

Original Research Article

Performance, haematology and serum biochemical indices of broiler chickens fed toasted sesame seed (*Sesamum indicum*, Linn) meal based-diets

Abstract

Effects of dietary toasted sesame seed meal (TSSM) on growth, haematological and selected serum biochemical indices of broiler chickens was evaluated in a feeding experiment lasting 56 days. One hundred and eighty 1-day old Arbor acre chicks were divided into five treatments. Each treatment was replicated thrice each of twelve birds per replicate. Graded TSSM was included at the expense of soya bean meal in the basal starter and finishers broiler ration viz; 0 (T1), 25 (T2), 50 (T3), 75 (T4) and 100% (T5). The diets with water were offered to respective birds *ad libitum*. Feed intake, weight gain, final weight and feed conversion ratio of birds were significantly different ($P < 0.05$). Also, the packed cell volume, haemoglobin and white blood cell varied significantly ($P < 0.05$) with TSSM inclusion. However, the red blood cell, heterophils, lymphocytes, monocytes and eosinophils were not affected ($P > 0.05$) by the graded TSSM in the diets. Serum total protein, alanine amino transferase, alkaline phosphatase, cholesterol, triglycerides and very low density lipoprotein also showed significant differences ($P < 0.05$) among the treatments but there was no effect ($P > 0.05$) on serum albumin, creatinine, high density lipoprotein and aspartate amino transferase. It was concluded that beneficial effects of graded toasted sesame seed based diets on performance; haematology and biochemical indices of broiler chickens were obvious up to 25% levels of inclusion.

Keywords: Broiler serum lipids, Toasted sesame seed diets, Beeniseed for chickens feeding

Introduction

Supply of dietary protein (essential amino acids) in the right quality and quantity remained the biggest problem facing small scale broiler chicken producers in developing countries ⁽¹⁾. Proteins of legumes, a conventional plant protein source for poultry feed formulation, are of high nutritional value but deficient in the first three limiting amino acids ⁽²⁾. The synthetic amino acids commonly used in supplementing these legume based-diets are found in towns and cities not always accessible to rural farmers ⁽³⁾. Also, report ⁽⁴⁾ indicated that these synthetic amino acids are often scarce and are most times not accessible to rural poultry producers. Hence, rural poultry farmers are left with no other option than depriving intake of essential nutrients.

Sesame seed (*Sesamum indicum*) is an old cultivated crop and thought to have originated in Africa. Its fruit is an oblong, mucronate, pubescent capsule containing numerous small, oval, yellow, white, red, brown or black seeds. It is also considered as one of the major world oil crop grown by small farmers in developing countries ⁽⁶⁾.

Sesame seed (benniseed) is produced locally and it is a good source of proteins with appreciable amount of methionine ⁽⁵⁾. Sesame seed is rich in leucine, arginine and methionine, but relatively low in lysine. When used in the right proportions together with soybean meal which has higher content of lysine; more balanced rations with respect to lysine and methionine resulted ⁽²⁾. However, as with most tropical legumes, sesame seed contain anti-nutritional factors, which may reduce its nutritive value in poultry feed ^(7, 8).

Sesame meal is an excellent source of protein (47.1%)⁽⁹⁾ to (52.9%)⁽¹⁰⁾ and has amino acid composition similar to that of soybean meal (7.7%). It can partially replace soybean meal in the diet as a source of plant protein for chicks⁽¹¹⁾, broiler and laying hen⁽⁹⁾. It has been reported⁽¹²⁾ that sesame meal could be used to substitute soybean meal at 25% in broiler diet.

The ingestion of dietary components has measurable effects on blood constituents⁽¹³⁾. Although nutrient levels in the blood and body fluids are not valid indications of nutrient function at cellular level, they are considered to be proximate measures of long term nutritional status⁽¹⁴⁾.

The dependence of blood protein and Creatinine on the quality of dietary protein has been reported⁽¹⁵⁾, while feeding swine with cassava leaf supplement led to a significant reduction in ALT and AST with a significant increase in serum total protein⁽¹⁶⁾. Haematological values are widely used to determine systemic relationship and physiological or pathological adaptations including the evaluation of general health condition, diagnosis and prognosis of various types of animals' diseases⁽¹⁷⁾.

The present study was designed to evaluate the effects of inclusion of graded levels of toasted sesame seed on performance, haematology and serum indices of broiler chickens.

Materials and Methods

One hundred and eighty 1-day old Arbor acre chicks were divided into five treatments. Each treatment was replicated three times with a total of twelve birds per replicate. The toasted sesame seed was included at graded levels viz; 0 (T1), 25 (T2), 50 (T3), 75 (T4) and 100% (T5) in broiler diets. The diets with water were offered to the respective birds *ad libitum*. Records of feed intake and weights of birds were taken every week. Blood samples with or without anti-coagulant (EDTA) were obtained from the jugular vein of two birds per replicate at day 56. Blood samples collected with EDTA were used for haematological analysis while those collected without anti-coagulant were used for serum biochemical analysis. The experiment lasted eight weeks.

Table 1: Composition (g/100gDM) of experimental diets

Ingredients	Starter	Finisher
Maize	43.00	45.00
Full fat Soybean Meal	40.00	35.00
Sesame seed (Toasted)	-	-

Fish meal (72% CP)	2.00	1.00
Wheat bran	8.80	12.80
Oil	3.00	3.00
DCP	1.50	1.50
Oyster	1.00	1.00
Premix	0.25	0.25
Salt	0.25	0.25
Lysine	0.10	0.10
Methionine	0.10	0.10
Total	100	100

CP- Crude Protein, ME- Metabolizable Energy, DCP- Dicalcium Phosphate

Statistical analysis

Data were analysed using simple regression as well as analysis of variance (ANOVA) and means were separated⁽¹⁸⁾.

Results and Discussion

The results of performance, haematological and serum biochemical indices were presented in Tables 2, 3 and 4.

There were significant variations ($P < 0.05$) in performance indices measured. Feed intake decreased across the dietary treatments. The differences in the rate of feed intake as shown in the various treatments indicated the unacceptability of the seed in the diets due to its bitter taste and high amount of oil⁽¹⁹⁾. It could also be attributed to the anti-nutritional factors contained in the seed as earlier remarked⁽⁷⁾.

Body weight gain of the birds decreased across the dietary treatments. Diets T1 and T2 had similar effect ($P > 0.05$) on weight gain of the birds. This was in line with earlier document⁽¹²⁾. Birds on T₅ which contained predominant level of toasted sesame seed recorded lower weight gain (283g). This was due to the corresponding lowered feed intake as a result of the anti-nutritional factors in the seed⁽⁷⁾⁽⁸⁾. Regression analysis from this study indicated that 22% inclusion of graded toasted sesame seed in broiler diets will significantly favour body weight gain of 1700g.

Results of final weight decreased across the dietary treatments were attributed to lowered feed intake of birds.

Feed conversion ratio (FCR) is an important index of performance which is a direct indication of how best feed offered to birds was utilized for meat production. The lower the FCR value, the better the feed utilization, birds with higher FCR value had suppressed growth.. The FCR increased across dietary treatments which was in line with the earlier observation⁽¹⁰⁾. This study revealed that birds on diet T2 (2.36) utilized nutrients better compared to those on control diet. Regression of graded levels of toasted sesame seed meal on FCR was positive which revealed that 22% dietary toasted sesame seed meal resulted in FCR value of 2.22 ($R^2 = 0.729$).

Table 2: Performance of broilers fed graded toasted sesame seed based diets (0- 8weeks)

Parameters	T1	T2	T3	T4	T5	SEM
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Final weight(g)	1688.90 ^a	1500.03 ^a	966.67 ^b	705.70 ^c	322.20 ^d	38.74
Weight gain(g)	1649.70 ^a	1460.83 ^a	927.47 ^b	666.50 ^c	283.00 ^d	38.74
Feed Intake (g)	3708.90 ^a	3430.83 ^b	2458.93 ^c	1822.77 ^d	871.17 ^e	18.06
FCR	2.27 ^c	2.36 ^{bc}	2.65 ^b	2.74 ^{ab}	3.10 ^a	0.07

Means with different superscripts on the same row are significantly different ($P < 0.05$).

FCR- feed conversion ratio, SEM- Standard error of means

The haematological indices of broiler birds were presented in Table 3. There were significant variations ($P < 0.05$) in the values of PCV, Hb and WBC among dietary treatments. The PCV level is one of the indicators that suggest the presence of toxic factor that adversely affected blood formation (20). The PCV values obtained from this study were within the standard range of 22-35% (21) for healthy chickens except for those birds on diet T5 (19.67%) that fed on diet that contained highest level of toasted sesame seed. This suggests the effect of anti nutritional factors in the seed. Haematological indices especially PCV and Hb were correlated with nutritional status of animal (23).

Haemoglobin; the red pigment of the erythrocyte functions in the transport of oxygen and carbon (IV) oxide in animal body. Results for this index was indicative of variations in oxygen and carbon (IV) oxide carrying capacity of birds fed graded levels of toasted sesame seed based diets. The values were within the standard range of 7-13g/dl (21). There was a general progressive decrease in the value with the increasing inclusion of TSSM. However, value recorded for birds on T5 (6.55g/dl) could be as a result of high dietary energy as earlier reported (22). Birds on T2 had higher values for both PCV (29%) and Hb (9.66g/dl). This showed that the diet contained relatively higher quality protein that met both the birds' protein requirement as well as favoured the health status.

The values obtained for white blood cell (WBC) of the experimental birds were within the reference range of $9-31 \times 10^3/\text{mm}^3$ (21) for healthy birds. Decreased WBC below the normal range is an indication of allergic conditions, anaphylactic shock and certain parasitism or presence of foreign body in circulating system (24)(25). Birds on diets T1, T2 and T5 had similar ($P > 0.05$) values which revealed that the effect of diets were similar on the birds.

The values obtained for the blood differential counts; heterophils, lymphocytes, monocytes and eosinophils for birds on diets T1, T2, T3, T4 and T5 respectively indicated that graded dietary TSSM had no influence on the indices ($P > 0.05$).

Red blood cell (RBC) values obtained in this study did not vary significantly ($P > 0.05$). This showed that graded dietary TSSM had no influence on RBC of the birds and it revealed that the birds were not anaemic.

Table 3: Haematology of broilers fed graded toasted sesame seed based diets

Parameters	T1	T2	T3	T4	T5	SEM
PCV (%)	32.00 ^c	29.00 ^{bc}	26.33 ^b	26.33 ^b	19.67 ^a	1.37

Hb (g/dl)	10.66 ^c	9.66 ^{bc}	8.78 ^b	8.77 ^b	6.55 ^a	0.45
RBC (x10 ⁶ /mm ³)	3.66	4.00	4.27	3.50	4.23	0.25
WBC (x10 ³ /mm ³)	23.25 ^{ab}	22.60 ^{ab}	24.72 ^b	17.67 ^a	23.25 ^{ab}	1.69
Heterophils (%)	34.33	31.67	39.33	33.67	39.00	5.72
Lymphocytes (%)	61.67	65.33	56.33	62.67	57.67	5.75
Monocytes (%)	1.33	0.67	0.67	1.33	1.00	0.39
Eosinophils (%)	3.00	2.67	3.67	2.33	2.33	1.01
Basophils (%)	0.00	0.00	0.00	0.00	0.00	0.00

Means with different superscripts on the same row are significantly different ($P < 0.05$).

SEM- Standard error of means

PCV- Packed cell volume, RBC- Red blood cell, Hb- Haemoglobin, WBC- White blood cell.

Table 4: Selected biochemical indices of broilers fed graded toasted sesame seed based diets

Parameters	T1	T2	T3	T4	T5	SEM
Total protein (g/dl)	2.56 ^a	4.02 ^b	3.51 ^{ab}	3.12 ^{ab}	3.06 ^{ab}	0.34
Albumin (g/dl)	1.48	1.79	1.74	2.07	1.85	0.20
Urea (mg/dl)	1.77	1.72	2.94	2.18	3.40	0.80
Creatinine (mg/dl)	0.77	0.71	0.77	0.64	0.50	0.15
AST (iu/l)	82.56	90.22	94.23	92.61	92.83	14.00
ALT (iu/l)	13.74 ^{ab}	17.22 ^b	11.89 ^{ab}	9.39 ^a	10.99 ^a	1.80
ALP (iu/l)	15.08 ^a	13.37 ^a	30.15 ^b	23.15 ^{ab}	30.76 ^b	3.32
Cholesterol (mg/dl)	111.84 ^a	115.72 ^{ab}	150.7 ^{ab}	169.03 ^b	166.77 ^b	16.27
Triglycerides (g/dl)	33.81 ^a	74.59 ^b	91.29 ^{bc}	94.09 ^{bc}	120.05 ^c	12.01
VLDL (mg/dl)	6.76 ^a	14.92 ^b	18.26 ^{bc}	18.82 ^{bc}	24.01 ^c	0.48
HDL (mg/dl)	59.62	60.84	78.11	58.44	59.60	2.40
Phosphorus (mg/dl)	3.03	3.61	3.25	3.31	3.20	7.49

Means with different superscripts on the same row are significantly different ($P < 0.05$).

SEM- Standard error of means

AST- Aspartate amino transferase, ALT- Alanine amino transferase, ALP- Alkaline phosphatase,

HLD- High density lipoprotein, VLDL- Very low density lipoprotein

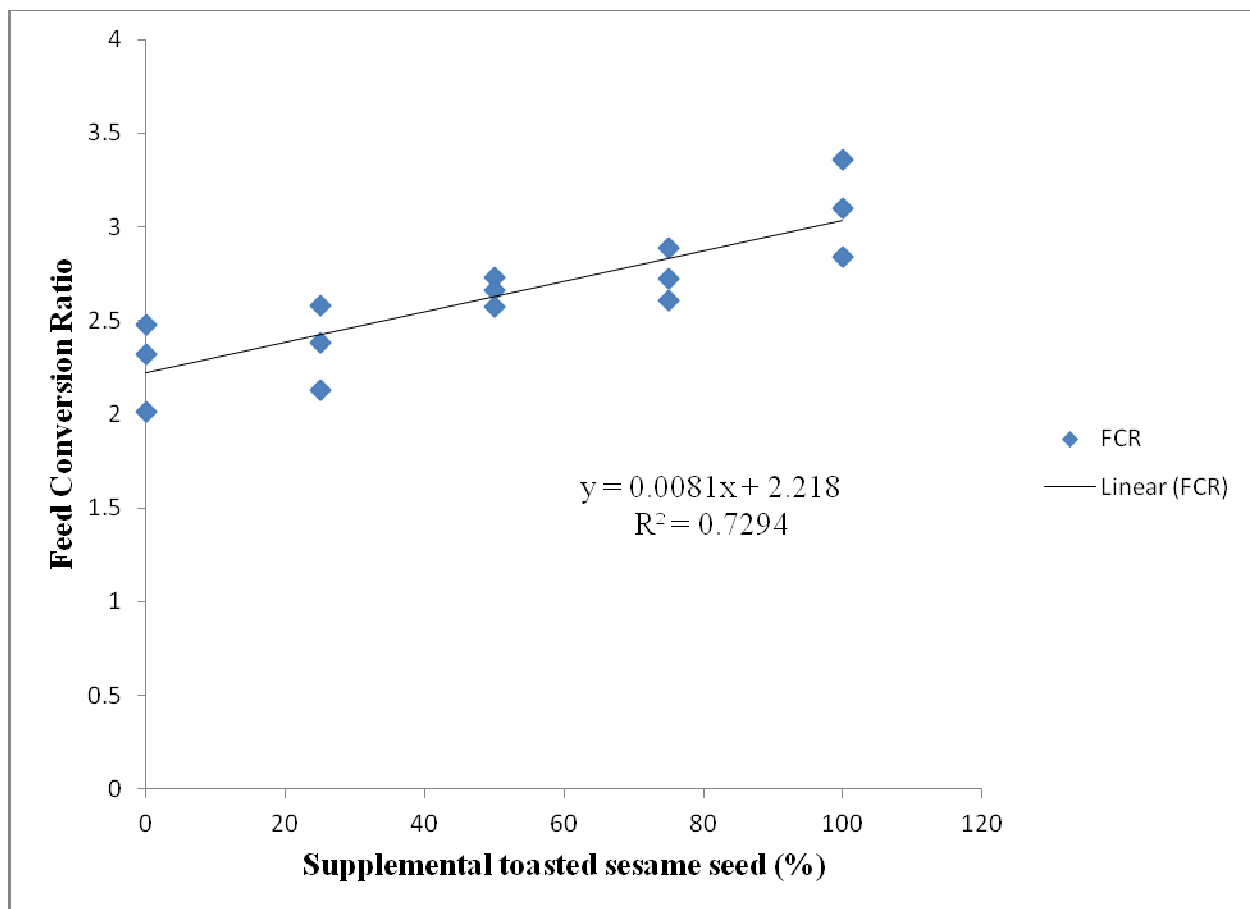


Figure 1: Relationship between supplemental graded toasted sesame seed and feed conversion ratio of broilers fed experimental diets

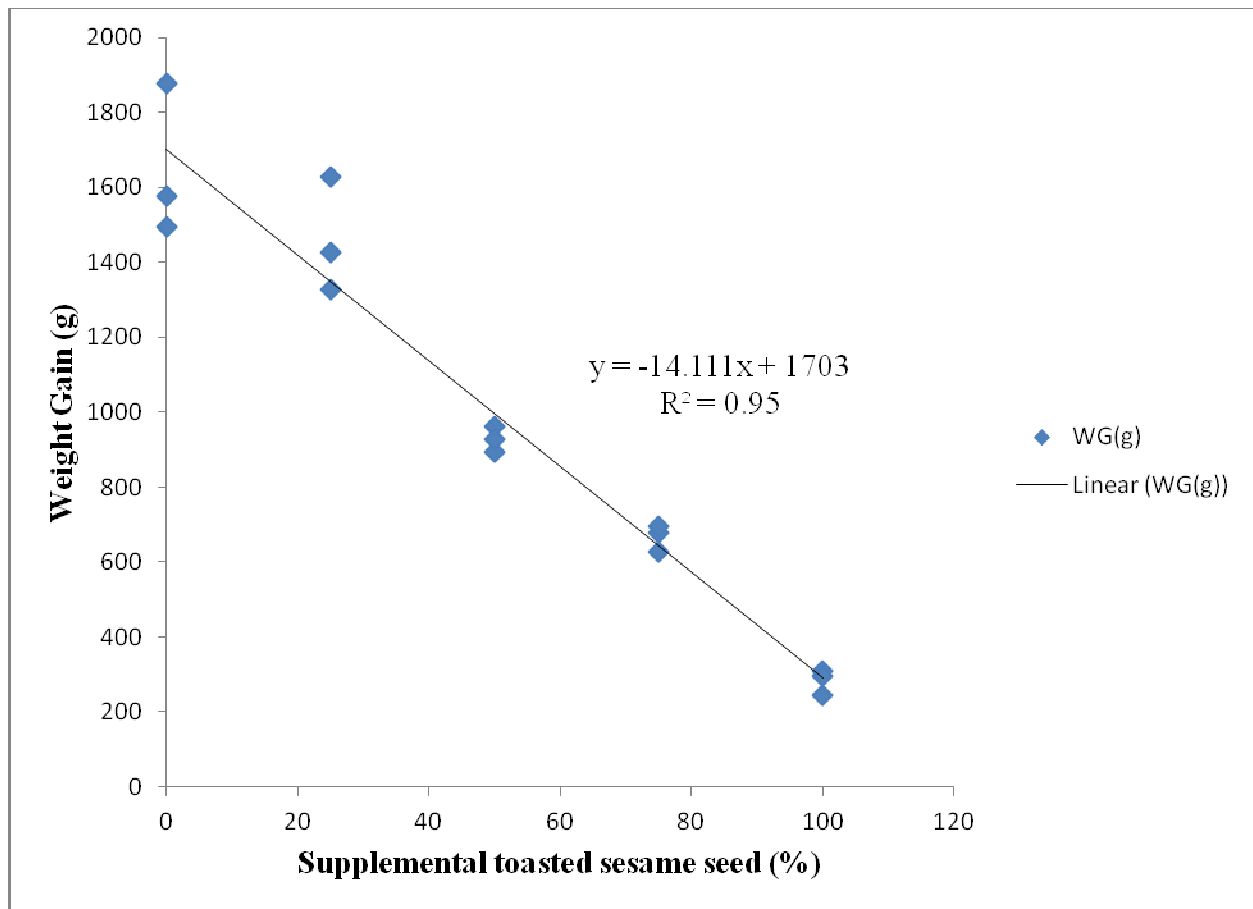


Figure 2: Relationship between supplemental graded toasted sesame seed and weight gain of broilers fed experimental diets

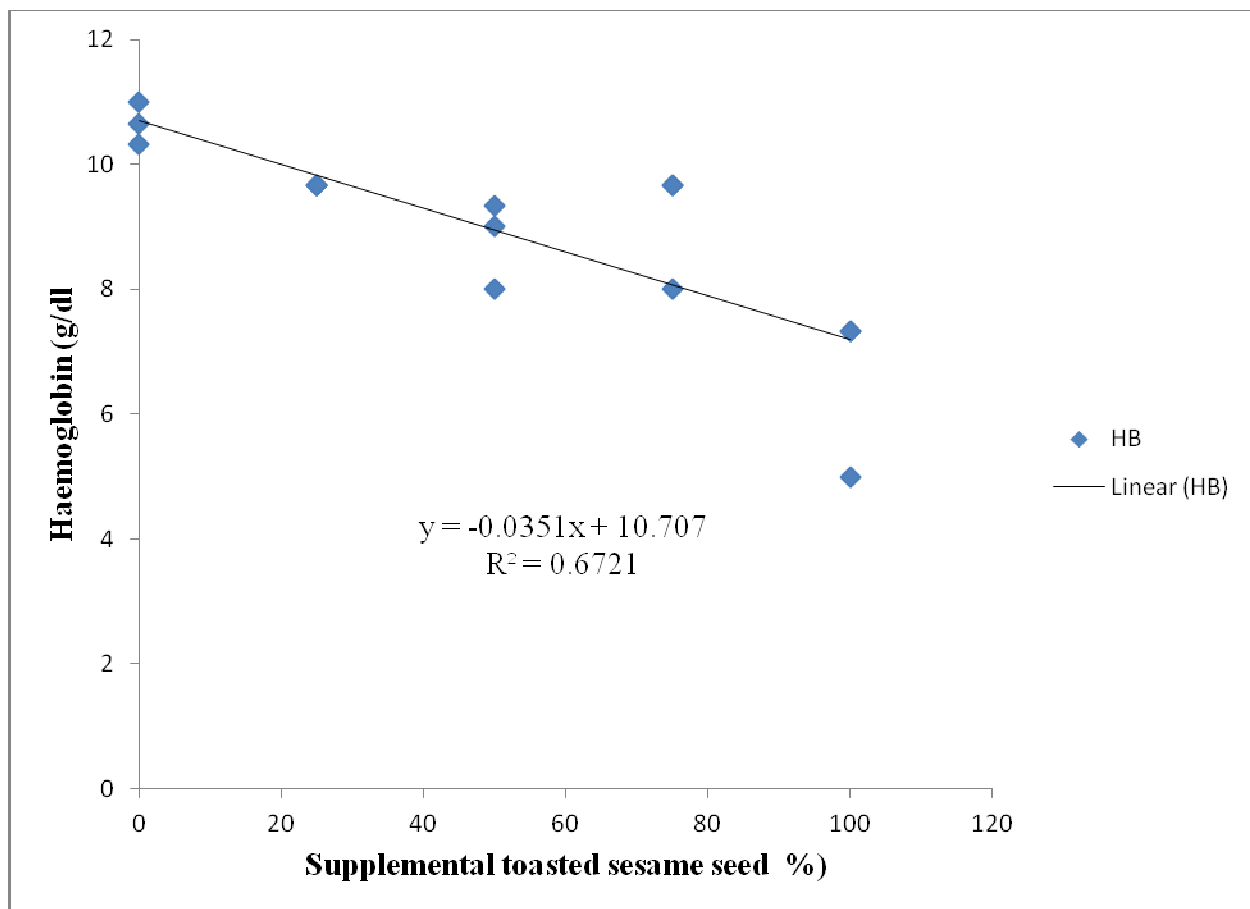


Figure 3: Relationship between supplemental graded toasted sesame seed and haemoglobin of broilers fed experimental diets

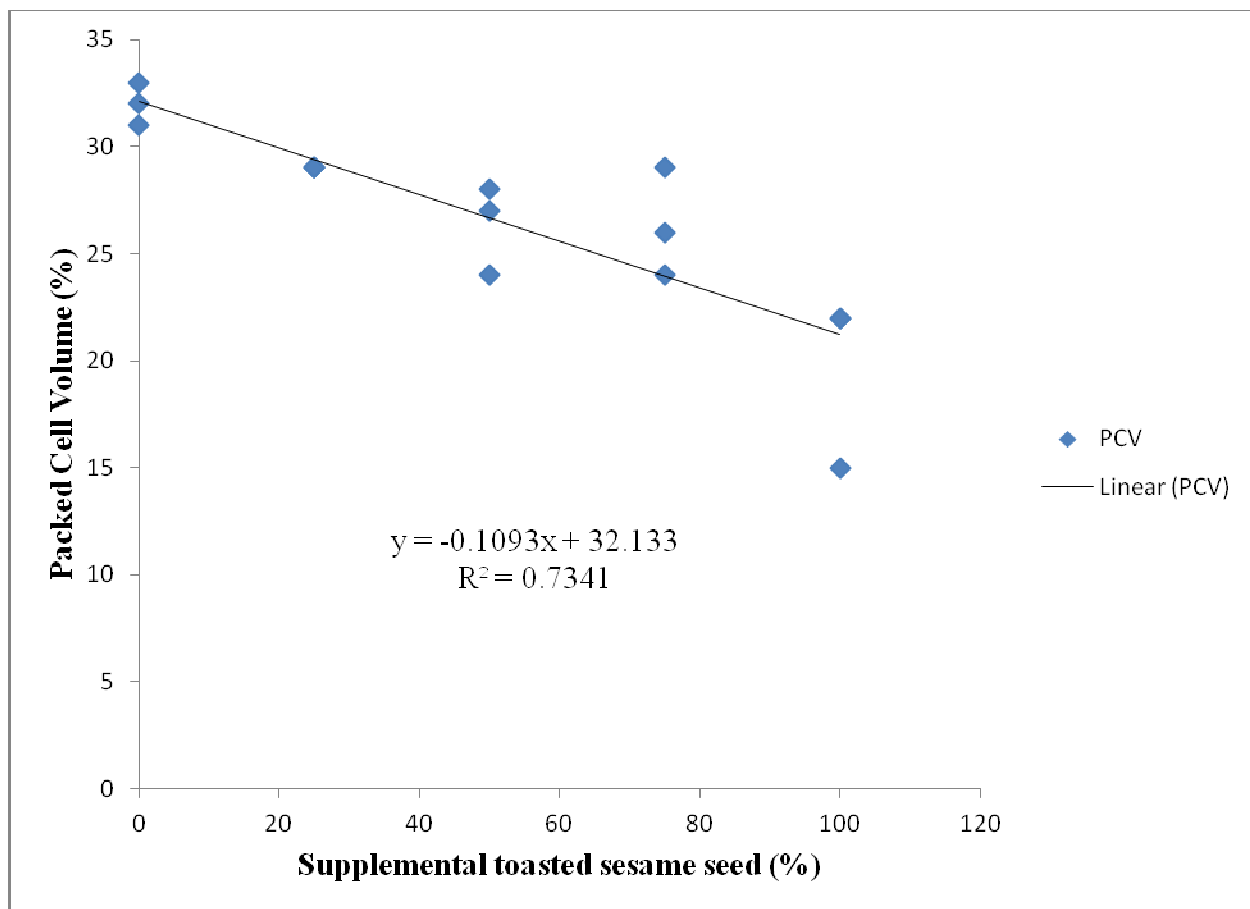


Figure 4: Relationship between supplemental graded toasted sesame seed and packed cell volume of broilers fed experimental diets

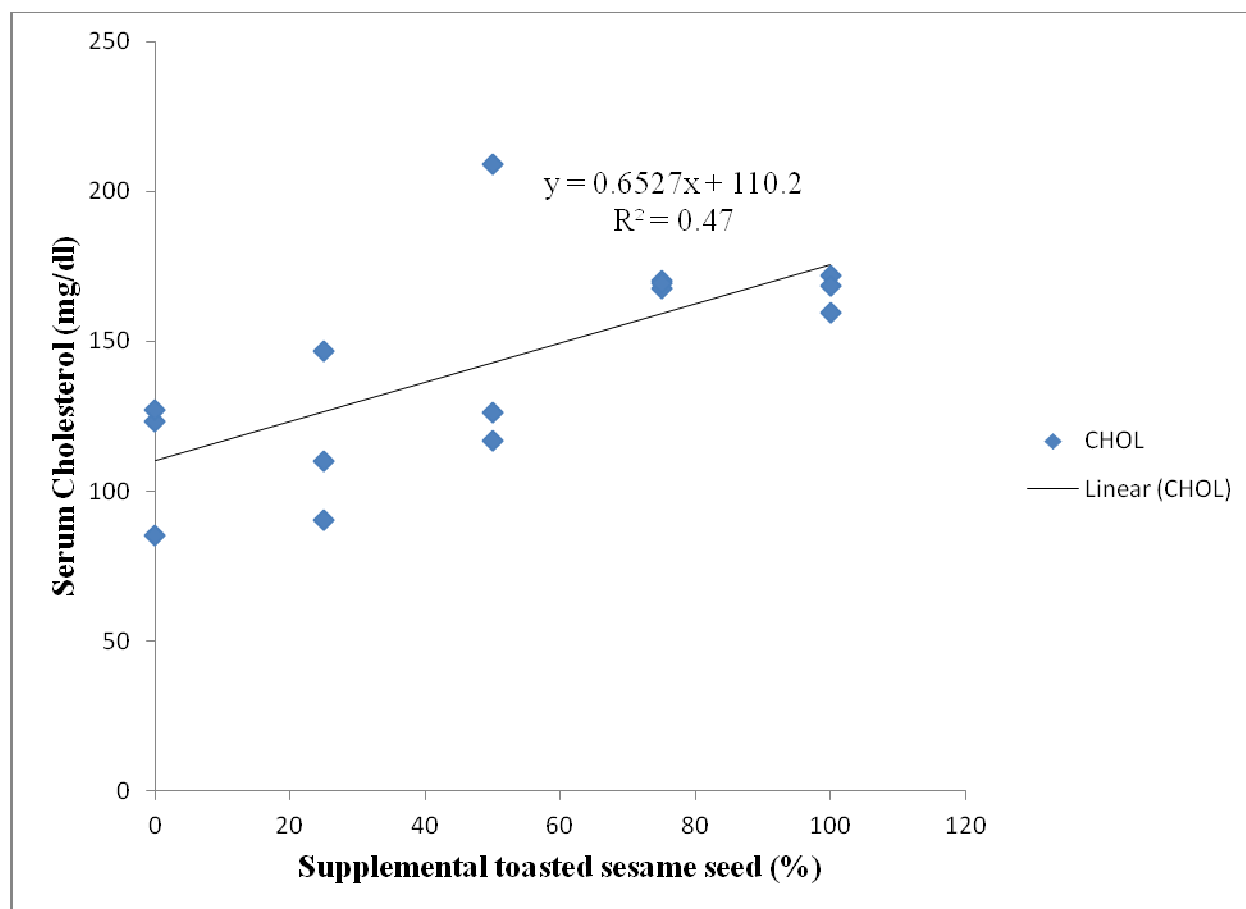


Figure 5: Relationship between supplemental graded toasted sesame seed and serum cholesterol of broilers fed experimental diets

Serum biochemical indices of broiler chickens fed graded dietary TSSM were presented in Table 4. There were significant differences ($P < 0.05$) in the obtained values of total protein, ALT, ALP, cholesterol, triglycerides and VLDL among dietary treatments. The recorded variations in serum total protein stemmed from the different rate of protein metabolism and utilization by the birds. The values obtained were in line with earlier observation⁽²⁶⁾. Birds on diets T2 had higher value (4.02). This indicated that the diet is of good quality and that the birds were more efficient in protein metabolism and utilization. Birds on diets T3, T4 and T5 showed similar variations ($P > 0.05$). This revealed that the rate of protein metabolism and utilization were similar. Values of ALT obtained for birds on T1 and T3 as well as T4 and T5 were similar ($P > 0.05$) which revealed that the livers of birds' on these diets were functioning similarly. The values of

ALP are indicative of liver functioning and perhaps the rate of bone mineralization of the broiler chickens. The varied ($P < 0.05$) ALP values could be attributed to varying dietary phosphorus in the feed or its utilization as affected by phytate content of TSSM as earlier reported (8, 27). Birds on diets T1 and T2 as well as diets T3 and T5 had similar variations ($P > 0.05$). Cholesterol values obtained showed similar trend ($P < 0.05$) (28). This showed variations in cholesterol absorption, utilization and rate of lipid deposition among experimental birds. Sesame seed is known to contain lignans found to lower total blood cholesterol (29) contrary to results of high blood cholesterol concentration with increasing TSSM from this study. This could however be due to the presence of saponins in toasted TSSM which might interfere with the absorption of dietary lipids and cholesterol as earlier reported (30). Serum triglycerides values obtained increased ($P < 0.05$) progressively with higher inclusion of TSSM in the diets (22). This indicated variations in triglycerides absorption and utilization among broiler chickens fed graded levels of TSSM based diets. Birds on diet T5 which contained predominant level of TSSM had higher value (120.05g/dl) which could be as a result of high amount of oil and calorie content of sesame seed as earlier documented (28). The VLDL values obtained in this study were within the normal documented range (31) of 2-30mg/dl for healthy birds. The variations ($P < 0.05$) indicated varied capacity of experimental birds in metabolizing and in transport of fat or lipids from livers to tissues. Birds on diets T3 and T4 had similar values ($P > 0.05$) which revealed similarity in the production potentials of VLDL by the livers. From the regression analysis in Figure 1, 22% dietary TSSM will result in 8.91mg/dl value of VLDL which is within the reported (31) normal value for healthy birds. The values obtained for serum urea, creatinine, AST, HDL and phosphorus for birds on T1, T2, T3, T4 and T5 respectively were not significantly different ($P > 0.05$) which showed that the inclusion of graded dietary TSSM had no influence on these serum biochemical indices.

Conclusion

Toasted sesame seed could be incorporated up to 22% in the diets of broiler chickens without any adverse effect on performance, haematological parameters and serum biochemical indices. However for maximum utilization of the embedded nutrients in sesame seed, **toasting** as a treatment method alone may not be adequate to remove the entire innate anti nutritional factors totally. Therefore, the use of relevant additives and other treatments are recommended.

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