follows:

$$\text{MCV (pg)} = \frac{\text{PCV (\%)}}{\text{RBC (x10}^6\text{/mm}^3\text{)}}, \quad \text{MCH (fl)} = \frac{\text{Hb (g/dl)}}{\text{RBC (x10}^6\text{/mm}^3\text{)}}, \quad \text{MCHC (\%)} = \frac{\text{MCH (pg)}}{\text{MCV (fl)}}$$

Differential counts which include eosinophils, lymphocytes, monocytes, neutrophils and basophils were also determined. Serological variables determined were total protein, albumin, globulin, glucose, cholesterol, urea, creatinine, alkaline phosphates, total bilirubin and conjugated bilirubin.

**Statistical Analysis**

All data collected were subjected to analysis of variance (ANOVA) of the CompletelyRandomized Design (CRD) using Statistix 9.0 (12).Least significant difference (LSD) was used to separate treatment means where significant differences exist at 95% level of probability (0.05 level of significance).

**Results and Discussions**

Results of the productive performance of broiler chickens fed differently processed *Senna obtusifolia* seed meal are presented in Table 3. The final live weight, overall weight gain, daily feed intake and Feed Conversion Ratio (FCR) showed significant ($p<0.05$) differences among treatment groups. Chickens fed sprouted *Senna obtusifolia*seed meal had lower ($p<0.05$) final and overall weight gain compared to the other treatment groups. This effect could be as a result of the high level of anti-nutritional factors still present in sprouted *Senna obtusifolia* seed meal. This finding compared favourably with the results obtained by (13) when raw *Senna obtusifolia* seed meal was fed to cockerels. The better ($p<0.05$) final

weight, overall weight, daily feed intake and FCR observed in T6 (FSOSM) agreed with (14) who revealed that cooking and fermentation improved nutrient quality and reduced anti-nutritional factors in *Senna obtusifolia* seed. (15) also pointed out that inclusion of fermented feeds in poultry diets improves nutrient digestibility and growth performance. Feed conversion ratio (5.35) was better in T6 (fermented *Senna obtusifolia* seed meal) than the other treatment groups. This could be attributed to the marked reduction of the anti-nutritional factors in the fermented SOSM included in the diet as earlier reported by (20).

**Table 3: Productive Performance of Broiler Chickens Fed Differently Processed *Senna obtusifolia* Seed Meal at 20% Level of Inclusion**

| Parameters | Diets (Treatments) | | | | | | SEM |
|---|---|---|---|---|---|---|---|
| | T1(0% SOSM) | T2(BSOSM) | T3(TSOSM) | T4(SBSOSM) | T5(SPSOSM) | T6(FSOSM) | |
| Mean initial weight (g) | 330.33 | 312.67 | 323.00 | 339.67 | 323.67 | 330.67 | $8.44^{NS}$ |
| Mean final weigh (g) | $1326.30^{a}$ | $1008.70^{b}$ | $976.33^{bc}$ | $831.33^{bc}$ | $814.33^{c}$ | $1441.00^{a}$ | $38.87^{*}$ |
| Overall wt. gain (g) | $996.00^{a}$ | $969.00^{b}$ | $653.33^{bc}$ | $491.67^{c}$ | $490.67^{c}$ | $1111.00^{a}$ | $37.68^{*}$ |
| Daily feed intake (g) | $111.63^{ab}$ | $98.36^{c}$ | $104.08^{bc}$ | $107.76^{bc}$ | $105.91^{bc}$ | $121.08^{a}$ | $1.21^{*}$ |
| Daily weight gain (g) | $20.32^{a}$ | $14.20^{b}$ | $13.33^{b}$ | $10.03^{c}$ | $10.01^{c}$ | $22.67^{a}$ | $2.69^{*}$ |
| Feed conversion Ratio | $5.54^{a}$ | $6.93^{ab}$ | $7.82^{b}$ | $10.77^{c}$ | $10.73^{c}$ | $5.35^{a}$ | $0.44^{*}$ |

a,b,c = Means within the same raw bearing different superscripts differ significantly ($p<0.05$), * = Significant at 5% level of probability ($p<0.0$% NS Not significant ($p>0.05$), SEM = Standard error of means, BSOSM = Boiled *Senna obtusifolia* seed meal, TSOSM = Toasted *Senna obtusifolia* seed meal, SBSOSM = Soaked and boiled *Senna obtusifoliai* seed meal, SPSOSM = Sprouted *Senna obtusifolia* seed meal, FSOSM = Fermented *Senna obtusifolia* seed meal

Results of carcass characteristics and some organs weight are presented in Table 4. The result showed significant ($p<0.05$) differences for live weight, slaughter weight, plucked weight, dressing percentage and some cut-up parts. Broiler chickens fed fermented *Senna obtusifolia* seed meal (T6) recorded superior live weight, slaughter weight, plucked weight and dressed weight than the other treatment groups. The values (844.33 to 1612.70g) of plucked weight were similar to the values (1033.30 to 1883.30g) obtained by (13) when broiler chickens were fed with raw *Senna obtusifolia* seed meal. The dressed weight and dressing percentage followed similar trend. The cut-up parts that showed significant ($p<0.05$) differences among treatment groups were drumsticks, thighs, neck and shank while the breast, wings and head showed no significant ($p>0.05$) differences among treatment groups. This observation could be attributed to the different processing methods and level of anti-nutritional factors in the feeds. Organs weight such as caeca, abdominal fat, proventriculus and heart showed no significant ($p>0.05$) differences among treatment groups, while liver and intestine were significantly ($p<0.05$) different in all the

treatment groups. The relative weight of liver was heavier ($p<0.05$) in soaked and boiled *Senna obtusifolia* seed meal (T4) treated group. This finding agreed with (16) who fed processed *Senna obtusifolia* seed meal to broiler chickens. The results of carcass characteristics obtained in this study indicates that *Senna obtusifolia* seed meal processed differently can be used at 20% level of inclusion in broiler chicken diets without deleterious effects on carcass yield and organs weight but best results were obtained with fermentation.

**Table 4: Carcass Characteristics and Some Organ Weight of Broiler chickens Fed Differently Processed *Senna obtusifolia* Seed Meal at 20% Level of Inclusion**

| Parameters | T1 (0%) | T2 (BSOSM) | T3 (TSOSM) | T4 (SBSOSM) | T5 (SPSOSM) | T6 (FSOSM) | SEM |
|---|---|---|---|---|---|---|---|
| Live weight (g) | 1733.00$^{a}$ | 1327.70$^{b}$ | 1082.30$^{b}$ | 989.33$^{b}$ | 948.33$^{b}$ | 1745.30$^{a}$ | 81.74$^{*}$ |
| Slaughter wt. (g) | 1658.00$^{a}$ | 1272.30$^{b}$ | 1049.33$^{b}$c | 964.33$^{bc}$ | 895.00$^{c}$ | 1699.00$^{a}$ | 7.97$^{*}$ |
| Plucked wt. (g) | 1612.70$^{a}$ | 1192.00$^{b}$ | 992.00$^{b}$ | 899.00$^{b}$ | 844.33$^{b}$ | 1564.70$^{a}$ | 75.86$^{*}$ |
| Dressed wt. (g) | 1229.00$^{a}$ | 844.33$^{b}$ | 712.33$^{b}$ | 621.00$^{b}$ | 616.00$^{b}$ | 1207.70$^{a}$ | 61.81$^{*}$ |
| Dressing (%) | 70.72$^{a}$ | 63.76$^{bc}$ | 65.77$^{abc}$ | 62.78$^{c}$ | 64.90$^{bc}$ | 69.16$^{a}$ | 1.30$^{*}$ |
| **Cut-up parts** | | | | | | | |
| Drum stick | 10.62 | 9.69 | 9.43 | 9.76 | 9.65 | 10.62 | 0.63$^{NS}$ |
| Thigh | 12.04 | 10.55 | 10.80 | 10.27 | 10.10 | 11.36 | 0.65$^{NS}$ |
| Breast weight | 20.94 | 17.55$^{a}$ | 17.19$^{ab}$ | 15.86$^{ab}$ | 16.08$^{b}$ | 19.69$^{ab}$ | 0.83$^{*}$ |
| Back | 14.72 | 13.66 | 14.45 | 13.43 | 15.15 | 14.43 | 0.77$^{NS}$ |
| Wings | 8.04$^{b}$ | 7.41$^{ab}$ | 8.42$^{ab}$ | 8.30$^{ab}$ | 9.65$^{a}$ | 6.55$^{b}$ | 0.62$^{*}$ |
| Neck | 4.63 | 4.66 | 5.49 | 4.84 | 5.16$^{a}$ | 5.04 | 0.30$^{NS}$ |
| Head | 2.44$^{b}$ | 2.67$^{ab}$ | 2.95$^{ab}$ | 3.10$^{ab}$ | 3.31$^{a}$ | 2.44$^{b}$ | 0.18$^{*}$ |
| Shanks | 4.41 | 5.41 | 5.21 | 4.95 | 5.28 | 4.58 | 0.28$^{NS}$ |
| Empty gizzard | 1.69$^{b}$ | 2.59$^{a}$ | 2.41$^{a}$ | 2.72 | 2.82$^{a}$ | 2.28$^{ab}$ | 0.23$^{*}$ |
| Caeca | 0.54 | 1.06 | 0.52 | 0.94 | 0.84 | 0.46 | 0.25$^{NS}$ |
| Abdominal fat | 2.29 | 5.45 | 2.37 | 1.65 | 1.85 | 1.83 | 1.72$^{NS}$ |
| Proventriculus | 0.54 | 0.62 | 0.61 | 0.63 | 0.56 | 0.42 | 0.07$^{NS}$ |
| Heart | 0.42 | 0.40 | 0.40 | 0.54 | 0.45 | 0.45 | 0.05$^{NS}$ |
| Liver | 1.80$^{ab}$ | 1.95$^{ab}$ | 1.66$^{b}$ | 2.12$^{a}$ | 1.69$^{b}$ | 1.52$^{b}$ | 0.09$^{*}$ |
| Intestine | 5.10$^{ab}$ | 7.12$^{a}$ | 5.52$^{ab}$ | 7.13$^{a}$ | 6.17$^{ab}$ | 4.77$^{b}$ | 0.44$^{*}$ |

a,b,c = Means within the same raw bearing different superscripts differ significantly ($p<0.05$), * = Significant at 5% level of probability ($p<0.0$% NS Not significant ($p>0.05$), SEM = Standard error of means, BSOSM = Boiled *Senna obtusifolia* seed meal, TSOSM = Toasted *Senna obtusifolia* seed meal, SBSOSM = Soaked and boiled *Senna obtusifolia* seed meal, SPSOSM = Sprouted *Senna obtusifolia* seed meal, FSOSM = Fermented *Senna obtusifolia* seed meal, wt = weight

Results of haematological parameters and serum biochemical indices are presented in Tables 5 and 6 respectively. The packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cells (RBC) count, white blood cells (WBC) count, MCV, MCH, MCHC, eosinophils, lymphocytes, monocytes and neutrophils showed no significant ($p>0.05$) differences among all the treatment groups. The PCV values (24.33 to 26.00 %) obtained in this study were lower than the values (30 to 33 %) for normal chickens reported by (17).

This shows that feeding broiler chickens with *Senna obtusifolia* seed meal processed differently at 20 % level of inclusion had adverse effects on PCV. (18) reported that when the PCV values are below the normal range, the chickens were anaemic which inevitably could result in the alteration of other physiological processes including assimilation and utilization of nutrients. The haemoglobin values, red blood cells count and white blood cells count were within normal ranges reported by (17).

Results of serum biochemical indices (Table 6) showed that total protein, albumin, globulin and urea were not significantly ($p>0.05$) different among treatment groups, while glucose, cholesterol and alkaline phosphates were significantly ($p<0.05$) different among treatments. All the values were within the normal ranges reported by (19). This is an indication that the diets were well tolerated by the chickens.

**Table 5: Haematological Parameters of Broiler Chickens as Influenced by Feeding Differently Processed *Senna obtusifolia* Seed Meal**

| Parameters | T1 (Control) | T2 (BSOSM) | T3 (TSOSM) | T4 (SBSOSM) | T5 (SPSOSM) | T6 (FSOSM) | SEM |
|---|---|---|---|---|---|---|---|
| PCV (%) | 25.67 | 24.67 | 26.00 | 25.00 | 26.33 | 24.33 | $0.92^{NS}$ |
| Haemoglobin (Hb) g/dl | 8.53 | 8.17 | 8.63 | 8.30 | 8.77 | 8.08 | $0.31^{NS}$ |
| Red Blood Cell (RBC) count ($10^6$/L) | 17.30 | 19.43 | 19.27 | 17.83 | 18.87 | 19.67 | $0.74^{NS}$ |
| White Blood Cells (WBC) count ($10^3$ cells/L) | 14.26 | 14.80 | 14.13 | 12.67 | 15.53 | 13.80 | $0.79^{NS}$ |
| MCV (fl) | 14.45 | 12.71 | 13.55 | 14.06 | 13.98 | 12.46 | $0.73^{NS}$ |
| MCH (pq) | 4.80 | 4.20 | 4.50 | 4.67 | 4.65 | 4.13 | $0.24^{NS}$ |
| MCHC (%) | 33.24 | 33.10 | 33.20 | 33.19 | 33.20 | 33.11 | $0.06^{NS}$ |
| Eosinophils | 0.67 | 2.00 | 1.00 | 0.67 | 1.67 | 1.33 | $1.14^{NS}$ |
| Lymphocytes | 76.33 | 67.33 | 78.67 | 68.00 | 73.00 | 67.00 | $4.00^{NS}$ |
| Monocytes | 0.00 | 0.00 | 0.00 | 0.33 | 0.33 | 0.00 | $0.19^{NS}$ |
| Neutrophils | 23.00 | 30.67 | 20.33 | 31.00 | 25.00 | 31.67 | $4.67^{NS}$ |
| Basophils | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

NS = Not significant ($p<0.05$), SEM = Standard error of means, BSOSM = Boiled *Senna obtusifolia* seed meal, TSOSM = Toasted *Senna obtusifolia* seed meal, SBSOSM = Soaked and boiled *Senna obtusifoliai* seed meal, SPSOSM = Sprouted *Senna obtusifolia* seed meal, FSOSM = Fermented *Senna obtusifolia* seed meal, MCV = Mean corpuscular volume, MCH = Mean corpuscular haemoglobin, MCHC = Mean corpuscular haemoglobin concentration

**Table 6: Serum biochemical indices of broiler chickens as influenced by feeding differently processed *Senna obtusifolia* seed meal**

| Parameters | T1 (Control) | T2 (BSOSM) | T3 (TSOSM) | T4 (SBSOSM) | T5 (SPSOSM) | T6 (FSOSM) | SEM |
|---|---|---|---|---|---|---|---|
| Total protein (g/L) | 54.67 | 55.67 | 54.67 | 51.00 | 60.33 | 56.33 | $4.20^{NS}$ |
| Albumin (g/dl) | 35.67 | 38.67 | 34.67 | 33.00 | 39.00 | 36.00 | $3.43^{NS}$ |
| Globulin (g/dl) | 19.00 | 17.00 | 20.00 | 18.00 | 21.33 | 20.33 | $1.91^{NS}$ |
| Glucose (mmol/l) | $4.77^{ab}$ | $5.20^{ab}$ | $4.70^{ab}$ | $5.57^{a}$ | $4.00^{b}$ | $4.63^{bc}$ | $0.31^{*}$ |
| Cholesterol mmol/L) | $1.97^{c}$ | $6.67^{ab}$ | $7.97^{a}$ | $7.77^{a}$ | $5.40^{ab}$ | $4.33^{bc}$ | $0.55^{*}$ |
| Urea (mmol/L) | 4.23 | 5.73 | 6.27 | 6.17 | 5.97 | 4.13 | $0.70^{NS}$ |
| Creatinine (mmol/L) | $53.00^{bc}$ | $48.33^{c}$ | $58.67^{abc}$ | $78.00^{abc}$ | $83.33^{ab}$ | $89.33^{a}$ | $7.10^{*}$ |
| Alkaline phosphate (µ/L) | $100.67^{ab}$ | $79.67^{bc}$ | $67.33^{c}$ | $85.33^{bc}$ | $120.33^{a}$ | $85.00^{bc}$ | $5.69^{*}$ |
| Total bilirubin (mmol/L) | 1.77 | 2.10 | 2.37 | 2.13 | 2.07 | 1.40 | $0.30^{NS}$ |
| Conjugated bilirubin (mmol/L) | 3.40 | 4.00 | 3.97 | 4.43 | 3.60 | 2.90 | $0.41^{NS}$ |

a,b,c = Means within the same raw bearing different superscripts differ significantly ($p<0.05$)* = significant ($p<0.05$), NS = Not significant ($p>0.05$), SEM = Standard error of means, BSOSM = Boiled *Senna obtusifolia* seed meal, TSOSM = Toasted *Senna obtusifolia* seed meal, SBSOSM = Soaked and boiled *Senna obtusifoliai* seed meal, SPSOSM = Sprouted *Senna obtusifolia* seed meal, FSOSM = Fermented *Senna obtusifolia* seed meal

**Conclusion and Application**

From the results obtained in this study, it was concluded that:

1. Inclusion of fermented *Senna obtusifolia* seed meal up to 20% had no adverse effects on performance, carcass and health status of broiler chickens.
2. Fermentation as a processing method is effective in reducing the adverse effects of anti-nutritional factors in *Senna obtusifolia* seed meal.
3. Processing methods such as soaking and boiling, toasting and sprouting of *Senna obtusifolia* seed meal can also be used in formulating broiler chickens diets.
4. Poultry farmers are encouraged to collect *Senna obtusifolia* seeds which are naturally produced in abundance in the wild, process them and incorporate in poultry diets to reduce cost of conventional feed ingredients.
5. Further studies should be carried out using other processing methods and with other classes of poultry.

**References**


1. Akinmutimi, A. H. and Onwukwe, C. C. (2002). Effect of cooking with various concentrations of potash on nutrient composition of Lima beans. *Journal of Agricultural Biotechnology* 1:1 – 3.
2. Abu, O.A., Onifade, A.A., Abanikannda, O. T. F. and Obiyan, R. I. (2008). Status and promotional strategies for rabbit production in Nigeria. 9th World Rabbit Congress, June 10 – 13, 2008, Verona, Italy, 1499 – 1504.
3. Tarnopolsky, M. A., Akinson, S. A., Macdonald, J. D., Chesley, A., Philips, S. and Schwarez H. P. (1992). Evaluation of protein requirements for trained athletes. *Journal of Applied Physiology* 73 (5): 1986 – 1995.
4. Oladoja, M. A. and Olusanya, T. P. (2009). Impact of private formulation

and production as a tool for poverty alleviation among poultry farmers in Ogun state, Nigeria. *International Journal of Poultry Science* (10): 1006 – 1010.

5. Nduaka, U. K. (2006). Effects of enzyme supplementation on the utilization of fibrous feed ingredient in broiler diets. M.Sc. Thesis, Animal Science Department, Ahmadu Bello University, Zaria, Nigeria.
6. Augustine, C., Domo, G.A., Ngiki, Y.U., Midiga, R, Abdulrahman, B. S., Tarimbuka, L. I. and Midau, A. (2017). Response of albino rats fed graded levels of raw sickle pod (*Senna obtusifolia*) seed meal. *Proceedings of the 42nd Annual Conference of the Nigerian Society for Animal Production* (NSAP), 26 – 30th March, 2017, Landmark University, Omu-Aran, Kwara state, Nigeria. Pp. 482 – 484.
7. Agness, I. (2011). Invasive species compendium on line data street. Sickle pod (*Senna obtusifolia*) CABI publishing, 2011. *www.cabi.org/isc*.Accessed on 21st August, 2017.
8. Ingweye, J.N., Kalio, G.A., Ubua, J.A. and Umoren, E. P. (2010). Nutritional evaluation of wild sickle pod (*Senna obtusifolia*) seeds from Obanliku, South-Eastern, Nigeria. *American Journal of Food Technology*, 5:1 – 12.
9. Encarta (2007). *Microsoft Students Encarta Dictionary*. Inc. USA. Retrieved March 25, 2017 from http:/commons.wikimedia.org/wiki/commons DVD.
10. Afolayan, S.O., Makinde, A. A., Shuaibu, M., Idris, B. A. Yaduma, J. J. and Yau, M. G. (2013). Rainfall harvesting a sustainable water management alternative for food security in Nigerian *Journal of Agricultural Research and Management*, Article ID sjarm – pp. 136 – 2012.
11. Raji, A. O., Aliyu, J., Igwebuike, J.U., and Chiroma, S. (2009). Effect of storage methods and egg quality traits of laying hens in a hot dry climate. *ARPN Journal of Agriculture and Biological Science*, 4:1 – 7.
12. Statistix (2003). Statistix for windows manual. Analytical Software. Version 8.0.
13. Augustine, C., Kwari, I.D., Igwebuike, J.U., Adamu, S.B., Medugu, C.I., Khobe, D., Babale, D.A.M. and Obidah, L. U. (2017). Nutrient digestibility and growth performance of cockerels fed raw and processed *Senna obtusifolia* seed meal. *Nigerian Journal of Animal Production* 44(4): 198 – 206.
14. Ari, M.M., Ayanwale, B.A. Adama, T. Z. and Olatunji E. A. (2012). Effects ofdifferent fermentation methods on the proximate composition, amino acid profile and some anti-nutritional factors (ANFS) in soya beans (*Glycine max). Fermentation Technology and Bioengineering*, 2: 3 – 2.
15. Hirabayashi, M., Matusi, T., Yanoh, A., and Nakajima, T. (1998). Fermentation of soya bean meal with *Aspergillus usmii* reduces phosphorus excretion in chicks. *Poultry Science*, 77: 552 – 556.
16. Augustine, C. (2017). Response of tropical sickle pod *Senna obtusifolia* seed meal to varying soaking periods. *Researcher*, 9(8): 29 – 32.
17. Jaime, S. (2006). Diagnostic value of Haematology. International Veterinary information service. *Clinical Avian Medicine*, Vol. 11, pp. 608.
18. Kepeme, E.V., Elaluu, V. Koofreh, M.E. and Udensis, O. (2011). Phytochemistry and Haematology potential of ethanol seed, leaf and pulp extracts of carioca

papaya (inn).*Pakistan Journal of Biological Sciences*, 14: 408 – 411.

19. Latrimer, K. S., Mahaffey, E.A. and Prasse, K.W. (Ed). Duncan and Prasse Veterinary Laboratory. Medicine and clinical pathology, 4th edn. Willy-Blackwell, 2003. Reference ranges varying between laboratories.
20. Augustine, C., Kwari I.D., Igwbuike, J.U. and Adamu, S. (2017). Evaluation of chemical composition of raw and processed tropical sickle pod (*Senna obtusifolia*) seed meal. *Agricultural Science and Technology*, 9(2): 110 – 113. Doi: 10.15547/ast.2017.02.019