Nigerian J. Anim, Sci. 2024, 26 (3): 115-123

Growth performance, cut parts and internal organ characteristics of broiler chickens fed raw *Senna obtusifora* seed meal supplemented with enzymes.

[1]Assam E.D.,[1]Inyang, U. A., [1]Udoh, E. I. and [2]Usoro, O. O.

[1]Faculty of Agriculture, University of Uyo, Uyo. P.M.B 1017 Akwa Ibom State.
[2]Faculty of Agriculture, Akwa Ibom University, Mkpat Enin, Akwa Ibom State.
Corresponding author's email: estherdassam@uniuyo.edu.ng 08066227918

Target Audience: Animal Scientists, Poultry Farmers

Abstract

Growth, cut parts and internal organ characteristics of broiler chickens fed raw Senna obtusifolia seed meal (SOSM) supplemented with enzymes was evaluated. 96 day-old unsexed Arbor acre chicks were randomly assigned to 4 dietary treatments of 24 birds, replicated thrice with 8 birds per replicate in a Completely Randomized Design. The dietary treatments 1, 2, 3 and 4 contained 0%, 5%, 7.5% and 10% raw SOSM, with each diet supplemented with 20 g/100 kg Maxigrain® enzymes, except T1 diet (control) at starter and finisher phases, which lasted 56 days. At the end of the experiments, growth parameters were evaluated. Also one bird per replicate whose weight was close to the mean, was selected for evaluation of carcass and internal organs characteristics and data were expressed as percentage of dressed weight. All data were subjected to one-way analysis of variance. The results showed that broiler chickens fed raw SOSM supplemented with enzymes did not significantly (P>0.05) influenced all the growth parameters. The final live weights ranged from 1833.33 g to 2363.33 g. Also, carcass characteristics of broiler chickens showed no significant differences (P>0.05) in all the parameters except the wings. However, the final live weight before slaughter numerically decreased from 2034.33 g for birds fed T1 diet to 1942.33 g for birds fed T4 diet. There was significant difference (P<0.05) in the mean values of broiler chicken wings fed raw SOSM supplemented with enzymes. Birds fed T3 diet recorded the highest value of 10.84, which was significantly different from birds fed T2 diet (8.81). There was numerical decrease in mean weights of liver and kidney across treatments with increasing dietary of raw SOSM, supplemented with enzyme. In conclusion, raw SOSM could be fed up to 10% inclusion level, with enzyme supplementation, to broiler chickens without any adverse effects on their growth, cut parts and internal organs parameters.

Keywords: Enzymes, Senna obtusifolia, growth, carcass, broiler chickens

1. Description of problem

Animal feed situations in Nigeria today are a national issue and have become one of great concern. The average price of a 25kg bag of poultry feed which was five naira in 1976, rose to twelve naira in 1980, twenty-one naira in 1985, and seventy naira in 1990 (1). Ukachukwu (1997) reported that in 1997, the

price was six hundred and fifty naira. Today, the average price of a 25kg bag of poultry feed stands at a staggering figure of twenty-five and twenty-nine thousand naira. With these trends, fewer people are getting involved in raising animals. The implication is that there is a fall in animal protein supply to meet the needs of Nigerians. This, therefore calls for solutions to check the steadily increasing prices of feeds to encourage more people to get back into poultry production and increase animal protein supply.

One such solution involves the use of alternative, cheap feedstuff like *Senna obtusifolia* seed meal to achieve the least cost ration for poultry, especially broiler chickens (2). *Senna obtusifolia* (synonyms *Cassia tora, Cassia obtusifolia*) was originally described by Linnaeus as such (3; 4). It is also known as sicklepod, foetid cassia, sickle senna, Chinese senna, coffee weed, coffee pod, java bean, or arsenic weed. It is a dicot legume plant in the family *Fabaceae*, subfamily *Caesalpinoideae,* and genus *Senna*. Assam *et al.* (2017) reported that raw *Senna obtusifolia* seeds contained 88.50% dry matter, 11.50% moisture, 9.63% crude protein (CP), 2.0% ether extract (EE), 10.0% crude fibre (CF), 5.0% Ash, 73.37% Nitrogen Free Extract (NFE) and 3.594 Kcal/g gross energy. However, raw SOSM contains anti-nutritional factors (ANFs) such as saponins, alkaloids, and phenolic compounds (2), which makes it difficult for the chickens (poultry) to utilize nutrients efficiently, resulting in poor weight gain negatively impacting broiler performance. It was in light of the foregoing that this research was undertaken to evaluate the growth performance, cut parts and internal organ characteristics of broiler chickens fed raw *Senna obtusifolia* seed meal (SOSM) supplemented with enzymes.

Materials and Methods

Study Location

The research was conducted at the Poultry Unit of the Department of Animal Science, Departments of Animal Science and Biochemistry Laboratories, University of Uyo, Uyo, Akwa Ibom State. Uyo is located on latitude $4^0 59^1$ and $5^0 04^1$N and longitude $7^0 53^1$ and $8^0 00^1$E, with an elevation of about 60.96m above sea level. Uyo has a bi-modal rainfall pattern with mean annual rainfall of 2190mm and mean relative humidity of 81% (University of Uyo Meteorological Station Report, 2022).

Experimental animals and diets

Mature dried pods of *Senna obtusifolia* were obtained from Bauchi State and dehulled to release the raw seeds, which were ground and stored for feed formulation. Ninety-six unsexed Arbor acre chicks were randomly allotted to four treatments, replicated thrice with 8 birds per replicate. The four (4) treatments designated as T1 to T4 were diets formulated such that Treatments 1, 2, 3 and 4 diets contained 0%, 5%, 7.5% and 10% raw SOSM. Maxigrain®, a multi-grade feed enzyme, was added at 20 g/100 kg to each of the diets, except T1 diet, which served as control at both starter and finisher phases. The birds were raised in a deep litter system. Both the diets and water were provided *ad libitum*. Necessary vaccinations and medications were administered. The experiment lasted for 56 days.

Growth parameters evaluated were initial weight, final weight, weight gain, average feed intake, feed conversion ratio, feed efficiency ratio and mortality.

Carcass characteristics and internal organs

At the end of the experiments, one bird whose weight was close to the mean weight per replicate was selected for evaluation of carcass quality and internal organs according to procedures described by (5) and data was expressed as a percentage of dressed weight.

Statistical analysis and design

Data were analyzed using a one-way analysis of variance and significant means were separated using the Duncan Multiple range test using SPSS version 25.0.

Results and Discussion

Growth performance

There was no significant difference (P>0.05) on all growth parameters of broiler chickens fed raw SOSM diets supplemented with enzymes, as presented in Table 3. The final live weights of birds fed with the control (0%), T2 (5%), T3 (7.5%) and T4 (10%) inclusion levels of raw SOSM supplemented with enzymes did not differ significantly, however, there were numerical differences across treatment means. Birds fed with T1 diet had the highest numerical value of 2363.33g, T2 and T4 had similar numerical value of 1900.00g and T3 had the lowest numerical value of 1833.33g. This could be attributed to the effect of supplementation with feed grade enzymes on raw SOSM. Adeola and Cowieson (6), reported that the use of exogenous enzymes in non-ruminant diets, enhances nutrient utilization, reduces anti-nutritional factors and improves gut health. This present result agreed with (7), who reported that there were no significant (P > 0.05) difference in final live weight of broilers fed oven dried SOSM. This present result however disagreed with (2) who reported that raw SOSM, without enzyme supplementation above 5% level of inclusion reduces final live weight. The weight gain obtained from the current study were 2328.08 g, 1864.75 g, 1798.08 g and 1864.75 g for birds fed T1, T2, T3 and T4 respectively. It was observed that the birds fed T1 diet had the highest numerical value of 2328.08 g, while birds fed T2 and T4 diet had similar value of 1864.75 g and birds fed T3 diet had the lowest numerical value of 1798.08 g. This could be attributed to the action of enzymes supplementation on anti-nutritional factors of the raw SOSM. Aderemi *et al.* (11), reported that the combination of enzymes resulted in the highest improvement in weight gain, feed conversion ratio and nutrient digestibility compared to individual enzymes supplementation. Enzymes mitigate the negative effects of anti-nutritional factors by breaking down or inactivating compounds (8). This present result agreed with. (7), who reported that SOSM inclusion at high level increased body weight gain of poultry chicken fed oven dried SOSM. The value obtained by the authors for body weight gain for T1 diet was 2040.07 g, T2 2049.77 g, T3 2049.11 g and T4 diet 2043.90 g at 0%, 5%, 10% and 15% respectively. However, the values for weight gain obtained by the authors were significantly (P < 0.05) higher than the value obtained for this study. However, the results disagreed with the study carried out by (12), who reported that birds fed with high levels of raw SOSM had poor performance in terms of body weight and weight gain. The results for average daily weight gain obtained from this study were 41.57 g, 33.29 g, 32.11 g and 33.29 g for the control, T2, T3, and T4 diets respectively. The improved performance may be due to increase in nutrient digestibility caused by the supplementation

TABLE 1: Composition (% DM) of experimental Starter diet

Ingredients %	**Levels**	**Of**	**Inclusion**	**(%)**
	T1 (0%)	T2 (5.0%)	T3 (7.5%)	T4 (10%)
Maize	50.0	45.0	42.5	40.0
Soya bean meal	33.81	33.79	33.74	33.69
SOSM	-	5.0	7.50	10
Enzymes	0.0	0.02	0.02	0.02
Palm kernel meal	10.00	10.00	10.00	10.00
Fishmeal	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Vit/TM premix*	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**
Calculated Nutrients				
Crude Protein	23.00	23.00	23.00	23.00
ME (Kcal/g)	2850	2832	2813	2795

*1kg of premix contains vitamins A (5,000,000Iu), Vitamin D_3 (1,000,000 1U), Vitamin E (16,000mg), vitamin K_3 (800mg), vitamin B_1 (1,200mg), Vitamin B_2 (22,000mg), Niacin (22,000mg), Calcium pantothenate (4,600mg), Vitamin B6 (2000mg), Vitamin B_{12} (10mg), Folic acid (400 mg), Biotin (32mg), Choline chloride (200,000mg), Manganese (48,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg), iodine (600mg), Cobalt (120mg), Selenium (40mg), antioxidant (48,000mg).
SOSM – *Senna obtusifolia* seed meal

of the enzyme. A trial by (13), demonstrated that a combination of xylanase and phytase improved nutrient digestibility and growth rates in broilers. A research carried out by (14), indicated that enzyme supplementation can lower feed cost by improving nutrient digestibility and allowing the use of alternative feed ingredients. This result agreed with (7), who reported that broiler chickens fed with oven-dried *Cassia tora* seed meal showed no significant differences in daily weight gain across the treatment. This result disagreed with. (2), who reported that the average daily weight gain was decreased at 7.5% and 10% inclusion levels of raw *Senna obtusifolia* seed meal. The non-significant dietary effects on the feed intake could point to the ability of the broiler chickens to tolerate contents of anti-nutritional factors in raw SOSM with the help of the enzyme in the diets. Ravindran (14), reported that enzymes help in maintaining gut health by reducing the presence of anti-nutritional factors and improving the balance of beneficial bacteria in the gastrointestinal tract, which can lead to reduced incidences of digestive disorders and improved immune function. This agreed with Muhammad (16), who reported that the daily feed intake was not significantly influenced by the replacement of full fat soya bean for soaked-toasted *Senna obtusifolia* seed meal in the diets. The value obtained by the authors for average daily feed intake for T1 diet was

TABLE 2: Composition (% DM) of experimental Finisher diet

Ingredients %	**Levels** T1 (0%)	**Of** T2 (5.0%)	**Inclusion** T3 (7.5%)	**(%)** T4 (10%)
Maize	53.0	45.50	43.0	40.50
Soya bean meal	26.00	26.00	26.00	26.00
SOSM	-	5.00	7.50	10.00
Enzymes	0.0	0.02	0.02	0.02
Palm kernel meal	15.00	15.00	15.00	15.00
Fishmeal	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00
Methionine	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20
Vit/TM premix*	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**
Calculated Nutrients				
Crude Protein	20.00	20.00	20.00	20.00
ME (Kcal/g)	2903	2870	2852	2833

*1kg of premix contains vitamins A (5,000,000Iu), Vitamin D_3 (1,000,000 1U), Vitamin E (16,000mg), vitamin K_3 (800mg), vitamin B_1 (1,200mg), Vitamin B_2 (22,000mg), Niacin (22,000mg), Calcium pantothenate (4,600mg), Vitamin B6 (2000mg), Vitamin B_{12} (10mg), Folic acid (400mg), Biotin (32mg), Choline chloride (200,000mg), Manganese (48,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg), iodine (600mg), Cobalt (120mg), Selenium (40mg), antioxidant (48,000mg).

Table 3: Growth performance of broiler chickens fed raw *Senna obtusifolia* seed meal (SOSM) supplemented with enzymes

	LEVELS OF INCLUSION				
PARAMETERS	**T1 (0%)**	**T2 (5%)**	**T3 (7.5%)**	**T4 (10%)**	**SEM**
Initial Wt (g)	35.25	35.25	35.25	35.25	0.01
Final Wt (g)	2363.33	1900.00	1833.33	1900.00	127.96
Weight Gain (g)	2328.08	1864.75	1798.08	1864.75	127.96
ADWG (g/b)	41.57	33.29	32.11	33.29	2.28
ADFI (g/b/d)	82.16	109.36	135.59	116.56	11.76
FCR	1.97	3.27	4.22	3.50	0.01
FER	0.50	0.30	0.23	0.28	0.20
Mortality	0	1	1	0	0.01

a,b means with the same superscript across treatment means are significantly different ($p < 0.05$), SEM = standard error of mean, Wt = weight, ADWG = average daily weight gain, ADFI = average daily feed intake, FCR = feed conversion ratio, DPI = daily protein intake, PER = protein efficiency ratio, SOSM = *Senna obtusifolia* seed meal.

93.53g, T2 97.01g, T3 84.72g and T4 diet 80.56g. at 0%, 5%, 10% and 15% respectively. However, the values for average daily feed intake for T1 diet obtained by the authors were significantly ($P < 0.05$) higher than the value obtained for T1 diet of this study while T2, T3 and T4 diets values obtained by the authors were significantly ($P < 0.05$) lower than the values of T2, T3 and T4 diets of this study. However, this disagreed with (15), who reported a significantly ($P < 0.05$) lower feed intake in broiler Chickens fed differently processed *Cassia tora* seeds. It also disagreed with (16), who reported that overall feed intake and weight gain of birds fed *Leucaena leucocephala* seed meal were decreased as dietary inclusion of raw *Leucaena* seed increased. The value of feed intake obtained by the authors for T1 diet was 721.15 g, T2 806.42 g, T3 741.25 g and T4 diet 682.21 g for 0%, 3%, 6% and 9% respectively. The non-significant difference ($P>0.05$) results for feed conversion ratio obtained from this study showed that efficiency of energy utilization was better on birds fed on enzymes supplemented diets.

Carcass characteristics and Cut parts

The effect of raw Senna obtusifolia seed meal supplemented with enzymes on cut parts (expressed as a percentage of dressed weight) of broiler chickens is as presented in Table 4. There was no significant difference ($P>0.05$) observed in all the parameters measured except the wings. The non-significant difference in the cut parts showed that the chickens were not affected in the finisher phase by different dietary levels of raw Senna obtusifolia seed meal supplemented with feed-grade enzyme. There were no established trends in mean values of some cut part parameters measured with the increasing inclusion of raw S. obtusifolia seed meal in broiler diets. But (2) however reported that the cut parts of finisher broilers fed raw SOSM without enzyme supplementation, decreased with increasing dietary inclusion of the experimental diet. The final live weight before slaughter in this study decreased from 2034.33 g for birds fed the T1 diet (0% SOSM) to 1942.33 g for birds fed the T4 diet (10 % SOSM). It was also observed that values of dressed weights decreased with increasing dietary inclusion of raw SOSM, supplemented with enzyme. The values for

Table 4: Cut parts of broiler chickens (expressed as a percentage of dressed weight) fed raw *Senna obtusifolia* seed meal (SOSM) supplemented with enzymes

	LEVELS OF INCLUSION				
PARAMETERS	T1 (0%)	T2 (5.0%)	T3 (7.5%)	T4 (10%)	SEM
Final Live weight (g)	2034.33	2017.33	1995.67	1942.33	21.15
Dressed weight (g)	1869.67	1839.67	1824.33	1777.00	22.69
Dressing percentage (%)	91.89	91.15	91.39	91.47	0.27
Breast cut (exp as % of DW)	29.06	27.93	26.52	29.04	0.64
Back cut	14.63	14.11	14.85	14.61	0.29
Drum stick	11.66	12.07	12.53	12.18	0.21
Thigh	11.99	12.03	11.88	12.05	0.22
Wings	9.27^{ab}	8.81^{b}	10.84^{a}	9.00^{ab}	0.34
Full intestine	4.51	4.93	3.65	4.62	0.40

^{a,b} Means of different superscripts across the rows show significant differences ($P<0.05$).

dressed weights were (T1) 1869.67 g, (T2) 1839.63 g, (T3) 1824.33 g, and (T4) 1777.00g. The dressing percentage ranged from 91.89% for birds fed control (T1) diet to 91.15% for birds fed T4 diet. There was a significant difference ($P<0.05$) in the mean values of wings of broiler chickens fed raw SOSM, supplemented with. Birds fed the T3 diet recorded the highest value of 10.84, which was not significantly different from 9.27 and 9.00 recorded for birds fed the T1 and T4 diets. The lowest value of wings (8.81) was recorded for birds fed a T2 diet. Assam et al. (2) however concluded that above 5% dietary level of inclusion of raw SOSM, without enzyme supplementation, the rate of tissue deposition in the breast and back cuts were reduced. The thighs, drumstick, and wings were however, slightly higher than the values of 12.95, 11.67, and 8.21%, respectively reported by (10).

Internal organs

The results of internal organs in this present study are presented in Table 5. There was no significant difference ($P>0.05$) in all the parameters measured. It was however observed that the numerical mean weights of the liver and kidney across treatment means decreased with increasing dietary inclusion of raw SOSM. This may be due to the enzyme supplementation. Enzymes can mitigate the negative effects of ANFs by breaking down or inactivating these compounds (6), thus lessening the pressure of detoxification by the liver. Ukachukwu (10) reported that the liver is a target and detoxification organ, hence, an increase in its activity may result in its enlargement and probably increased weight. The result however contrasted an earlier report by (2) who reported significant differences in the liver weights of birds fed the same SOSM at the same dietary levels, without enzyme supplementation. The results of this study aligned with (9) who reported a decrease in the weight of the liver when raw lima beans were fed to broiler chickens. From the results of this study, birds fed T4 diet (10% SOSM), containing the highest level of raw SOSM and possibly ANFs could have increased the activities of the liver and kidney, resulting in its enlargement. However, this was not the case, as birds fed T4 diet recorded the lowest mean

Table 5: Internal Organs Characteristics of broiler chickens (expressed as a percentage of dressed weight) fed raw *Senna obtusifolia* seed meal (SOSM) supplemented with enzymes

	LEVELS OF INCLUSION				
PARAMETERS	T1 (0%)	T2 (5.0%)	T3 (7.5%)	T4 (10%)	SEM
Liver	1.84	1.77	0.49	0.61	0.03
Heart	0.39	0.41	0.40	0.42	0.01
Lungs	0.65	0.52	0.49	0.61	0.03
Kidney	1.36	0.60	0.58	0.55	0.17
Empty gizzard	2.13	1.97	2.07	2.24	0.01
Spleen	0.05	0.05	0.05	0.05	0.00
Pancreas	0.22	0.26	0.17	0.28	0.02
Proventriculus	0.51	0.48	0.52	0.46	0.01
Abdominal fat	0.92	0.53	1.01	0.40	0.14
Gall bladder	0.15	0.14	0.14	0.16	0.14

values of liver and kidney, which could be attributed to the effect of the enzymes supplementation in the diets.

Conclusion and applications

1. Raw Senna obtusifolia seed meal (SOSM) could be fed at a 10% inclusion level, with enzyme supplementation, to broiler chickens without any adverse effects on their growth performance.
2. Raw Senna obtusifolia seed meal (SOSM) could be fed at a 10% inclusion level, with enzyme supplementation, to broiler chickens without any adverse effects on their carcass and internal parameters.

Acknowledgments

The authors are grateful to TETFUND for the sponsorship of this research through their 2023 IBR intervention program.

References

1. Obioha, F.C. (1992): Alternative Raw Materials and Feed Formulations for Profitable Livestock Enterprise. National Seminar on Agricultural Production and Resource Infrastructure in Nigeria Organized by Greenwoods Ventures LTD and ADP held in Owerri, Imo State.
2. Assam, E.D., Ndelekwute, E. K. and Okonkwo, A. C. (2017): Nutritional evaluation of sicklepod (Cassia tora) seed meal in broiler chickens diet. International Journal of Agriculture, Environment and Bioresearch 2(3): 471 – 482.
3. ILDIS (International Legume Database and Information Service) (2005): Senna tora L. roxb. Version 10.01, November 2005. Retrieved 2007-Dec-20.
4. Nature Serve (2007): Senna tora (L.) Roxb Species Factsheet Version 6.3, 2007 – Oct., 29. Retrieved 2007. Dec. -20
5. Ojewola, G.S. and Longe, O.G. (1999): Comparative Response and Carcass Composition of Broiler Chickens fed Varying Protein Concentration. ASAN Conference Proceedings pp 69-72.
6. Adeola, O. and Cowieson, A. J. (2011): Board-invited review: opportunities and challenges in using exogenous enzymes to improve non-ruminant animal production. Journal of Animal Science, 89(10), 3189-3218.
7. Ndak, U. U., Usoro, O. O., Christopher, G. I., Okonkwo, A. C. and Ekaette, I. E (2022): Comparative evaluation of partial replacement of soybean meal with raw and oven-dried Cassia tora seed meal on the performance of broiler chickens. Global Journal of Agricultural Sciences Vol. 21,: 27-35
8. Oluyemi, J.A and Roberts, F.A. (2007). Poultry Production in Warm-Wet Climates. Revised ed. Spectrum Books Limited Ibadan Nigeria. 256 Pp.
9. Ologhobo, A. D., Mosenthin, R. and Alaka, O. O. (2003): Histological alteration in the internal organs of growing chicks from feeding raw Jack beans or lima beans. Veterinary Journal of Human Toxicology 45(1):10 – 13.
10. Ukachukwu, S. N. (2015): Killers to edibles: A key to sustainable livestock and national development. 22nd Inaugural lecture of Michael Okpara University of Agriculture, Umudike. Pp 1-30.
11. Aderemi, F. A., Lawal, T. E. and Onilude, A. A. (2019): Synergistic Effects of Multiple Enzyme Supplementation on

the Performance and Nutrient Digestibility of Broiler Chickens. Nigerian Journal of Animal Production, 41(3), 123-133.

12 Makama, A. J. Salako, R. A. and Ajiyi, O. O. (2020): National Evaluation of sickle pod (Casia tora) Seed meal in broiler birds. International Journal of Agriculture, Environment and Bioresearch 2(3):471-482.

13 Meng, X., Slominski, B. A., Nyachoti, C. M., Campbell, L. D. and Guenter, W. (2005): Degradation of cell wall polysaccharides by combinations of carbohydrase enzymes and their effect on nutrient utilization and broiler chicken performance. Journal of Poultry Science, 84(1), 37-47.

14 Ravindran, V. (2013): Feed enzymes: The science, practice, and metabolic realities. Journal of Applied Poultry Research, 22(3), 628-636.

15 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 Nigeria Journal Animal Production. Volume 44, pp. 198-206

16 Mohamed, E. A and Khadiga, A. A. (2009): Chemical composition and amino acids Profile of Leucaena leucocephala Seeds. International Journal of Poultry Science 8 (10): 966-970.