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How Diets Containing Raw *Senna Obtusifolia* Seed Meal Supplemented with Multi-Enzymes Affected Performance and Blood Characteristics of Finisher Broiler Chickens

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ABSTRACT: This study was conducted to evaluate how raw *Senna obtusifolia* seed meal (SOSM) supplemented with multi-enzymes affected performance and blood characteristics of finisher broiler chickens. Ninety-six-day-old unsexed broiler chicks of agrited strain were randomly assigned to 4 dietary treatments of twenty-four (24) birds each. Each treatment was replicated thrice with eight (8) birds per replicate in a Completely Randomized Design (CRD). 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. Initial weights of the birds were taken before commencement of the experiment and subsequently on weekly basis till the end of the experiment, which lasted for 56 days. At the end of the experiment, one bird per replicate was selected for collection of blood for hematological parameters. This was done by severing the jugular veins of the birds and blood collected into sterile sample bottles containing EDTA as anti-coagulant. The samples were immediately taken to the laboratory for analysis, using digital hematology analyser. Performance parameters evaluated were initial weight, final weight, weight gain, average feed intake, feed conversion ratio, feed efficiency ratio, daily protein intake and protein efficiency ratio. Data obtained were subjected to Analysis of variance using SPSS version 25 and significant difference was determined using Duncan New multiple range test using SPSS version 25.0.The results showed that enzymes supplementation in finisher broiler chickens diets fed with raw SOSM did not significantly ($P > 0.05$) influenced all the performance parameters. The final live weights were 2363.33 g, 1900.00 g, 1833.33 g and 1900.00 g for birds fed with T1, T2, T3 and T4 diets. Also, the average daily weight gain were 41.57 g, 33.29 g, 32.11 g and 33.29 g for birds fed with T1, T2, T3 and T4 diets respectively. The average daily feed intake were 82.16, 109.36, 135.59 and 116.36 g/b/d for birds fed with T1, T2, T3 and T4 diets respectively. The feed conversion ratio obtained were 0.04 g, 0.06 g, 0.07 g and 0.06g.

It was also observed that enzymes supplementation in finisher broiler chickens diets containing raw SOSM did not significantly ($P >0.05$) influenced all the hematological indices measured.

From the results, non-significant difference ($P>0.05$) was observed for all hematological parameters measured, except white blood differentials. This suggested that the diet was not toxic to the animals. The PCV values ranged from 30.83% to 34.46% for birds fed T1 to T5 diets. Values of white blood cells (WBC) ranged from 50.06 to 58.43 across treatments. The values of hemoglobin (Hb) obtained in this study ranged from 11.33 g/dl to 12.10 g/dl. The red blood cells (RBC) values ranged from 2.50 x10^6µl to 2.70 x 10^6 µl. It was further observed that birds fed T2 and T5 diets recorded numerically lower RBC values of 2.52 and 2.50 x 10^6µl respectively. The mean values of platelets obtained in this study ranged from 1.33 for birds fed T2 diet to 5.00 for birds fed T5 diet. Others were 6.67 for T1 diet, 3.67 for T3 diet and 4.33 for T4 diet.

Apart from basophils, all other WBC differentials showed significant (P<0.05) difference. There was significant (P<0.05) difference in the neutrophils and values obtained were 52.53 (T1), 55.00 (T2), 63.43 (T3), 56.70 (T4) and 45.46% (T5). The results of MCH, MCV and MCHC values of birds obtained in this study suggested the ability of the birds to withstand stress. The lipid Profile of broiler chickens fed PGLM showed no significant difference (P>0.05) in all parameters measured, except high density lipoproteins (HDL), which differed significantly (P<0.05) across treatment means. The values of total cholesterol (TC) did not differ significantly but ranged from 2.30 to 2.94mg/dl. However, means across treatments were 2.93mg/dl, 2.84mg/dl, 2.94, 2.30 and 2.92mg/dl for birds fedT1, T2, T3, T4 and T5 diets in that order. Mean values of triacylglycerol obtained across treatments were 0.59, 0.41, 0.73, 0.65 and 0.45 for birds fed T1 - T5 diets. There was significant difference (P<0.05) in the values of high density lipoproteins (HDL) for birds fed *P. guineense* leaf meal. The values of HDL obtained in this study ranged from 1.69 – 2.31mg/dl. The lowest value of 1.69mg/dl was obtained in birds fed T4 (7.5% PGLM) diet while the highest value of 2.31mg/dl was obtained in birds fed control (T1 – 0%PGLM) diet. Mean values of HDL obtained across treatment in this study were 2.31, 2.19, 2.25, 1.69 and 2.05 mg/dl for birds fed T1 to T5 diets respectively. It was further observed that HDL values for birds fed T1, T2, T3 and T5 were statistically similar but differ significantly from HDL values of broiler chickens fed T4 diet. The low density lipoproteins (LDL) and very low density lipoproteins (VLDL) were not significantly different across treatment means.

In conclusion, supplementation of multiple enzymes effectively enhanced the utilization of raw SOSM at 10% level of inclusion in finisher broiler chickens diets by improving overall growth performance, without any deleterious effect on the birds, as observed in the hematological results.

KEYWORDS: Raw Senna obtusifolia seed meal, performance, hematology, finisher chickens.

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BACKGROUND INFORMATION

Poultry is a rapid growing business in Nigeria just like it is all over the world. As a result, it is important and pertinent that more research is carried out to add to the existing body of knowledge. However, high cost of conventional feed ingredients and feeds have resulted in the decline in production and profit of the poultry industry. The feed crises facing the Nigerian livestock industry can be minimized by harnessing the nutritional potential of wild legume seeds that are predominant in Nigeria (Augustine *et al*., 2016). The seeds of *Senna obtusifolia* are one of such seeds, which have good potential as alternative, cost effective source of energy in monogastric diet, especially broilers (Assam *et al.,* 2017). According to Assam *et al.* (2017), *Senna obtusifolia* seeds meal (SOSM) could serve as energy rich feed for livestock and birds, having contained crude protein up to 9.63%. However, SOSM contains anti-nutritional factors (ANFs) such as saponins, alkaloids, and phenolic compounds, which can negatively impact broiler performance (Augustine *et al.,* 2014; Assam *et al.,* 2017). ANFs in SOSM can reduce nutrient absorption, impair gut health, and decrease broiler performance, leading to economic losses (Ingweye *et al.,* 2010). Saponins, in particular, can reduce nutrient absorption by forming complexes with nutrients, making them unavailable to the bird. Alkaloids and phenolic compounds can also impair gut health by reducing the integrity of the gut epithelium and increasing inflammation (Augustine *et al.,* 2014). The negative effects of ANFs in SOSM necessitated the use of feed grade enzymes to mitigate their effects. Feed grade enzymes are biologically active proteins added to animal feeds to enhance the digestion and absorption of nutrients (Adeola and Cowieson, 2011). Enzymes like protease, amylase, and xylanase can break down protein, carbohydrates and fibre enhancing nutrient availability (Adeola and Cowieson, 2011). Enzyme supplementation has improved nutrient digestibility in broiler performance in various studies. Enzymes can also mitigate the negative effects of ANFs by breaking down or inactivating these compounds (Adeola and Cowieson, 2011).

The use of feed grade enzymes in broiler production has several benefits, including improved nutrient digestibility, increased feed efficiency, and reduced environmental impact. According to Bedford and Cowieson (2012), enzyme supplementation in broiler diets can improve nutrient utilization, leading to better gut health and reduced susceptibility to pathogenic bacteria, making them a more sustainable option. However, there is paucity of information on how raw *senna obtusifolia* seed meal supplemented with multi-enzymes affected performance and blood characteristics of finisher broiler chickens. Hence the need for this study.

MATERIALS AND METHODS

The research was carried out at poultry unit of the Teaching and Research farm, Departments of Animal Science and Biochemistry Laboratories located in the Annex campus of the University of Uyo, Uyo, Akwa Ibom State, Nigeria. Uyo is situated on latitude 5°17' and 5°27' North and longitude 7°27' and 5°58' East of the Greenwich. Its climatic condition are temperature ranges between 26° to 28°, average annual rainfall ranges between 2000mm to 3000mm and relative humidity ranges between 78% to 93% (Eko *et al.,* 2014). 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 broiler chicks of agrited strain 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. Initial weights of the birds were taken before commencement of the experiment and subsequently on weekly basis. Performance parameters evaluated were initial weight, final weight, weight gain, average feed intake, feed conversion ratio, feed efficiency ratio, daily protein intake and protein efficiency ratio. At the end of the experiment, one bird per replicate was selected for collection of blood for hematological parameters. This was done by severing the jugular veins of the birds and blood collected into sterile sample bottles containing EDTA as anti-coagulant. The samples were immediately taken to the laboratory for analysis, using digital hematology analyzer. The parameters analysed for were red blood cells, hemoglobin, white blood cells, differentials, platelets etc. All data collected were analyzed using a one-way analysis of variance (ANOVA) and significant means were separated using the Duncan Multiple range test using SPSS version 25.0.

RESULTS AND DISCUSSION

The results of the performance of finisher broiler chickens fed raw *Senna obtusifolia* seed meal (SOSM) supplemented with feed grade enzymes is as presented in Table 3. There was no significant difference ($P > 0.05$) observed in all the performance parameters measured. The initial weights of the birds were 35.25 g across treatment means. The absence of the significant difference is an indication that the treatment effects of the diet were yet to be impacted as at the time the initial weight was taken. There was no significant ($P > 0.05$) difference in the final weight of finisher broiler chickens fed with the control (0%), T2 (5%), T3 (7.5%) and T4 (10%) inclusion levels of raw SOSM. 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 feed grade enzyme on birds fed raw SOSM. Adeola and Cowieson (2011), 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 Ndak *et al.* (2022), who reported that there were no significant ($P > 0.05$) difference in final live weight of broilers fed oven dried SOSM. The value the author obtained for final body weight for T1 diet was 2078.74 g, T2 2088.67 g, T3 2087.81 g and T4 diet 2082.70 g at 0%, 5%, 10% and 15% respectively. However, the values for final live weight obtained by the author were significantly ($P < 0.05$) higher than the value of this study. This present result however disagreed with Assam *et al.* (2017) who reported that raw SOSM above 5% level of inclusion reduces final live weight. There was also no significant ($P > 0.05$) difference across treatment means in the weight gain of birds fed raw SOSM supplemented with feed grade enzyme. Although numerical differences existed between the treatment groups. 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 multiple enzymes on anti-nutritional factors of the raw SOSM. Aderemi *et al.* (2019), 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 (Adeola and Cowieson, 2011). This present result agreed with Ndak *et al.* (2022), 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 Makama *et al.* (2020), 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 of the enzyme. A trial by Meng *et al.* (2005), demonstrated that a combination of

xylanase and phytase improved nutrient digestibility and growth rates in broilers. A research carried out by Ravindra, (2013), indicated that enzyme supplementation can lower feed cost by improving nutrient digestibility and allowing the use of alternative feed ingredients. This result agreed with Ndak *et al.* (2022), who reported that broiler chickens fed with oven-dried *Cassia tora* seed meal showed no significant differences in daily weight gain across the treatment. The value obtained by the authors for average daily weight gain for T1 diet was 36.63 g, T2 36.60 g, T3 36.59 g and T4 diet 36.50 g at 0%, 5%, 10% and 15% respectively. However, the values for average daily weight gain for T1 diet obtained by the authors were significantly ($P < 0.05$) lower than the value obtained for T1 diet of this study while T2, T3 and T4 diets values obtained by the authors were significantly ($P < 0.05$) higher than the values of T2, T3 and T4 diets of this study. This disagreed with Assam *et al.* (2017) who reported that the average daily weight gain was reduced by 7.5 and 10% inclusion levels of raw *Senna obtusifolia* seed meal. There was no significant ($P > 0.05$) difference of birds fed control (0%), T2 (5%), T3 (7.5%) and T4 (10%) inclusion levels of raw SOSM in average daily feed intake. However, the numerical differences between the treatment groups showed that birds fed T1 diet had the lowest numerical value of 82.16 g, T2 had 109.36 g while T3 had the highest numerical value of 135.59 g and T4 had 116.56 g. 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 (2013), 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 the result of the work carried out by Muhammad (2020), 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 93.53 g, T2 97.01 g, T3 84.72 g and T4 diet 80.56 g 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 Augustine *et al.* (2017), who reported a significantly ($P < 0.05$) lower feed intake in broiler Chickens fed differently processed *Cassia tora* seeds. It also disagreed with the result of the work carried out by Mohamed and Khadiga (2009), who reported that overall feed intake and weight gain of birds fed *Leucena leucocephala* seed meal were decreased as dietary inclusion of raw *Leucena* 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. There was no significant ($P > 0.05$) difference between the control (0%), T2 (5%), T3 (7.5%) and T4 (10%) inclusion levels of raw SOSM in feed conversion ratio. The results for feed conversion ratio obtained from this study were 0.04g, 0.06g, 0.07g and 0.06 for the control, T2, T3, and T4 diets respectively. Birds fed T1 diet had the lowest numerical value of 0.04 g, T2 and T4 had similar value of 0.06 g and T3 had the highest numerical value of 0.07 g. The decreased feed conversion ratio by the birds could be attributed to decreasing contents of anti-nutritional factors in the raw SOSM as a result of enzymes supplementation. This agreed with the research carried out by Kocher *et al.* (2000), who reported that the results for feed conversion ratio and digesta viscosity of birds fed enzyme with high Concentrations of canola or sunflower seed meals suggested that efficiency of energy utilization was better on birds fed on enzymes supplemented diets. The feed conversion ratio value obtained by the authors for sunflower seed meal were 1.994 g, 1.924 g, 1.900 g, for 0%, enzyme A and enzyme B respectively. According to Ndak *et al.* (2022), the absence of anti-nutritional factors in diets accounts for effective utilization of nutrients which is responsible for highest Weight gain and lower feed conversion ratio. But this present result however disagreed with the author, who reported that the feed conversion ratio of broiler chickens fed raw *Cassia tora* seed meal was significantly ($P < 0.05$) different at 15% inclusion level. The values obtained by the authors for feed conversion ratio were 2.32 g, 2.32 g, 2.31 g and 2.76 g for 0%, 5%, 10% and 15% levels of inclusion respectively. There was no significant ($P > 0.05$) difference between the control (0%), T2 (5%), T3 (7.5%) and T4 (10%) inclusion levels of raw SOSM in feed efficiency ratio. Although there were numerical differences among the treatment groups. T1 had the highest numerical value of 30.70g, T2 had 17.52g, T3 had the lowest numerical value of 15.75g and T4 had 16.40g. This could be attributed to the inclusion of enzyme in the diet.

There was no significant ($P > 0.05$) difference between the control (0%), T2 (5%), T3 (7.5%) and T4 (10%) inclusion levels of raw SOSM in protein efficiency ratio. Although there were numerical differences between the treatment groups. T1 diet had the highest numerical value of 120.50 g, T2 had 96.52 g while T3 diet had the lowest numerical value of 92.97 g and T4 diet had 96.37 g. This could be attributed to breakdown of protein in the raw SOSM by the enzyme supplement. Protease enzymes break down proteins into smaller peptides and amino acids, improving protein digestibility, reducing the presence of anti-nutritional factors, improved nutrient absorption, growth performance, and feed efficiency (Ravindran, 2013). This agreed with Ndak *et al.* (2022), who reported that inclusion of processed *Cassia tora* seed meal up to 15% has no detrimental effect on the performance of broiler Chickens. This disagreed with Assam *et al.* (2017), who reported that feed gain ratio and protein efficiency ratio were negatively affected by including 7.5 and 10% raw *Cassia tora* seed meal in broiler diets. The results of the hematological parameters of finisher broiler chickens fed raw *Senna obtusifolia* seed

meal (SOSM) supplemented with feed grade enzymes is presented in Table 4. It showed that significant difference (P<0.05) was observed in red blood cells (RBC) and mean corpuscular hemoglobin (MCH) only while other parameters showed non-significant difference (P>0.05). This suggested that the diet was not toxic to the animals. The blood parameters in this study did not deviate from established ranges (Mitruka and Rawnsley, 1986) and hence the health of the finisher broiler chickens were not affected by inclusion of the experimental diets. The significant difference in RBCs observed in this present study showed that birds fed T4 (10%) recorded the highest value of 2.28, which was not significantly different from 2.09 and 1.99 recorded for birds fed T1 (control) and T2 (5%) diets. This result agreed with Assam (2017) who indicated that blood variables most consistently affected by dietary influence include red blood cells (RBC), packed cell volume (PCV) or hematocrit and plasma proteins. The RBC also known as erythrocytes, perform most important function of transporting oxygen in the presence of hemoglobin. They are produced in the bone marrow and contributes to red colouration of the blood (Ekunseitan *et al.,*2013). Abnormally low values of RBCs is indicative of anemia resulting from blood loss, bone marrow failure and malnutrition. On the other hand, abnormally high number may indicate congenital heart disease, lung disease, dehydration or kidney disease (Ibu, 2005). Mean corpuscular hemoglobin (MCH), Mean corpuscular volume (MCV) and Mean corpuscular hemoglobin concentration (MCHC) values are used to determine the presence and severity of anemia. The results of MCH, MCV and MCHC values of birds obtained in this study suggested the ability of the birds to withstand stress.

CONCLUSION / RECOMMENDATION

The results obtained from this study showed that supplementation of feed grade multiple enzymes in the diets containing raw *Senna obtusifolia* seed meal for finisher broiler chickens was effective in reducing the effect of anti-nutritional factors content of raw SOSM thereby improving performance of finisher broiler chickens. There was also no deleterious effects as observed from the non-significant difference on some key hematological parameters. Thus, multiple-enzyme can be added at 20g/100Kg in finisher broiler chickens diets containing raw SOSM up to 10% dietary inclusion levels without any negative effects on the performance and hematology of finisher broiler chickens.

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Table 1: Composition (% DM) of Experimental Starter diet

Ingredients %	Levels T1 (0%)	Of T2 (5.0%)	Inclusion 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	-	5.00	7.50	10.00
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				
ME (Kcal/g)	23.00	23.00	23.00	23.00
	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 (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).
SOSM – *Senna obtusifolia* seed meal

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				
ME (Kcal/g)	20.00	20.00	20.00	20.00
	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: Performance Parameters of Finisher Broiler Chickens fed diets containing Raw *Senna Obtusifolia* Seed Meal 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	
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	0.04	0.06	0.07	0.06	0.01
FER	30.70	17.52	15.75	16.40	3.02
DPI	1587.37	2112.96	2622.37	2251.56	2278
PER	120.50	96.52	92.97	96.37	6.62
Mortality	0	1	1	0	

^{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.

Table 4 Hematological Parameters of Finisher Broiler Chickens fed diets containing Raw *Senna Obtusifolia* Seed Meal supplemented with Enzymes

	LEVELS OF INCLUSION				
PARAMETERS	**T1 (0%)**	**T2 (5.0%)**	**T3 (7.5%)**	**T4 (10%)**	**SEM**
Red Blood cells	2.09 [ab]	1.99 [ab]	1.94 [b]	2.28 [a]	0.05
Hemoglobin	8.90	8.76	8.56	9.40	0.20
Packed cell volume	30.00	29.70	28.76	31.66	0.54
Platelets	4.30	2.33	7.00	3.67	0.18
White blood cell	32.86	31.82	33.51	39.20	1.53
Neutrophils (%)	61.40	55.56	52.40	55.90	1.97
Lymphocytes (%)	18.13	30.60	24.63	25.16	2.37
Monocytes (%)	15.43	7.10	14.76	12.76	1.54
Eosinophils (%)	4.80	6.60	8.06	6.03	1.18
Basophils (%)	0.23	0.13	0.13	0.13	0.35
MCV	143.80	148.90	148.70	138.96	1.96
MCH	42.63 [ab]	44.13 [a]	44.20 [a]	41.06 [b]	0.48
MCHC	29.70	29.66	29.76	29.70	0.30

[a,b,c] Means of different superscript across the rows show significant difference (P<0.05). MCV-mean corpuscular volume, MCH- mean corpuscular hemoglobin, MCHC- mean corpuscular hemoglobin concentration, SEM-standard error of mean

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