



Serum Biochemistry and Haematology of Broilers Fed Baobab and Moringa Leaf Meal as Premix

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Authors' contributions

This work was carried out in collaboration between all authors. Authors AUH and AMS designed the study. Author AUH carried out the experiment, statistical analysis, managed the literature searches and come up with the first draft of the manuscript. Authors ISH, SMI, BMD, FAM and AMB read and approved the final manuscript.

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ABSTRACT

Serum biochemistry and haematology of broilers fed baobab and moringa leaf meal as premix were studied using 36 broiler birds. The birds were grouped into six dietary treatments labeled T₁, T₂, T₃, T₄, T₅ and T₆ respectively. T₁ was maintained on commercial premix (CP), T₂ on CP and baobab (BB), T₃ on commercial premix and moringa (MG), T₄ on BB only, T₅ on MG only and T₆ on BB/MG leaf meal in 1:1 ratio. The data collected on serum biochemistry were analyzed and the results revealed that total protein was similar in all the treatments except for T₃ which differ significantly (P< 0.05) from other treatments and albumin differ significantly (P< 0.05) in all the treatment groups except for T₃ which did not differ (P>0.05) from the control group. However, the highest serum protein was recorded in birds on T₆ while T₄ and T₅ had the highest albumin values. The values for AST in T₃ and T₄ were significantly affected (P<0.05) by the dietary treatments when compared to

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control group and other treatments. Levels of GGT were not significant ($P > 0.05$) in all the treatments. Significant decrease ($P < 0.05$) was also observed in the values of urea but lowest values were recorded in T_2 , T_3 and T_4 . The best significant decrease ($P < 0.05$) for creatinine was recorded in T_3 . There was significant increase in all the haematological parameters measured ($P < 0.05$) except for the values of Hb and RBC in T_6 which showed a significant decrease. The highest significant increase ($P < 0.05$) for WBC was recorded in T_4 and lowest in T_2 . The highest significant increase ($P < 0.05$) in PCV was recorded in T_3 while the lowest was seen in T_6 . The levels of RBC differ significantly ($P < 0.05$) among the treatments as T_3 recorded highest the level. The MCV, MCH and MCHC values increase significantly ($P < 0.05$) in a similar pattern among the entire treatment groups. Replacement of commercial premix with baobab and moringa leaf meal in broilers diet has no deleterious effect on their biochemical and haematological parameters.

Keywords: Serum biochemistry; haematology; broilers; baobab; moringa; leaf meal; premix.

1. INTRODUCTION

The potential of poultry industry in alleviating the challenges of low availability of animal protein for human consumption in developing countries is being hampered by high cost of production [1]. The search for least-cost formulations has involved the replacement of expensive feeding-stuffs with cheaper alternatives in the formulation of poultry ration [2,3,4]. One of the ways of reducing the cost of poultry feed is by preparing vitamin-mineral premix from materials sourced locally.

Serum biochemical and haematological parameters have been observed as good indicator of the physiological status of animal and their changes are important in assessing the response of animal to various physiological situations [5,6]. Changes in haematological parameters are often used to determine health status of the body and to know the degree of environmental, nutritional and pathological stresses [7].

The use of leaf meals as feed ingredients alternative to conventional feed resources is a novel area of research in animal nutrition [7,8,9]. Leaf meals of some tropical legumes and browse plants, rich in nutrients like vitamins, minerals and carotenoids have been reported [10,11,12]. The uses of leguminous multipurpose trees and shrubs have been suggested to be a viable alternative source of proteins, vitamins and minerals for poultry feeding. Plant leaves are commonly processed into leaf meals for use as poultry feed [13].

Murro et al. [14] reported that, *Moringa oleifera* leaves are highly nutritious containing significant quantities of vitamins and minerals. The baobab leaves have reasonable amounts of macro and micronutrients especially magnesium, manganese and high iron content compared to

numerous other wild-gathered foods, and also rich sources of calcium, zinc and phosphorus [15].

Premixes are homogenous mixtures required in small amounts in rations containing one or several micronutrients with diluents or carriers. As critical as the presence of premix is in the ration of monogastric animals in enhancing their performance and well being, information on how to assemble premix is limited because such is the manufacturer's trade secret [16]. Thus the need to evaluate a number of premixes compounded from locally available ingredients relative to commercial premix [17]. The need to harness the potentials green vegetable plants as part replacements for the more expensive conventional feed ingredients such as premix have been variously expressed by [5,12]. The purpose of this research work was therefore to evaluate the biochemical and haematological parameters of broiler chickens fed baobab and moringa leaf meal as premix.

2. MATERIALS AND METHODS

The baobab and moringa used in this experiment were sourced from college farm air-dried, grinded and stored in plastic container before used.

2.1 Experimental Site

The experiment was carried out at the Poultry Unit of the department of animal health and production College of agriculture Zuru Kebbi state Nigeria. The area is geographically located within latitude $11^{\circ} 55'$ north and longitude $4^{\circ} 45'$ and $5^{\circ} 25'$ east of the equator [18].

2.2 Experimental Diets

Six experimental diets were formulated and tagged T_1 , T_2 , T_3 , T_4 , T_5 and T_6 . Diet 1(control)

contains only commercial premix (CP) in addition to other ingredients while diet 2, 3, 4, 5 and 6 contains baobab leaf and commercial premix (CP/BB), moringa leaf meal and commercial premix (CP/MG), baobab leaf meal only (BB), moringa leaf meal only (MG) baobab and moringa leaf meal (BB/MG), as premix in addition to other ingredients respectively.

2.3 Management of Experimental Birds

A total of thirty six, (36) day old broilers were randomly allocated into six (6) dietary treatment groups. Each treatment composed of six birds and each treatment was fed one of the experimental diets for the period of four weeks.

2.4 Sample Collection

Approximately, 2 ml of blood were taken from the wing vein of the birds and disposed into plain test tubes for biochemical analysis and into EDTA (ethylene-diamine tetraacetic acid) tube for haematological analysis using 2 ml syringe.

2.5 Data Analysis

Data collected were subjected to one way analysis of variance (ANOVA). The significant means were separated using Duncan multiple range test.

3. RESULTS AND DISCUSSION

Table 2 shows the effects of baobab and moringa leaf meal as premix on biochemical

parameters of broilers. Among all the parameters measured, total protein was similar in all the treatments except for T₃ which differ significantly (P< 0.05) from other treatments and albumin differ significantly (P< 0.05) in all the treatment groups except for T₃ which did not differ (P>0.05) from the control group. However, the highest serum protein was recorded in birds on T₆ while T₄ and T₅ had the highest albumin values. The values for AST in T₃ and T₄ were significantly affected (P<0.05) by the dietary treatments when compared to control group and other treatments. The levels of GGT were not significant (P> 0.05) in all the treatments. Significant decrease (P< 0.05) was observed in the values of urea but the lowest values were recorded in T₂, T₃ and T₄. The best significant decrease (P<0.05) for creatinine was recorded in T₃.

The haematological indices of the broiler chickens fed the experimental diets from Table 3 indicated that there was significant increase in all the haematological parameters measured (P<0.05) except for the values of Hb and RBC in T₆ which showed a significant decrease. The highest significant increase (P<0.05) for WBC was recorded in T₄ and lowest in T₂. The highest significant increase (P<0.05) in PCV was recorded in T₃ while the lowest was observed in T₆. The levels of RBC differ significantly (P<0.05) among the treatments as T₃ recorded highest the level. The MCV, MCH and MCHC values increase significantly (P<0.05) in a similar pattern among the entire treatment groups.

Table 1. Percentage composition of experimental diets fed to broiler finisher

Ingredients %	T1(CP)	T2(CP/BB)	T3(CP/MG)	T4(BB)	T5(MG)	T6(BB/MG)
Maize	62.00	62.00	62.00	62.00	62.00	62.00
Soybean meal	37.70	37.70	37.70	37.70	37.70	37.70
Wheat offal	02.00	02.00	02.00	02.00	02.00	02.00
Blood meal	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	3.10	3.10	3.10	3.10	3.10	3.10
Premix	0.50	0.25	0.25	0.00	0.00	0.00
Baobab leaf	0.00	0.25	0.00	0.50	0.00	0.25
Moringa leaf	0.00	0.00	0.25	0.00	0.50	0.25
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
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated analysis						
CP%	20.00	20.00	20.00	20.00	20.00	20.00
ME (Kcal/kg)	2958	2958	2958	2958	2958	2958
Calcium	1.00	1.00	1.00	1.00	1.00	1.00
Phosphorus	0.80	0.80	0.80	0.80	0.80	0.80

Table 2. Biochemical indices of birds fed baobab and moringa leaf meal

Parameters	T1	T2	T3	T4	T5	T6	±SEM
TP (g/dl)	2.77 ^b	2.85 ^b	1.40 ^a	3.62 ^b	3.07 ^b	4.02 ^b	0.14
ALB (g/dl)	0.72 ^{ab}	0.97 ^b	0.17 ^a	1.42 ^b	1.40 ^b	1.00 ^b	0.15
AST (iu/L)	20.82 ^a	22.22 ^a	47.40 ^b	43.88 ^b	22.05 ^a	21.45 ^a	18.1
GGT (iu/L)	2.05	1.97	1.75	1.85	2.05	2.32	0.50
UREA (mg/dl)	0.48 ^b	0.38 ^a	0.38 ^a	0.36 ^a	0.50 ^b	0.53 ^b	0.04
CRT (mg/dl)	0.24 ^b	0.23 ^b	0.19 ^a	0.28 ^{ab}	0.28 ^{ab}	0.23 ^b	0.02

^{a,b} Means within a row with different superscripts are significantly different ($p < 0.05$) TP= Total protein; ALB = Albumin; AST = Aspartate amino transferase; GGT = Gamma glutamyl transferase; CRT = Creatine; SEM = Standard error mean

Table 3. Haematological parameters of birds fed baobab and moringa leaf meal

Parameters	T1	T2	T3	T4	T5	T6	±SEM
WBC ($10^6/\text{mm}^3$)	314.3 ^a	313.7 ^a	350.0 ^b	369.0 ^b	366.7 ^b	333.3 ^{ab}	6.16
PCV (%)	26.80 ^b	27.50 ^b	29.50 ^{ab}	27.75 ^b	27.25 ^b	21.00 ^a	2.22
Hb (g/dl)	8.72 ^a	9.62 ^b	9.97 ^b	9.84 ^b	9.87 ^b	7.47 ^a	1.52
RBC ($\times 10^3/\text{mm}^3$)	19.97 ^a	21.05 ^{ab}	21.90 ^{ab}	21.42 ^{ab}	20.55 ^{ab}	17.40 ^b	2.18
MCV	133.1 ^a	130.7 ^a	131.1 ^a	133.1 ^a	139. ^b	139.4 ^b	3.41
MCH (g)	43.85 ^a	48.97 ^b	44.42 ^a	43.10 ^a	50.07 ^b	53.82 ^b	4.06
MCHC (%)	33.00 ^a	36.35 ^{ab}	36.87 ^{ab}	34.42 ^a	37.22 ^b	38.20 ^b	10.1

^{a,b} Means within a row with different superscripts are significantly different ($p < 0.05$) MCV = mean corpuscular volume; MCH = Mean cell haemoglobin; MCHC = Mean corpuscular haemoglobin concentration; RBC= Red blood cell; Hb = Haemoglobin; PCV = Packed cell volume; WBC = White blood cell; SEM = Standard error of mean

The observed increase in serum total protein and albumin is positively related to high quality of the dietary components, protein synthesis and health of many tissues of birds [19,20,21,9]. Low total protein and albumin levels can suggest liver and kidney disorder, or a disorder in which protein is not digested or absorbed properly. The total protein value obtained in this study is similar to what was reported by Adegbenro et al. [16]. Who reported a slight increase in serum total protein and albumin of broiler birds fed leaf composite mix premix, this report is also the same with the one where significant difference occurred in the total protein value of birds served fluted pumpkin leaves extract supplement [22]. It is however contrary to the findings of Tijani et al. [11]. Who indicated serum albumin to be significantly ($P < 0.05$) higher in birds fed control diet than those fed varying level of moringa leaf meal. The increase in albumin levels recorded in this research is suggestive of proper maintenance of the integrity of the liver and extrahepatic tissues involved in protein synthesis. From the result of the liver enzymes, the reduction in AST and GGT activities compared to control group shows that the premix from the two leaf meals is not toxic to the liver, as elevation in the activity of these enzymes is associated with liver disease [1]. Creatinine and

urea levels in the serum are used to test the kidney function and protein breakdown [23]. The lower values recorded in this study is an indication that there was good absorption and utilization of protein in the diet [24]. Creatinine value is also an indicator of muscle mass catabolism [25]. These results showed the normal physiological process in the broiler chickens fed the test ingredients and it confirmed the nutritional adequacy and safety of the experimental diets. Haematological parameters are a reflection of the animal responsiveness to both external and internal factors which include feed and feeding [23,10]. Findings from this research have shown that there was significant differences in the mean values of the RBC PCV, Hb and WBC across all the dietary treatments, although, they were within reference range in broilers [26]. This observation suggests that the health of the birds were not compromised throughout the study period. Red blood cells are responsible for the transportation of oxygen and carbon dioxide in the blood as well as the manufacture of haemoglobin [17]. Hence, high values of RBC indicate greater potential for these functions and a better state of health this could be attributed to level of iron in baobab and moringa leaf.

The significant increase in the level of WBC could be related to the ability of baobab and moringa leaf meal to provide and maintain the essential amino acids and minerals in the diets which are necessary for the normal functioning of the blood cells producing tissues and organs. It has been reported that granulocyte-macrophage colony stimulating factor, interleukins IL-2, IL-4 and IL-5 regulate the proliferation, differentiation and maturation of committed stem cells responsible for the production of white blood cells [27,28]. It is suggestive therefore, that baobab and moringa leaves have immunostimulatory effects. The values of MCV, MCH and MCHC increase significantly in the same pattern among the treatment groups indicating the quality of baobab and moringa leaves in maintaining the integrity of blood indices in broiler birds [29].

4. CONCLUSION

From the result of obtained it could be concluded that use of baobab and moringa leaves as substitute for commercial premix has no detrimental effect on serum biochemical and haematological parameters of broilers.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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