GSC Biological and Pharmaceutical Sciences
eISSN: 2581-3250 CODEN (USA): GBPSC2
Cross Ref DOI: 10.30574/gscbps
Journal homepage: https://gsconlinepress.com/journals/gscbps/

(RESEARCH ARTICLE)

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Serum biochemistry of broiler chickens fed different levels of pawpaw leaf meal (PLM) in the diet

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GSC Biological and Pharmaceutical Sciences, 2022, 19(02), 233–238

Publication history: Received on 04 April 2022; revised on 14 May 2022; accepted on 17 May 2022

Article DOI: https://doi.org/10.30574/gscbps.2022.19.2.0173

Abstract

Ninety six 21 day- old unsexed broiler chickens were used for the study designed to evaluate the effect of different levels of pawpaw leaf meal on the serum biochemistry of broiler chickens. The experiment consisted of four treatment groups, each in three replicates of eight birds per replicate. The treatments reflect the different levels of inclusion of the pawpaw leaf meal: T_1 (control 0 g/kg of PLM in feed), T_2 (3 g/kg of PLM in feed), T_3 (5 g/kg of PLM in feed) and T_4 (7 g/kg of PLM in feed). The experiment was framed in a completely randomized design and lasted from the beginning of the fourth week till the end of the eight week (five weeks). Results showed that alanine amino transferase and globulin were significantly affected by treatments ($p<0.05$), though values were still within the normal range reported in the literature for best physiological functions of broiler chickens. Pawpaw leaf meal inclusion in the diet did not affect the other biochemical indices studied. It was concluded that the immune vigilance of the chickens appeared not compromised by the inclusion of pawpaw leaf meal in the diet up to 7 g/kg inclusion level.

Keywords: Serum; Pawpaw; Chickens; Immune; Biochemistry; Physiology

1. Introduction

Formulation of poultry diets greatly depend on plant proteins that can supply the necessary amino acid that are not available in adequate quantities in the cereals. Plant protein sources are relatively cheaper and more readily available than animal protein sources [1]. Broiler chickens (*Gallus gallusdomesticus*) are domesticated fowls bred and raised especially for good meat production. Most commercial broilers reach slaughter weight between four and seven weeks of age, although slower growing breeds reach slaughter weight at approximately fourteen weeks of age. This is due to extensive breeding and selection for rapid early growth and the husbandry used to sustain these broilers [2].

The use of locally available and cheap feed ingredients has received particular attention as a viable alternative to the use of conventional feed stuffs in developing countries [3; 4; 5]. Vegetable-based feeds are rich sources of essential plant amino acids, vitamins, minerals and antioxidant. In addition to the rich content mentioned above, it has been established that green vegetable leaves are cheaper and abundant sources of protein because of their ability to synthesize amino acids from a wide range of available primary materials [6].

Among tested leaf meals in poultry nutrition are *Leucaena leococephala* (Mimosoid tree), cassava leaf meal, *Lablab purpureus* (bean species in the family Fabaceae), *Tithonia diversifolia* (flowering plant species in the family Asteraceae), *Microdesmis puberula* (species from the family Pandaceae), *Ipomea asarifolia* (genus in the flowering plant family Convolulaceae), *Azadirachta indica* (neem tree family Meliaceae), *Tephrosia bracteolate* (flowering plants in the pea family Fabaceae) among many others [7; 8; 9; 5; 4; 10]. D'Mello [10] recommended 5.0 and 10.0 % dietary levels of leaf meals for broiler and laying hen respectively. Ademola and Farinu [11] recommended dietary inclusion of *Tithonia*

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diversifolia in combination with either penicillin or streptomycin at 100 ppm in the diet of laying hens while Odunsi [5] recommended 100 and 150 g/kg of *Lablab purpureus* leaf meal for laying hen.

Pawpaw (*Carica papaya*) is a plant native to tropical America. It is popular in the tropics and subtropics for its easy cultivation, rapid growth, quick economic returns and adaptation to diverse soil and climates [13; 14]. However, pawpaw has been naturalized in many tropical and subtropical countries [15]. Pawpaw leaf meal contains four identified proteolytic enzymes: papain, chymopapain A, chymopapain B and papaya peptidase. Very few published works are available on the effect of pawpaw leaf meal on the serum biochemistry of broiler chickens with particular reference to the humid tropical environment of Nigeria, hence the need for this study.

Objective of the study

The objective of this study was to determine the serum biochemistry of broiler chickens subjected to different levels of pawpaw leaf meal in the diet.

2. Material and methods

2.1. Location and Description of Experimental Site

The study was carried out at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Production, Kogi State University, Anyigba. Anyigba is located in the derived savanna of Nigeria between latitude 7 °15 ' and 7 °29 'N of the equator and between longitude 7 °11 ' and 7 °32 'E of the Greenwich meridian with an average altitude of 420 m above the sea level. The zone is characterized by 6-7 months of annual rainfall ranging from 1400 - 1500mm and daily temperature range of 25 °C – 30 °C with the highest temperature being between June - July [15].

2.2. Source of feed and experimental diet

The pawpaw leaves (*Carica papaya*) used for this experiment were harvested from the pawpaw trees around the University farm. The leaves were harvested and dried under shade until they became crispy while still retaining its greenish colouration. Commercial feed was used for the feeding trial. The proximate composition of the pawpaw leaf meal and of the commercial feed are presented in Table 1 and Table 2 respectively.

2.3. Experimental birds and their management

A total of ninety six unsexed 21 days old broiler. At the beginning of the feeding trial the birds were weighed individually and were randomly allotted to four dietary treatment groups. The treatments consisted of 0 g/kg, 3 g/kg, 5 g/kg and 7 g/kg PLM/kg in feed reflecting the different levels of inclusion of pawpaw leaf meal (PLM), in a Completely Randomized Design. Each of the treatments was replicated three times. There were eight birds per replicate, and hence, 24 birds per treatment. The feeding trial lasted for five weeks and feed and water were provided *ad libitum*.

2.4. Blood samples collection and evaluation

At the end of the 8th week, two broilers from each replicate were randomly selected for blood sample collection. 2ml of blood was gently collected from the wing vein into Bijou bottles (plain bottles) without anticoagulant and were used for the biochemical assay. The samples were immediately taken for analysis at the Medical Biochemistry Laboratory of Kogi State University Anyigba. Serum biochemical indices analyzed were: total protein, albumin, globulin, blood urea, aspartate amino trasferase (AST), alanine amino transferase (ALT) and cholesterol.

2.5. Statistical analysis

All data collected were subjected to one way analysis of variance (ANOVA) using statistical package for social sciences (SPSS) version 20. Significant differences between the treatment means were separated using Least Significant Difference (LSD) at 5 % level of significance.

Table 1 Proximate composition of pawpaw leaf meal

Nutrients	Percentage
Crude protein	27.59
Crude fibre	13.15
Nitrogen Free Extract	26.51
Ether Extract	8.32
Ash	10.25
Moisture	14.19

Table 2 Proximate composition of commercial diet

Nutrients	Percentage
Crude protein	17.41
Crude fibre	6.90
Nitrogen free extract	46.99
Ether extract	7.65
Ash	15.55
Moisture	5.50

3. Results and discussion

The result of the biochemical response of broiler chickens fed different levels of Pawpaw Leaf Meal (PLM) is presented in Table 3. Alanine amino transferase (ALT) was significantly affected by treatment ($P<0.05$). ALT values increased from T_1 to T_4 (9.50 µl to 16.66 µl). These values, though below the average value of 22.10 µl reported for broiler chickens [16] is in agreement with the observation of Okpe [17] for broiler chickens in the same environment. ALT is known to increase with hepatocellular damage, hepatocytes proliferation or hepatocellular degeneration [16]. However, elevation of ALT levels does not automatically mean that medical problems exist, diurnal variations due to strenuous exercise and use of certain medications are also normal causes of ALT of elevation. Aspartate amino transaminase was not affected by treatment ($P >0.05$). These observations may indicate normal functioning of the liver and kidney of the birds within the confines of the inclusion levels of PLM used. There was no treatment effect on urea ($P>0.05$). This observation is in agreement with the report of Okpe [17] broiler chickens. Urea is the final degradation product of protein and amino acid metabolism. Increase in blood urea level may be due to cardiac decomposition, water depletion due to increase protein metabolism and high protein diet [18]. Okeke [19] reported that when poor quality proteins are eaten, there is an increase in blood urea values. The result of this present study may therefore indicate the presence of high quality protein in the PLM diet consumed by chickens. Cholesterol concentration was numerically but not significantly ($P>0.05$) reduced with treatment up to 5 g/kg inclusion level. This result is in agreement with that of Ologhobo [20] and Okpe [17] who reported low blood concentration levels in broiler chickens. Cholesterol concentration has been reported to vary with the bird's diet [21; 20], and its level is increased when biliary flow is obstructed [20]. Low levels may be attributed to the absorption of intestinal cholesterol by dietary fibre and rapid excretion [20]. The non-significant ($P<0.05$) treatment effect on cholesterol observed in this study may suggest that the diet might have assisted in reducing the deposition of cholesterol in the muscle, and consequently produce lean meat. Oluwagbemi and Okpe [22] reported that low cholesterol levels may have nutritional and health benefits on animals.

Total protein values were within the range of 3.26 - 8.80 g/l reported by Bowes *et al*. [23]; Iheukwumere and Herbert [24] and Okpe [17] for healthy broiler chickens. This may be an indication of nutritional adequacy of dietary protein since serum protein synthesis is related to the amount of available protein in the diet [25]. Similarly, the range of values obtained for albumin and globulin agrees with the report of Durotoye *et al*.[26] and Okpe [17] for healthy broilers indicating there was no alteration in the normal synthetic protein utilization and that the chickens have good resistance to diseases and a corresponding high immunity.

Table 3 Serum biochemistry indices of broiler chicken fed different levels of pawpaw leaf meal

Parameter	T_1 (0 g/kg)	T_2 (3 g/kg)	T_3 (5 g/kg)	T_4 (7 g/kg)	SEM	LOS
AST (ul)	122.66	104.16	95.16	123.50	19.02	NS
ALT (ul)	9.50^{c}	13.50^{b}	15.16^{a}	16.66^{a}	2.83	*
Urea (mg/dl)	0.58	0.63	0.50	0.48	0.20	NS
Cholesterol(mg/dl)	1.96	1.90	1.78	1.98	0.12	NS
Albumin (g/dl)	1.65^{ab}	1.70^{a}	1.55^{b}	1.50^{c}	0.05	*
Total protein (g/l)	3.65	3.71	3.61	3.55	0.11	NS
Globulin (g/dl)	2.00	2.01	2.06	2.05	0.06	NS

^{abc} =Means on the same row with different superscripts are significantly different (P<0.05); * = significant; Ns = not significant (P>0.05); LOS = level of significance ; SEM = standard error of mean; AST = aspartate aminotransferase; ALT = alanine aminotransferase

4. Conclusion

This study determined the biochemical response of broiler chickens fed different dietary level of pawpaw leaf meal (PLM). The immune vigilance of the birds and their defence against infections appear not to be compromised by the inclusion level of PLM in the diets. Improved liver and kidney functions were also indicated from the result of the study. Higher levels of inclusion of PLM may be investigated to determine the upper limit the chickens can tolerate. Treatment should also commence at an earlier age in future studies to ascertain the safest age which may not be physiologically injurious to the birds.

Compliance with ethical standards

Acknowledgments

The Authors are grateful to the Authorities of the Department of Animal Production, Kogi State University, Anyigba for permission to use their facilities.

Disclosure of conflict of interest

The Author hereby declare that no conflict of interest exist.

Statement of ethical approval

The research complied with the ethical standards of Kogi State University, Anyigba, Nigeria.

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