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# Apparent nutrient digestibility, liver function indices and lipid profile of broiler chickens fed raw and boiled sickle pod (*Senna obtusifolia)* seed meal

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***Target Audience****: Poultry farmers, Nutritionist and Feed producers*

## Abstract

*This study was carried out to determine the apparent nutrient digestibility, liver function and lipid profile of broiler chickens fed raw and boiled Senna obtusifolia seed meal. The experiment was conducted in the Teaching and Research Farm, Department of Animal Science, Ahmadu Bello University, Zaria. Three hundred and thirty (330) day old chicks were used for this study. Chicks were allotted in a complete randomized design to five (5) treatment groups with three (3) replicate having twenty birds per replicate. Five (5) experimental diets were formulated with inclusion of 5% and 10% raw and boiled S. obtusifolia seed meal each at both starter and finisher phases. Data collected were analyzed using the statistical package of SAS and differences between means were separated using Dunnett test. Results showed that there were no significant differences in most parameters measured on apparent nutrient digestibility except for ether extract. The liver enzymes parameters (ALT, AST and ALP) showed no significant differences and were within the normal range as reported in literature. Results obtained from lipid profile showed that significant (P<0.05) differences were observed in total cholesterol and HDL except for triglyceride and LDL. Birds fed 10 % BSOSM had significantly (P<0.05) higher serum cholesterol and HDL than those fed 0% SOSM. Birds fed RSOSM and BSOSM had lower triglycerides values than the control. This indicated that inclusion of S. obtusifolia seed meal in the diets of broiler chickens could reduce the risk of heart problem. It was concluded that inclusion of raw and boiled S. obtusifolia seed meal up to 10% in the diets of broiler chickens had no adverse effect on apparent nutrient digestibility and liver function. However, up to 10% inclusion of S. obtusifolia increased the cholesterol and HDL level in the serum. Lower percentage (less than 10 %) of raw and boiled S.obtusifolia seed meal should be use in the diets of broiler chickens to reduce adverse effect on cholesterol level.*

***Keywords:*** *Nutrient digestibility, liver function, lipid profile, broiler and chicken*

## Description of the Problem

Poultry Industry has witness fast growth and has been a popularly known segment in the livestock sector globally. Increase in the cost of feed resulting from high prices of protein and energy sources has been the major challenge facing the poultry industry (1). The high and increasing prices for animal feeds have compelled researchers to direct their attention to non-conventional feed sources, with particular emphasis on protein substitutes. The use of leguminous multipurpose trees and shrubs has been suggested to be a viable alternative source of proteins, vitamins and minerals for poultry feeding. Laboratory tests on blood constituents (both on haematological and serum indices) are vital tools that will help

detect any deviation from normal in the animal body (2). Serum includes all proteins not used in blood clotting and all the electrolytes, antibodies, antigens, hormones and any exogenous substances. The result of haematology and serum analysis is usually used to assess the health status of an animal. Haematological and serum parameters have been observed as good indicators of the physiological status of animal and their changes are important in assessing the response of such animal to various physiological situations (3). *Senna obtusifolia* is among the leguminous multipurpose trees and shrubs as well as an underutilized plant legume that mostly grows in the wild. The seed have been reported to contain some anti-nutritional factors such as tannins, alkaloid and phytate which affect the digestibility and utilization of nutrients (4). Therefore, the aim of this study was to determine the effect of graded levels of *S. obtusifolia* seed meal on apparent nutrient digestibility and serum biochemical profile of broiler chickens.

## Materials and Methods

### Experimental site

This study was carried out at the Poultry Unit of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria. The site is located on latitude 11˚11' N and longitude 07˚38' E. It is situated at an altitude of 686m above sea level. The mean maximum temperature varies between 26˚C to 35˚C depending on the season, while the mean relative humidity during the wet and dry (harmattan) seasons are 72% and 21% respectively (5). The area has an average annual rainfall of 1080mm as reported by (6).

### Experimental diets, design and management of birds

Five (5) experimental diets were formulated with inclusion of 5% and 10% raw and boiled *Senna obtusifolia* seed meal each for both starter and finisher phases and a control diet without S. *obtusifolia* Three hundred and thirty (330) day old chicks were used for this study. Chicks were allotted in a complete randomized design to five (5) treatment groups with three (3) replicates having twenty birds per replicate. Birds were housed in a deep litter system with water and feed provided *ad-libitum*. Birds were fed the experimental diets from 0-4 weeks and 5-8 weeks respectively. All required vaccination and medication were administered as recommended by Veterinary Teaching Hospital ABU, Zaria.

### Digestibility trial

At the end of the feeding trial, three birds from each replicate making a total of 9 birds per treatment were selected and arranged in clean, separate and disinfected metabolic cages. Three days of acclimatization was allowed prior to the commencement of the trial. A known quantity of feed which matched their previous daily feed intake was fed to them during the digestibility. Excreta collection was done daily for a period of four days. The daily excreta voided by each bird was dried overnight (at 55˚C) while, total collections per bird was pooled at the expiration of 4 days. Dried excreta samples were taken for proximate analysis at the Biochemical Laboratory of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria for determination of nutrient digestibility parameters such as dry matter, crude protein, crude fibre, ether extract and nitrogen free extract using the method as described by (7). Percentage digestibility was calculated using the formula below:

Digestibility % =

$$\frac{\text{Nutrient intake - Nutrient output}}{\text{Nutrient intake}} \times 100$$

**Liver function and Lipid profile study**

At the end of the feeding trial, 2mls of blood was collected from 3 birds per replicate with the aid of sterile syringes and needles via the wing vein. Blood samples were collected into sterilized bottles devoid of Ethylene Di-amineTetra Acetic Acids (EDTA). Samples were taken to Clinical Pathology Laboratory, Faculty of Medicine, Ahmadu Bello University, Zaria for determination of Total protein, albumin, glucose, glubulin, AST, ALT and ALP. The samples were allowed to clot and then centrifuged, serum was then separated and stored at -20ºC according to the methods described by (8).

**Statistical Analysis**

Data obtained from these studies were subjected to analysis of variance (ANOVA) using the general linear model of (9). Significant differences among treatment means were compared using (10).

**Results and Discussion**

Table 1 shows the nutrient digestibility of broiler chicken fed raw and boiled *Senna obtusifolia* seed meal at eight weeks. There were no significant (P>0.05) differences in most of the parameters on nutrient digestibility except for ether extract compared with the control group. This result is similar with the report of (11) who reported no significant (P>0.05) difference in all parameters measured on growth performance and nutrient digestibility of broiler chicken fed processed sickle pod (*S. obtusifolia*) seed meal. The significant (P<0.05) differences obtained in ether extract could possibly be due to variation in laboratory procedure used for analysis. This could also be an indication of higher level of ether present in the feed material. Ash content in this study decreased with increased percentage of boiled seed. Mean values of dry matter ranged from 56.25-61.39%, crude protein ranged from 66.41-69.74%, ether extract values ranged from 79.73-87.79%, crude fibre values ranged from 73.37-80.20% and ash content ranged from 65.05-71.00% respectively.

**Table 1: Apparent nutrient digestibility of broiler chickens fed raw and boiled *Senna obtusifolia* seed meal**

| | Control | RSOSM | | BSOSM | | | |
|---|---|---|---|---|---|---|---|
| Parameter (%) | 0% | 5% | 10% | 5% | 10% | SEM | LOS |
| Dry Matter | 59.86 | 61.12 | 61.39 | 56.25 | 61.35 | 3.73 | NS |
| Crude Protein | 67.67 | 68.54 | 69.74 | 66.41 | 69.68 | 2.75 | NS |
| Ether Extract | 87.79$^{a}$ | 85.51$^{ab}$ | 84.46$^{ab}$ | 79.73$^{b}$ | 83.14$^{ab}$ | 1.88 | * |
| Crude Fibre | 76.79 | 79.98 | 76.99 | 73.37 | 80.20 | 2.39 | NS |
| Ash | 68.67 | 71.00 | 68.34 | 65.05 | 70.12 | 3.06 | NS |
| NFE | 50.77 | 52.15 | 53.22 | 46.66 | 52.03 | 4.72 | NS |

$^{ab}$ means with different superscript on same row are significantly (P<0.05) different, NFE= Nitrogen Free Extract, SEM= Standard Error of Means.*= significant differences, NS= no significance, RSOSM= Raw *Senna obtusifolia* Seed Meal, BSOSM= Boiled *Senna obtusifolia* Seed Meal

Table 2 shows the liver function indices of broiler chickens fed raw and boiled *Senna obtusifolia* seed meal. There were no significant (P>0.05) differences in all the liver function enzyme: total protein, albumin and globulin except for glucose. This result

indicated that the birds were in normal physiological state. The highest value (4.03g/dl) of total protein was obtained in birds fed 10% RSOSM and the lowest (3.67g/dl) was recorded on birds fed 5% and 10% BSOSM which had similar values respectively. Albumin was highest (2.30g/dl) in birds fed 10% RSOSM while the lowest (1.40g/dl) was observed at 5% BSOSM. Total protein and albumin are indicators of protein reserve in the animal body (12). The values recorded for total protein and albumin in this study fell slightly below the normal range as reported by Anon (1980 and (13). Lower values of serum protein and albumin indicate poor seed quality and amount of protein from diet (14 and 15). This could be associated with the source of seed or environmental effect which could lead to stress. The liver enzymes ALT, AST and ALP showed no significance and were within the normal range as reported by (16) and 17). This indicated that RSOSM and BSOSM had no adverse effect on the normal functioning of the liver.

**Table 2: Liver function indices of broiler chickens fed raw and boiled *Senna obtusifolia* seed meal**

| | Reference | Control | RSOSM | | BSOSM | | | |
|---|---|---|---|---|---|---|---|---|
| Parameters | Value | 0% | 5% | 10% | 5% | 10% | SEM | LOS |
| AST (U/L) | 70-220[2] | 79.33 | 88.33 | 89.00 | 81.67 | 90.00 | 3.80 | NS |
| ALT (U/L) | 7-55[4] | 47.33 | 46.67 | 54.33 | 48.67 | 47.00 | 4.75 | NS |
| ALP (U/L) | 40-129[4] | 72.33 | 59.33 | 61.67 | 68.67 | 71.00 | 4.31 | NS |
| Total protein (g/dl) | 5-8[1] | 3.80 | 3.87 | 4.03 | 3.67 | 3.67 | 0.28 | NS |
| Albumin (g/dl) | 2-3.5[3] | 1.60 | 1.67 | 2.30 | 1.40 | 1.47 | 0.32 | NS |
| Globulin (g/dl) | 2.33-3.33[1] | 2.33 | 2.20 | 1.83 | 2.27 | 2.20 | 0.26 | NS |
| Glucose (mg/dl) | 125-200[3] | 159.33[b] | 178.33[a b] | 174.33[b] | 180.33[ab] | 205.33[a] | 8.99 | * |

[ab] means with different superscript on same row are significantly (P<0.05) different, SEM= Standard Error of Mean.*=significant differences,[1]=Anon 1980, [2]=Meluzzi et al 1992, [3]= Jain 1986, [4]=Clinical dianostic division 1990.RSOSM= Raw *Senna obtusifolia* Seed Meal, BSOSM= Boiled *Senna obtusifolia* Seed Meal, AST = Aspartate amino transferase, ALT= Alanine amino transferase , ALP= alkaline Phosphatase

**Table 3: Lipid profile of broiler chickens fed raw and boiled *Senna obtusifolia* seed meal**

| | Control | RSOSM | | BSOSM | | | |
|---|---|---|---|---|---|---|---|
| Parameters | 0% | 5% | 10% | 5% | 10% | SEM | LOS |
| Total cholesterol (mg/dl) | 72.84[b] | 80.73[ab] | 77.24[b] | 88.33[a] | 91.00[a] | 3.21 | * |
| Triglyceride (mg/dl) | 69.04[a] | 45.28[b] | 14.42[c] | 20.93[c] | 21.45[c] | 16.18 | NS |
| LDL (mg/L) | 18.61 | 26.47 | 23.06 | 27.93 | 24.93 | 5.31 | NS |
| HDL (mg/L) | 36.48[ab] | 23.79[b] | 39.76[ab] | 39.47[ab] | 44.62[a] | 5.13 | * |

[abc] means with different superscript on same row are significantly (P<0.05) different LDL=Low density lipoprotein, HDL= High density lipoprotein, SEM= Standard Error of Mean.*=significant differences, RSOSM= Raw *Senna obtusifolia* Seed Meal, BSOSM= Boiled *Senna obtusifolia* Seed Meal

Table 3 shows the lipid profile of broiler chicken fed raw and boiled *Senna obtusifolia* seed meal. There were significant (P<0.05) differences o in total cholesterol and HDL except for triglyceride and LDL. Birds fed 10 % BSOSM had significantly (P<0.05) higher serum cholesterol and HDL while those fed 0% SOSM had the lowest

cholesterol and LDL. This indicates that inclusion of *Senna obtusifolia* seed meal significantly increased the level of both serum cholesterol and HDL. Inhibiting cholesterol absorption from the intestine may reduce cholesterol deposition in poultry and poultry products and this could reduce the problem of coronary diseases in human beings following the consumption of these products (18). Cholesterol values obtained in this study in birds fed RSOSM and BSOSM were slightly higher than the control. This indicates that inclusion of *Senna obtusifolia* seed meal could not inhibit cholesterol synthesis in the liver and absorption from the intestine. High level of LDL reveals bad cholesterol while low level of HDL reveals good cholesterol. Birds fed 5% BSOSM, 10% RSOSM and 10% BSOSM had significantly ($P<0.05$) higher HDL than the control. However, those fed 5% RSOSM had lower HDL than the control. This result disagreed with the report of (19) who reported that plants extracts may lower blood cholesterol in broiler chickens via inhibition of the controlling enzyme for cholesterol synthesis. Lipid metabolites in chicken blood, including the levels of triglycerides, total cholesterol, lipoprotein fractions, as well as the fatty acids profile, are sensitive indicators of fat metabolism intensity (20). High level of triglycerides signifies that there are chances of obtaining excess cholesterol. They are harmful and increase the risk of heart disease (21). Triglycerides values obtained in this study for birds fed RSOSM and BSOSM was lower than that of the control. This indicates that inclusion of *Senna obtusifolia* seed meal in the diets of broiler chickens could reduce the risk of heart problems.

## Conclusion and Applications

1. Inclusion of raw and boiled *Senna obtusifolia* seed meal up to 10% in the diets of broiler chickens had no adverse effect on apparent nutrient digestibility and
2. Up to 10% inclusion of raw and boiled *Senna obtusifolia* seed meal in the diet of broiler chickens did not affect the normal functioning of the liver.
3. Serum cholesterol and HDL of broiler chicken was increased with inclusion of up 10 % *S. obtusifolia* seed meal.
4. Less than 10 % raw and boiled *S.obtusifolia* seed meal is recommended for incorporation in the diets of broiler chickens

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