ISSN: 2835-7914

Research Article

Biomedical Science and Clinical Research

Effect of Replacing Soybean Meal with Dried Bovine Blood Meal on Growth Performance, Haematology and Serum Profile of SASSO Birds

Abdul-Rahaman S. Salifu, Halidu Mamudu Agolisi*, Ebenezer Kofi Nartey and Shirley Shena Waltia

Department of Ecological Agriculture, School of Agriculture, Bolgatanga Technical University, P.O. Box 767, Ghana

***Corresponding Author**
Halidu Mamudu Agolisi, Department of Ecological Agriculture, School of Agriculture, Bolgatanga Technical University, P.O. Box 767, Ghana

Submitted: 2023, Oct 23 **Accepted:** 2023, Nov 20 **Published:** 2023, Nov 29

Citation: Salifu, A. R. S., Agolisi, H. M., Nartey, E. K., Waltia. S. S. (2023). Effect of Replacing Soybean Meal with Dried Bovine Blood Meal on Growth Performance, Haematology and Serum Profile of SASSO Birds. *Biomed Sci Clin Res, 2*(4), 405-408.

Abstract

The rising cost of processed feed has created a demand for more inexpensive feed options for chicken production. In most slaughterhouses, blood is thrown as trash, however, it can be used as a protein source. A study was conducted to assess the effect of replacing soybean meal with dry bovine blood meal on the growth performance and blood profile of SASSO birds. The treatments were as follows: The treatments were: control, 5 and 10% dried bovine blood meal (DBBM). Chemical analysis revealed that the blood meal content contained 86.76% crude protein, 1.36% ether extract, 1.98% crude fibre, and 8.54% DM ash. Birds fed the 5% DBBM diet had the highest daily DM intake (80.35%). The final weight and daily weight gain increased significantly (P<0.05) with increasing DBBM levels. Birds fed the 10 % DBBM diet had the best feed conversion. All haematological and serum profile parameters studied were within the normal physiological ranges. It was concluded that dried bovine blood meal supplementation of up to 10% had no adverse effects on dry matter intake, daily weight gain, growth performance, and blood parameters of SASSO birds.

Keywords: Bovine Blood, Sasso Birds, Haematological, Growth Performance, Serum Profile

1. Introduction

Poultry production contributes greatly to the economic development of any country, and Ghana is no exception. However, the cost and availability of feed ingredients are the most significant restraints in this market [1]. Feed and feeding costs account for roughly 70-75% of production overhead. The cost of fish and soybean meal is sometimes limited due to high pricing and production issues [2]. The high cost of soybean and fish meal has hampered the expansion of the poultry sub-sector and availability of animals proteins to human [3]. The poultry industry's long-term viability is jeopardized due to increased electricity costs. Processed feeds equipment, and drugs have resulted in a significant drop in chicken productivity, with many poultry farmers losing their farms and potential investors becoming less keen to engage in the field. This has prompted the quest for a less expensive protein source to replace fish meal and soya bean meal. Dried bovine blood meal (DBBM) is a low-cost protein source that could be profitable for poultry.

Blood is a major by-product of ruminant animals in slaughterhouses, and it is dumped as waste in most areas of the globe. Large volumes of blood are produced at slaughterhouses, producing substantial environmental pollution [4,5]. Blood meal contains of methionine, lysine, and cysteine. There have been instances of blood-rumen digesta being used in poultry diets. However, much of this research has concentrated on broilers rather than layers. There is limited literature on feeding a blood-meal-based diet to replace soybean meal in chickens. This study investigated the effect of replacing a portion of soybean meal with a dried bovine blood meal on the growth performance and serum profile of SASSO chickens

2. Materials and Method

2.1 Experimental Area

The study was conducted in the experimental livestock unit of Bolgatanga Technical University's Department of Ecological Agriculture in Sumbrungu, Ghana. The location is in the Upper East Region, where the average rainfall is 800mm from May to June and 1,100mm from September to October, in the Sudanian Savanna ecological zone.

3. Source and Processing of Blood Meal

Blood samples from cattle from the Bolgatanga abattoir were collected and transported to the experimental site. The blood was boiled in a petroleum drum for 30 minutes at 60-90°C, then sun-dried for three days to ensure its health.

4. Experimental Diets and Design

The dried blood meal was mixed thoroughly with other feed ingredients such as maize, wheat bran, soya bean meal, dried

blood-rumen digesta, oyster shells, salt, shea nut cake, and vitamin premix (Table 1). The trial used a completely randomized design (CRD) with three dietary treatments (0, 5%, and 10%) replicated four times for each treatment group.

	DBBM inclusion level (%)		
Ingredients (% As fed basis)	**Control**	**5**	**10**
Maize grain	60	60	60
Wheat bran	12.5	12.5	12.5
Soybean Meal	16	11	6
Dried Blood Meal	0	5	10
Shea Nut Cake	5	5	5
Oyster shell	5	5	5
Vitamin premix	1	1	1
Salt	0.5	0.5	0.5
Total	**100**	**100**	**100**

Table 1: Proportion of experimental ingredients

5. Management of Experimental Birds

A total of 72 Sasso grower birds (4 weeks old) and six (6) birds were randomly assigned to twelve (12) cages. The experimental cages were fitted with water and feed troughs. The cages were disinfected and sprayed ten (10) days before the experimental birds were placed. This was performed to ensure that all disease-causing organisms were eliminated. The cages measured two metre square with a stocking density of six birds per pen. The birds were divided into three treatment groups and fed for 84 days. Feed was regularly weighed, and leftovers were measured weekly. Cleaning of watering troughs was done daily. Weights were measured using a digital scale every two weeks.

6. Feed Conversion Ratio

The feed conversion ratio per replicate was calculated by dividing the total weight of feed consumed on a DM basis by the weight gain.

FCR=(Mean dry matter intake (g) /(Mean weight gain (g))

7. Chemical Analyses

The diets were ground in a centrifugal mill and passed through a 0.5 mm sieve (Retseh GmbH. Hann, Germany) for the chemical analyses. AOAC (2000) procedure was used to determine dry matter (DM), ash, and crude protein (CP) percentages.

8. Statistical Analysis

GenStat 18.2 edition's one-way analysis of variance approach was used to analyse the data. Turkey was used to distinguish between treatment means when an F statistic was significant (P0.05).

9. Results and Discussion

9.1 Chemical Composition of the Experimental Diets

The dried bovine blood meal used in this investigation has 95.21% dry matter, 86.76% crude protein, 1.36% ether extract, and 1.98% crude fibre (Table 2). This suggests that dried bovine blood meal can be substituted for soybean meal as an additional source of protein to lower production costs. With increasing blood meal levels, the diets' crude protein (CP) content increased, ranging from 15.34 to 18.67% (Table 2).

	DBBM inclusion level (%)			
Ingredients (% As fed basis)	**Control**	**5**	**10**	**Sole DBBM**
Dry matter (%)	95.25	95.00	95.25	95.21
Crude Protein (% DM)	15.34	16.95	18.67	86.76
Ether Extract (%DM)	8.50	8.91	9.31	1.36
Crude Fibre (% DM)	3.425	3.30	2.88	1.98
Calcium (% DM)	3.25	3.11	3.00	0.50
Ash (%DM)	10.56	10.45	10.34	8.54

Table 2: Chemical composition of the experimental diets

10. Feed Intake and Growth Performance

The daily nutrient intake of birds fed different levels of dried bovine blood meal as a replacement for soybean meal is presented in Table 3. There was a significant difference (P<.001) in daily dry matter intake (DMI), with a daily average DM intake of 69.24 to 80.35g/DM for the control and 5% inclusion levels of DBBM respectively. There was a significant difference (P<.001) in daily crude protein intake (CPI) with birds fed on 10% DBBM responding positively than the control.

Parameter	DBBM inclusion level (%)			SED	P. value
	Control	5	10		
DM intake (g/hen per day)	69.24[b]	80.35[a]	74.16[b]	1.83	<.001
CP intake (g/hen per day)	10.62[b]	13.60[a]	13.85[a]	0.332	<.001
Initial weight (g/h)	418.75	431.67	420.00	37.8	0.601
Final weight (g/h)	1024.24	1228.09	1306.00	44.70	0.037
BW gain (g/h)	591.67b	820.42[ab]	875.83[a]	54.60	0.025
Daily weight gain (g/d/h)	10.57b	14.65[ab]	15.64[a]	1.59	0.025
FCR (gDMI/gADG)	6.76	5.50	4.91	0.766	0.09

Table 3: Feed intake and growth performance of growers fed dried bovine blood meal at different levels

DM =dry matter, CP = crude protein, BW = body weight, FCR= feed conversion ratio, SED= Standard Error of difference. [abcd] Means within the same row with different superscripts are significantly different (P< 0.05).

Birds fed with 10% performed better (P<0.05) in terms of accumulated weight gain than their counterparts on the control and 5% DBBM diets. The average weight gain of the birds was 591.67 g and 875.83 g for the control and 10% DBBM diets, respectively. Consequently, birds assigned to the control diet had lower (10.57g/d) average daily weight gain than those fed the 10% DBM diet. The 10% DBBM diet had a better feed conversion ratio than the control and 5% DBBM diets, which accounted for the increased growth performance of the Sasso chickens. The dried bovine blood meal (DBBM) had a significant on growth performance of SASSO chickens. This suggests that dried blood meal is an alternative protein supplement for poultry nutrition. This supports the report that blood meal is the richest source of protein (lysine, arginine, methionine, cysteine, and leucine) compared with vegetable protein supplements (NRC, 1994).

11. Haematology and Serum Profile

All of the study's birds that were fed DBBM showed similar haematological parameters (Table 4) regardless of the dietary interventions. The packed cell volume (PCV) ranged between 29.57 and 30.97 for 5 and 10% DBBM respectively. While the WBC count ranged from 98.62 to 113.91 dl, the RBC was between 2.09 and 2.37 dl. From 6.80 to 7.43 g/dl, haemoglobin (Hb) was present. The consistency in the concentrations of the haematological markers in the birds fed the various dietary levels implies that DBBM may have been used in place of some of the soybean meal without having any negative impact on the birds' health.

Parameter	**DBBM inclusion level (%)**			**SED**	**P. value**
	Control	**5**	**10**		
PCV (%)	30.97	29.57	30.83	1.82	0.707
RBC (x10^6/dL)	2.37	2.09	2.35	0.13	0.103
WBC (x10^9/dL)	113.91	98.62	108.49	15.78	0.63
Hb (g/dL)	7.43	6.80	7.23	0.53	0.495
Albumin (g/dL)	41.40	40.13	37.87	2.76	0.462
ALT (U/L)	25.90[b]	24.03[b]	40.03[a]	4.62	0.014
AST (U/L)	28.33	27.20	25.17	6.57	0.889
Creatine (mmol/L)	87.0[b]	119.4[a]	83.2[b]	10.34	0.013
Urea (mmol/L)	4.99	4.06	4.74	1.31	0.769

Table 4: Haematology and serum profile of grower birds fed dried bovine blood meal at different levels

PCV: packed cell volume; RBC: red blood cell count; WBC: white blood cell count; Hb: haemoglobin; ALT: alanine transferase; AST: aspartate transferase; SED: standard error of difference of mean; P; probability. abcd Means within the same row with different superscripts are significantly different (P< 0.05).

The packed cell volume, RBC, and Hb values of 29.57 - 30.97%, 2.09 - 2.37 dl, and 6.80 - 7.43 g/dl found in this study were within the normal physiological ranges for birds of 22-35%, 2-3.5 x106 l, and 7 - 13 g/dl [6]. This demonstrates the potential of DBBM to offer the necessary amino acids and iron to maintain a healthy haemoglobin concentration, as well as the birds' increased immune system to deal with physiological stress or anaemic condition. In general, age, gender, and nutrition all have an impact on haematological parameters. The two factors that have the most effects on red blood cells are diet and sex [7]. Red blood cells transport oxygen from the lungs to tissues and remove carbon dioxide from tissues back to the lungs. Haematological investigations give critical information about an animal's clinical, physical, and nutritional health [8]. As indicators of an animal's nutritional status, haematological parameters are significantly influenced by nutrition. Indicators of haematology such as packed cell volume (PCV), haemoglobin, and red blood cells (RBC) are significantly influenced by nutrition. The reactions of

animals to different physiological and illness situations may be evaluated by looking at changes in haematological parameters. The WBC values in the present study were similar among the dietary treatments. However, these values were higher than the normal 12 – 30 x103 µl range. WBCs prevent foreign substances from entering the body and combat illnesses. Similar WBC levels suggest that the inclusion of DBBM in the food did not have an adverse effect on the birds' ability to fight illness. ALT and creatine were significantly influenced by dietary treatment ($p < 0.05$) for birds fed DBBM in the study. The serological parameters assessed for all birds did not differ among the dietary treatments (Table 4). There was a marginal decrease in the albumin concentration in the DBBM dietary treatments compared to that in the control diet. Albumin is synthesized in the liver, is essential for transporting insoluble substances in the blood, and aids in acoustic pressure maintenance. The main protein storage site for colloidal osmotic pressure and acid-base balance is albumin. Additionally, it serves as a transporter for tiny molecules such as fatty acids, hormones, vitamins, and minerals [9]. The birds on the 10% DBBM dietary treatment had a significant increase in the ALT compared to the control dietary treatment with values ranging between 24.03 and 40.03 µl whilst the aspartate aminotransferase (AST) ranged from 25.17 – 28.33 µl. Measurement of enzyme activity in blood serum is significant for diagnosing animal diseases; however, it is difficult to interpret due to a wide range of activities [10]. serological markers are crucial for revealing an animal's physiological health [11]. Most of the serological parameters examined in the study were within the normal physiological ranges for birds suggesting that the birds ability to secrete enzymes was not negatively impacted, demonstrating potentials of DBBM in poultry production [12-14].

12. Conclusion

The findings of this study demonstrated that up to 10% dried bovine blood meal can be use substitute soybean meal in the meals of SASSO birds without having adverse effects on their growth performance and general health.

Statement of Human and Animal Rights

All applicable institutional and/or national guidelines for the care and use of animals were followed.

Conflict of Interest Statement

The authors declare no conflict of interest in the article.

Funding and Data Availability Statement

The authors declare that no grants, funds or other support were received during the preparation of the manuscript.

Raw data were generated at the Livestock unit of the Department of Ecological Agriculture, Bolgatanga Technical University, Ghana. Derived data supporting the findings of this study are available from the corresponding author on request.

Contribution of Authors

All authors have made an important scientific contribution to the study and have assisted with the drafting or revising of the manuscript in accordance with the definition of an author.

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