
REPLACEMENT VALUE OF ENZYME FORTIFIED FEATHER MEAL ON HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF LAYER CHICKENS

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ABSTRACT

The study was conducted to investigate the replacement value of enzyme fortified feather meal on haematological and serum biochemical indices of layer chickens. A total of one hundred and fifty (150) Isa brown layers were used for the experiment. The birds were randomly assigned to five treatment groups in a completely randomized design, which was further replicated three times. Experimental diets 1,2,3,4,5, were formulated such that diet 1 contained 0% enzyme fortified feather meal, 2,3,4,5 contained 1, 2, 3 and 4% levels of enzyme fortified feather meal respectively. Blood samples were collected from the birds, one sample from each replicate making a total of nine samples per treatment for haematological and biochemical assessment. Results obtained showed significant difference ($P<0.05$) on all haematological indices and for serum biochemical indices except for albumin, globulin, creatinine, K, bicarbonate and chloride ions which recorded non-significant difference. The study suggested that enzyme fortified feather meal could be used in layer's diet up to 4% without any adverse effect.

Keywords: haematological, serum biochemical, Isa brown, layers, enzyme fortified feather meal

INTRODUCTION

Poultry plays a significant role in producing and providing animal protein most effectively within the shortest possible time (Chen *et al.*, 2016). Poultry production is considered to be a means of livelihood and a way of achieving certain level of economic independence in Nigeria (Ogundipe, 2002). Feeding which is an important aspect of poultry production accounts for about 70 to 80% of total cost of production as a result of competition among humans, industry and farm animals for the same food items, as either food, feed or raw materials (Assam *et al.*, 2022). The high cost of feed in broiler production has made many farmers to seek alternative methods to improve feed utilization for overall animal performance and profitability (Anyanwu *et al.*, 2022).

Haematological parameters are good indicators of the physiological status of animals (Khan and Zafar 2005). Isaac *et al.* (2013) reported that animals with full blood composition are likely to show good performance. The comparison of animal's haematological and biochemical indices with a reference interval provides evidence for numerous condition such as malnutrition, health status, infection and stress (Clifford and Briggs, 2007). Hence, the aim of the study was to determine the replacement value of enzyme fortified feather meal on haematological and biochemical indices of layer chickens.

MATERIALS AND METHODS

The study was conducted at the Poultry Unit, Teaching and Research Farm. Imo State University Owerri, Imo State. One hundred and fifty 35-week old ISA Brown hens were used for this purpose. They were divided into five treatment groups of 30 birds each and each group was randomly assigned to one of the experimental diets in a completely randomized design (CRD). Each treatment group was further sub-divided into three replicates of ten (10) birds. The birds were housed on a deep litter pen. Feed and water were provided *ad libitum*, vaccination and medication schedule were strictly adhered to. Daily routine management of washing of the feeder and drinker were done. The poultry feathers were sourced from commercial slaughter houses, washed, boiled with a batch cooker at internal pressure of 50-60Pa (Pascal) for 60-90 minutes (Tesfaye *et al.*, 2017) under high pressure until the resulting process of hydrolysis converts the feathers into a more soluble form. After boiling, the feathers were washed, sundried and milled to produce feather meal. The fish meal and other feed

ingredients used for the purpose of this study were procured from a reputable farm feed mill. Proximate analysis of the feather meal and fish meal were conducted at Precision Analytical and Research Laboratory Ibadan, Nigeria. The mineral analysis was carried out by the method described by Grueling (2000), while the gross energy was determined with Gallencamp Oxygen Adiabatic Bomb Calorimeter (AOAC, 1995).

Five experimental layer diets were formulated, where diet one (T₁) which served as the control contains 0.0% enzyme fortified feather meal, while diets, T₂, T₃, T₄ and T₅ contained 1.0, 2.0, 3.0, and 4% enzyme fortified feather meal with 100g of biozyme® per 100kg weight of feed respectively replacing fishmeal. The active component of biozyme® includes bacillus subtilis, saccharomyces cerevisiae, amylase, protease, bGlucanase, hemicellulose and lipase.

Data collection

At the end of the feeding trial, three birds were randomly selected from each replicate, making a total of nine birds per treatment for biochemical and haematological studies. Ten millilitres (10mL) of blood sample was collected from each of the bird through the wing vein with a 10mL sterile syringe. 5ml of blood was put into big bottles containing ethylene diamine tetra-acetic acid (EDTA) as an anti-coagulant and was used for the haematological assessment. The other 5mL of blood was put into a vial bottle (without anticoagulant) and was allowed to coagulate to produce sera used for serum biochemical analysis. Packed cell volume (PCV) was determined by the procedure described by Ratiff and Halls (1973), while other haematological parameters were determined using the procedure described by Schalm *et al.* (1975).

Data Analysis: Data obtained were subjected to one-way analysis of variance using the analytical software statistical package for social sciences (SPSS, 2012). Means were separated using the Duncan Multiple Range Test as outlined by the same SPSS package.

RESULTS AND DISCUSSION

Haematological indices of laying hens fed diets containing varying levels of enzyme fortified feather meal (EFFM) are shown in table 1. The results revealed that all indices of haemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC), erythrocyte sedimentation rate (ESR), mean cell volume (MCV), mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC), and white blood cell differentials (WBC) were significantly different ($P < 0.05$) among treatments. However, there was no trace of basophil seen anywhere within the treatment means. These values were much reduced in T₄ birds (3%), compared to other groups, while the ESR was significantly higher in this treatment group (T₄) more than the other treatment groups. Significant reductions ($P < 0.05$) in the WBC and heterophil values were also observed with increased inclusion levels of EFFM (T₄ and T₅). However, all the values obtained in this study were within the normal reference range for chicken (Merek Veterinary Manual, 2006).

Table 1: Haematological indices of laying hens fed diets containing varying levels of enzyme fortified feather meal

Parameters	T1 (0.00%)	T2 (1.00%)	T3 (2.00%)	T4 (3.00%)	T5 (4.00%)	SEM
Hb (g/dL)	13.00 ^{ab}	13.07 ^a	12.73 ^{bc}	12.43 ^c	12.80 ^{ab}	0.10
PCV (%)	42.67 ^{ab}	43.33 ^a	40.33 ^{bc}	38.33 ^c	41.00 ^{ab}	0.95
RBC (x10 ¹² /L)	12.17 ^{ab}	12.90 ^{ab}	12.60 ^{bc}	12.33 ^c	12.77 ^{ab}	0.12
MCV (fl)	132.87 ^{ab}	133.50 ^a	131.97 ^{bc}	131.07 ^c	132.07 ^{bc}	0.45
MCH (pg)	20.06 ^b	20.26 ^a	20.20 ^{ab}	20.20 ^{ab}	20.06 ^b	0.03
MCHC (g/dL)	30.43 ^b	30.37 ^b	31.70 ^{ab}	32.47 ^a	31.33 ^{ab}	0.46
ESR (mm ³ /h)	26.67 ^c	26.67 ^c	26.67 ^c	40.00 ^a	33.33 ^b	2.06
WBC (x10 ⁹ /L)	11.40 ^a	11.20 ^b	11.30 ^{ab}	11.24 ^b	11.23 ^b	0.04
Heterophils (%)	54.00 ^a	53.67 ^a	53.33 ^a	51.67 ^b	51.00 ^b	0.05
Eosinophil (%)	1.33	1.67	1.33	1.67	1.33	0.13
Lymphocytes (%)	43.33	42.67	44.00	45.33	45.67	0.48
Basophils (%)	0	0	0	0	0	0
Monocytes (%)	1.33 ^b	2.00 ^a	1.33 ^b	1.33 ^b	2.00 ^a	0.13

abcd means with different superscripts on the same horizontal row are significantly different ($P < 0.05$)

SEM: Standard Error of mean

The serum biochemical parameters of laying hens fed varying levels of enzyme fortified feather meal are summarized in Table 2. The results showed that the albumin, globulin, K and HCO₃⁻, Cl⁻ were similar ($P>0.05$) across the treatments while other parameters measured differed ($P<0.05$) across the treatment means. The serum biochemical constituents (TSP, albumin, globulin) have been used as predictors of serum/blood dietary proteins and also routinely used for the detection of organ diseases in domestic animals (Guleken *et al.*, 2020). The albumin, globulin values were similar among the groups indicating that the inclusion of enzyme fortified feather meal in the layer diets had no negative effect on protein metabolism of the experimental hens. The serum TSP and albumin indicates the quality and availability of protein, hence the enzyme fortified feather meal diets had sufficient protein enough to sustain normal protein levels in the blood (Kwari *et al.*, 2014). The serum protein values obtained in the study were within the reference range reported for chicken (Bamgbose *et al.*, 2007). Laying hens on diet 5 recorded the lowest serum urea value while hens on diets T3–T5 had lower but similar creatinine values in hens on the control treatment indicating that the birds did not suffer any impairment in protein synthesis or utilization (Denli *et al.*, 2009). The serum potassium, bicarbonate and chloride values were similar ($P>0.05$) among all treatment means. The electrolyte values were within the reported range for chicken (Obih, 2018).

Table 2: Serum biochemical parameters of laying birds fed varying levels of enzyme fortified feather meal for fish meal

Parameter	T1 (0.00%)	T2 (1.00%)	T3 (2.00%)	T4 (3.00%)	T5 (4.00%)	SEM
Total serum protein	65.00 ^a	66.67 ^a	64.00 ^{ab}	63.67 ^{ab}	61.00 ^b	0.61
Albumin (g/L)	21.33	23.33	22.00	21.00	22.00	0.48
Globulin (g/L)	43.67	43.33	42.00	42.67	39.67	0.62
Urea (mmol/l)	7.63 ^b	8.00 ^a	7.37 ^b	7.30 ^b	6.70 ^c	0.12
Creatinine (mmol/L)	51.33 ^b	55.67 ^a	53.00 ^b	52.00 ^b	51.33 ^b	0.52
Cholesterol (mmol/L)	8.27 ^b	8.50 ^a	8.20 ^{bc}	8.23 ^b	8.00 ^c	0.05
K ⁺ (mmol/L)	1.23	1.23	1.23	1.20	1.20	0.02
HCO ₃ ⁻ (mmol/L)	10.17	10.23	10.23	10.10	10.17	0.02
Na ⁺ (mmol/L)	42.33 ^b	45.33 ^a	42.33 ^b	42.33 ^b	42.33 ^b	0.43
CL ⁻ (mmol/L)	20.67	22.00	21.67	21.33	21.33	0.21
ALP (iu/L)	1.20 ^{ab}	1.27 ^a	1.13 ^b	1.17 ^{ab}	1.23 ^{ab}	0.02
SGOT (iu/L)	11.23 ^{ab}	11.30 ^a	11.17 ^{ab}	11.10 ^b	11.17 ^{ab}	0.02
SGPT (iu/L)	6.93 ^{ab}	7.17 ^a	6.87 ^b	6.80 ^b	6.50 ^c	0.07

abcd means with different superscripts on the same horizontal row are significantly different ($P<0.05$)
SEM: Standard Error of mean

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