

Original Research Article

Effects of feeding soaked-toasted Tallow (*Detarium microcarpum*, Guill and Sperr) seed meal as replacement for soybean meal on organ weights, haematology and serum biochemical indices of broiler chickens

Abstract

The effect of feeding graded levels of soaked-toasted Tallow seed meal (STTSM) as replacement for soybean meal on the organ weights, haematological and biochemical indices of broiler chicks was evaluated. Three hundred and sixty (360) day- old broiler chicks of the Amo Strain were used. The experimental layout was a completely randomized design with three treatments replicated three times. Each treatment allocated one hundred and twenty chicks and forty birds per replicate. The inclusion levels of STTSM in the diets were 0, 10 and 20 % on weight to weight basis. The parameters measured were feed live weight, organ weights, haematological and biochemical indices. ANOVA showed that there was better live weight ($P < 0.05$) from broiler chicks fed the control diet as compared to those fed 10 and 20% STTSM based diets. The substitution of STTSM in broiler chick diets did not statistically affected the organ weights of liver (3040g), heart(8-10g), kidney(2g), pancreas(5-7g), proventriculus (9-10g) and gizzard (39-65g). The fat deposit of birds on the control diet (65g) was significantly ($p < 0.05$) higher compared with STTSM (39g respectively) based diets. The results of the haematological and biochemical indices were statistically similar ($P > 0.05$) with incorporation of STTSM in the diets. Tallow seeds meal can be incorporated in broiler chickens ration up to 20% inclusion level with no adverse effects on organ weights and haematological and biochemical indices of broiler chicks.

Keyword: Integrated treatment, Tallow seeds, chickens, organs, haematology, biochemical indices

1. INTRODUCTION

Conventional sources of protein such as groundnut cake, soybean meal, fish meal and energy (maize) for monogastric animals are increasing in cost and scarce due to competition between man and livestock [1]. This has led to a renewed interest in the use of alternative, non-conventional, cheap and easily available ingredients of wild legumes in livestock feeding to meet future demand [2].

Tallow tree or Sweet dattock" tree (*Detarium microcarpum*) is a tropical legume plant which belongs to the family *Caesalpinoideae* and found mostly in savannah zones with a high productivity yield of seeds embedded in the fruits [3,4,5]. Previous investigations on the proximate composition of *D.microcarpum* seed by [6, 7,8, 9 10] have been reported to contain crude protein (8.8-37.20 %), crude fibre (1.1-5.6%), ash (1.5-3.2 %), fat (1.5-14 %) and carbohydrate (35-58%) with energy values of 5.53Kcalg^{-1} [11] compared with those reported in soybean (5.52Kcalg^{-1}) [12].

In view of the high nutritive and energy value of the seeds, negative reports of anti nutritional factors such as phytic acids, oxalate, saponin, tannin) have been implicated to affect performance parameters of experimental animals [7, 8]. Reports of residual anti nutrients has resulted to negative performance of broilers fed single processing method of legume seed meals in mucuna bean [13,14] and *D. microcarpum* seeds [9]. Integrated processing methods of legumes seed by soaked-cooked, cooked-ferment and toast-soaked have been reported to eliminate the negative effects of anti-nutritional factors present in tropical raw legumes and other vegetable protein sources [14,15].

Haematological, biochemical and enzymes indices are indicators of myriads of metabolites and other constituents, which provide a valuable medium for health clinical investigation and nutritional status of animals [16] fed toxic diets which affect the functional activity of the organ and transport of the molecules across organs concerned (Wright *et al.*, 1976). This study was therefore designed to investigate the implications of feeding broiler chickens with integrated processing methods by soaked-toasted Tallow seed meal on organ weights, haematological and biochemical indices.

2 MATERIALS AND METHODS

2.1 Site of the experiment:

The study was carried out at Aga Livestock Farm Ltd, a commercial farm with standard building for Teaching and Research in Wukari Metropolis, Taraba State, Nigeria. Wukari is located between Latitude 7°51*N, 9°47*E and Longitude 7°85*N, 9°78*E [18].

2.2 Collection and processing of seed meal

Dry Tallow fruits were collected from Wukari and its environs in Taraba State. The fruits were cracked open mechanically to remove the seeds. The raw seeds were cleaned of dirt soaked in water at room temperature for 24 h, drained and rinsed once with fresh water and air-dried for three days. The dried seeds were poured into a frying pan mixed with sand in ratio 2:1 under control open fire. Turning was constantly made (to avoid the seeds burning off) until the white endosperm seed turns crispy brown in colour after 30-35 min [19]. The roasted seeds were decorticated and then ground to form soaked-toasted Tallow seed meal (STTSM)

2.3 Birds, diets and experimental design

A total of 360 day-old unsexed broiler chicks (Amo) were purchased from a reputable Hatchery in Ibadan, Oyo State for this study, birds were weighed and randomly assigned to three treatments. Each treatment had three replicates and contained 40 birds each under a completely randomized design. Three diets were formulated to contain soaked-toasted Tallow seed meal (STTSM) at 0, 10 and 20% (starter and

finisher phases), respectively replacing soybean in the diets (Table 1). The diets were formulated according to requirements standard recommended by [20]. The brooder house was thoroughly cleaned, washed, disinfected, allowed to rest for a week before the arrival of chicks and artificial light provided to encourage the birds to eat in the night. Feed and water were provided *ad libitum*. All management procedures recommended for broiler chicks by [20] were strictly adhered to. The birds were weighed and feed intake recorded weekly from which average daily weight gain and feed intake were computed for 56 days.

2.4 Data collection:

2.4.1 Organ weights

On the 56th day of the trial, five birds per replicate group were randomly selected for organ weight evaluation after fasting them over night to the gut content. The birds were weighed, slaughtered and allowed to bleed thoroughly before the carcasses were de-feathered, cleaned, dissected and eviscerated. The heart, pancreas, liver, kidney, proventriculus and gizzard were removed and weighed. The fat deposit was removed from around the rectum in the cloacal portion and from the gizzard with proventriculus in the keel portion and weighed.

Table 1: Composition of experimental starter and finisher broiler chicks' diets.

Ingredients	% Dietary Starter Phase			% Dietary Finisher Phase		
	0%	10%	20%	0%	10%	20%
Maize	51.00	51.00	44.00	52.00	46.00	46.00
Maize bran	10.00	10.00	100.00	15.00	10.00	10.00
Soybean (Fullfat)	30.00	20.00	10.00	25.00	15.00	5.00
STTSM	0.00	10.00	20.00	0.00	10.00	20.00
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Lime stone	2.00	2.00	2.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated Analysis						
Crude protein	22.89	22.76	22.60	20.40	20.32	20.12
Crude fibre	4.20	4.40	4.70	5.00	4.63	4.60
ME (kcal/kg)	2876.00	2840.60	2832.31	2872.00	2860.00	2854.20

Analyzed chemical composition

Crude protein	22.00	21.81	21.72	20.13	19.85	19.60
Crude fibre	4.58	4.00	4.20	4.63	4.80	4.94
Fat	4.70	4.56	4.30	4.43	4.36	4.20
Ash	3.41	3.30	3.50	3.32	3.60	3.61
Ca	1.76	1.70	1.68	1.36	1.40	1.42
p	0.60	0.62	0.60	0.60	0.62	0.61

* To provide the following per Kg of feed: vit-A 100000 IU; vit. D₃2000iu; vit. B;0.75mg; nicotinic acid-25 mg; Ca, panthothenate- 12.50mg; vit.B₁₂2.5mg; vit. K-2.5mg; vitE-25mg; Cobalt 0.4mg Biotin-0.50mg; Folic acid- 1mg; Cholin chloride-25mg; Cu-8.00mg; Mg-64mg; Fe-32 mg; Zn 4mg; Iodine-0.80mg; Flavomyacin-100mg; Sapriomyin-5mg; DL-methionine-50mg; Selenium- 0.16mg; 1-lysine 120mg. STTSM: Soaked-toasted Tallow seed meal

2.4.2 Blood assay

Five (5) milliliters of blood was collected by wing vein from selected three birds by using a 24-gauge needle in separate screw-type tubes for obtaining plasma and serum. Each blood collection tube contained Ethylene Diaminetetra-acetic Acid (EDTA) as an anticoagulant for the study of various hematological parameters. The packed cell volume, red blood cells, haemoglobin, white blood cells and its differentials (lymphocytes, neutrophils, monocytes, basophils and eosinophils) were analyzed according to routine available clinical methods described by [21]. Blood samples for serum biochemical studies were collected into plain vacutainers (i.e. without anticoagulant) for serum separation. Serum was obtained by centrifugation machine for 5 minutes at 2000rpm and the harvested serum samples were used for analysis. Blood biochemical parameters of total protein (g/dL), glucose (mg/dL), urea (g/dL), (mg/dL), total cholesterol (mg/dL), calcium, sodium, magnesium, potassium, Aspartate aminotransaminase (AST) and Alanine aminotransaminase (ALT) activities were determined using commercial budiagnostic kits and spectrophotometric method as described by [22,23].

2.5 Proximate Analysis

Proximate composition of experimental diets was determined for moisture, crude protein, ash, fat and crude fibre according to [24].

2.6 Statistical analysis:

Data collected for all the parameters were subjected to analysis of variance (ANOVA) for CRD using the Statistical Package for Social Sciences (SPSS for windows), Version 20. Means were separated using Duncan Multiple Range Test [25].

3 RESULTS AND DISCUSSION

3.1 Live weight and organ weights

The results of the live weight and organ weights are shown in Table 2. The organ weights of broilers (liver, pancreas, proventriculus, kidney, heart and gizzard) were statistically similar ($p>0.05$) among the dietary treatment groups. The result of the abdominal fat deposits showed that birds on 0% STTSM diet had significantly ($p<0.05$) higher fat deposit compared with STTSM based diets.

The decrease in final live weight with increasing level of STTSM in the diets could be attributed to poor nutrient utilization of STTSM based birds. The non significantly ($p>0.05$) affected organs weight of the liver, heart, kidney, proventriculus, pancreas and gizzard is an indication of healthy chicks, suggesting that soaked-toasted processing method may have rendered the anti nutritional factors (ANFs) inactive as observed in the non inflammation of liver and pancreas. The observed similarity $p>0.05$ in visceral organs in this study is in agreement with previous observations by [15] that integrated processing methods (cooked and fermentation) render ANFs inactive and enhanced the nutritive value. The resultant slight depressed organ weight of birds with increased STTSM based diets is in agreement with earlier reports by [27] that the live weight and the surface area of birds determine the amount of feathers and visceral organs required. This result is in line with reports of [28,29] that similarity of organ weights of liver, gizzard and heart are not adversely affected by residual anti nutritional factors. The breast and abdominal fat components of finished broilers are very important in assessing quality. Broilers with better developed breast meat are considered superior while heavy deposit of fat in finished broilers indicates poor finishing [30]. From the result of this study, broilers fed tallow seed meal based diet seem to be better than those fed full fat soybean based diets. The present results are in agreement with earlier observations by [8] that residual toxic substances were not completely eliminated using single processing method of soaking, cooking and toasting detarium seeds.

3.2 Haematological indices of experimental birds

The results on Table 3 present the summary of haematological indices of broiler chickens. The observed results of the haematological indices of packed cell volume, red blood cell, haemoglobin, White blood cell and its differentials (lymphocytes, neutrophils, basophils, monocytes, eosinophils) are not significantly ($P > 0.05$) different.

The statistical similarity ($p>0.05$) in haematological indices in this study were all within the normal ranges reported by [31], indicate the better utilization of all the protein sources. Haematological values could serve as baseline information for comparison in conditions of nutrient deficiency, physiology and health status of farm animals [32]. The non disparity in values in these results is an indication adequate integrated treatment of methods by soaked-toasted to eliminate the metabolites by rendering them inactive thereby tolerable to birds' health. The PCV values are similar to the range of 27 – 33% reported by [33] which indicated that the birds were neither dehydrated nor anaemic. The RBC, WBC, and Hb

values obtained in this study were within the range of $2.5 - 3.2 \times 10^6 /\text{mm}^3$, $9 - 31 \times 10^3 /\text{mm}^3$ and $6.5 - 11 \text{ g/dl}$ reported by [33,34]. The comparable PCV, Hb, and RBC of broiler chickens fed experimental diets were similar ($P>0.05$), which suggest absence of dysfunction of blood haemopoiesis. The differential lymphocytes, monocytes, eosinophils and basophils showed no significant ($P>0.05$) difference among the treatment group, but the range of values observed were similar to the range of values reported by [35]. This is an indication of adequate production of anti-bodies and no bacterial or viral infection. This study is in agreement with reports that blood act as a pathological reflector of the status of exposed animals to toxicant and other conditions [36]. According to [37], changes in haematological parameters are often used to determine various status of the body and to determine stresses due to environmental, nutritional and/or pathological factors.

3.3. Biochemical indices of experimental birds

The result of the biochemical indices is shown on Table 4. There was no observed significant difference ($P > 0.05$) across the treatment groups in serum total protein, albumin, glucose, urea, cholesterol; globulin, AST, ALT, calcium, magnesium, sodium and potassium of birds fed graded levels of STTSM as replacement for soybean.

The non disparity in serum biochemical indices in serum total protein, albumin, globulin, urea and glucose values across the treatment groups irrespective of the STTSM inclusion level suggest no alteration in normal systemic and inhibition of protein utilization by the birds [38]. The electrolytes and marker enzymes; Aspartate aminotransferase (AST) and Alanine aminotransferase are equally not differed significantly as the STTSM level of inclusion varies in feed, indicating that the liver and the kidney were physiologically normal. The similarity ($p>0.05$) in serum urea values among the treatment groups suggest there is no wasting or catabolism of muscle tissue and live cell damage as reported by [39].

4. CONCLUSION

Substitution of soaked-toasted tallow seed meal with soybean meal in diets depressed the live weight and increased fat deposit but with no adverse affects on organ weights and haematological and biochemical indices of broiler chicks. Soaked-toasted treatment is an effective method to improve the nutritional value of tallow seeds for poultry. Based on low fat deposit, Tallow seed meal is a better protein source and can be utilized to produce broiler chickens up to 20% with superior carcass quality compared to full fat soybean.

ETHICAL CONSIDERATION

The study was conducted with permission from the Nigeria Institute of Animal Science welfare and ethics committee (Act No.26 Of 2007) in collaboration with the Department of Animal Production and Health, Federal University Wukari, Taraba State, Nigeria.

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. Table 2: Live weight and organ weights of finisher broiler chickens fed soaked-toasted tallow seed meal.

Parameters	0% STTSM	10% STTSM	20% STTSM	SEM
Mean Live weights (g)	1866.67 ^a	1683.33 ^b	1633.33 ^b	62.36
Liver (g)	39.67	30.00	33.33	1.75
Heart (g)	9.00	8.33	10.00	0.77
Pancreas (g)	7.00	6.33	5.33	1.09
Proventriculus (g)	10.33	9.33	9.33	0.75
Gizzard (full)(g)	52.00	48.67	43.00	2.46
Kidney (g)	2.00	2.00	2.00	0.00
Fat deposit (g)	65.33 ^a	39.33 ^b	39.00 ^b	8.14

Mean within the same row bearing different superscripts differ significantly (P<0.05)

Table 3. Haematological indices of birds fed diets containing soaked-toasted tallow seed meal

Parameters	0% STTSM	10% STTSM	20% STTSM	SEM
PCV (%)	28.00	28.12	28.37	0.30
RBC ($\text{mm}^3 \times 10^6$)	2.73	2.74	2.73	0.03
Haemoglobin (g/100ml)	11.00	11.00	10.67	0.10
WBC ($\text{mm}^3 \times 10^3$)	19.77	19.53	19.70	0.13
Lymphocytes, %	60.37	56.57	56.93	1.63
Neutrophils, %	43.00	43.47	43.67	0.47
Monocytes, %	6.10	6.43	6.86	0.29
Eosinophils, %	3.90	4.27	4.57	0.12
Basophils, %	1.33	1.00	0.67	0.72

Mean within the same row bearing different superscripts differ significantly ($P < 0.05$)

Table 4: Biochemical indices and serum electrolytes of experimental birds fed soaked-toasted Tallow seed meal.

Parameters	0% STTSM	10% STTSM	20% STTSM	SEM
Serum Total protein (g/100ml)	3.67	3.73	3.43	0.17
Albumin(g/100ml)	1.40	1.47	1.40	0.07
Urea (mmol/l)	2.67	2.67	2.70	0.14
Glucose (mg/100ml)	160.50	154.17	160.73	3.19
Cholesterol (mg/100l)	116.83	112.73	110.97	5.17
Globulin (g/100ml)	2.51	2.40	2.38	0.04
ALT (μl)	8.02	9.29	8.53	0.52
AST (μl)	13.01	13.87	12.87	0.41
Calcium (mg/100ml)	11.28	10.67	10.83	2.95
Na (mEq/l)	138.67	138.67	140.67	15.38
K (mEq)	5.21	4.53	4.77	1.3
Magnesium (mg/100ml)	1.94	1.74	1.91	0.09

Mean within the same row bearing different superscripts differ significantly ($P < 0.05$)