EFFECTS OF NUTRIENT-RESTRICTION AT THE STARTER PHASE ON HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF FINISHER BROILER CHICKENS

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Abstract
A 9-week experiment was conducted to investigate the effect of nutrient restriction at the starter phase on haematological and serum biochemical indices of finisher broiler chickens. Eighty (80) day-old chicks of Anak strain were randomly distributed into two groups using completely randomized design. Each group was replicated 4 times with 10 broiler chicks per replicate and each replicate housed in a 1.5m x 2m pen. Broilers in group 1 were given a low quality diet based mainly on palm kernel cake and wheat offal for the first 4 weeks and then placed on standard diet for the remaining 5 weeks of trial. Blood samples were collected at the end of the trial, from 3 birds per replicate for haematological and serum biochemical studies. Data collected were analyzed using the software SPSS (2013). Means were separated using SPSS statistical model (2013). Haemoglobin HB, red blood cells RBC, and platelets were significantly ($P<0.05$) different. Other haematological indices analyzed were statistically similar ($P>0.05$). The result of the serum biochemical analysis showed that, with the exception of albumin, globulin, AST, and ALP which were significantly ($P<0.05$) different, other parameters analyzed were not affected ($P>0.05$) by the trial. Feeding poor quality cheap diet at broiler starter phase does not adversely affect blood profile of finisher broilers.
Keywords: Compensatory growth, haematology, serum biochemistry, broilers

Introduction

In view of the increasing unavailability of poultry feed materials, coupled with the high cost of imported ingredients, the prices of commercial poultry feeds have increased by about 2000% within the last 20 years (Okere, *et al*., 2019; Al-
Mamun, *et al.*, 2020). There is therefore need for alternative sources of feedstuff or alternative methods of feeding poultry in the country. One possible way of reducing cost of production of poultry in the country may be the application of compensatory growth phenomenon. Compensatory growth is a phenomenon that enables an animal with retarded growth to catch up with the final weight of the unretarded animal (Zhang, *et al*., 2019). According to Payne and Wilson (1999), considerable commercial use has been made of the phenomenon of compensatory growth particularly in the rearing of beef cattle, because it is associated with greater efficiency in the use of stock feed. It has been used in Britain to enhance the efficiency of growing heavy weight turkeys (Leeson and Summers, 1978). Limited work has been done in Nigeria in the area of compensatory growth. Meremikwu (2009) demonstrated that restricted growth for 4 – 12 weeks with low nutrient intake was more efficient than continuous growth with appropriate calorie/protein rations in the production of heavy weight broilers. Udedibie and Adive (2014) also demonstrated that the principle of compensatory growth could be applied gainfully in the production of starter broilers. However, information on the effects of the phenomenon of compensatory growth on haematological and serum biochemical indices of the birds is scarcely available. Haematological and serum biochemical indices are used to evaluate the health status of farm animals and to determine stress due to environmental, nutritional and/or pathological factors (Esonu, 2006; Rosa, *et al* 2018). Therefore, this study was aimed at investigating the effects of restricted growth followed by compensatory growth on haematological and serum biochemical indices of broiler.

Materials and methods

The study was conducted at the poultry unit of the Teaching and Research Farm of the Federal University of Technology, Owerri, Imo State of Nigeria. A total of 80 day-old broiler chicks of Anak strain were randomly assigned into 2 treatment groups of 40 birds per treatment and each treatment having 4 replicates of 10 birds. Diet 1 was the standard balanced diet for starter broilers while diet 2 was a cheap low-quality, high fiber diet not ideal for starter broilers. A standard broiler finisher diet for 4 weeks and then placed on a standard broiler finisher diet for the next 5 weeks while group 2 received a low-quality cheap diet based mainly on palm kernel cake and wheat offal for the 4 weeks and then placed on standard broiler finisher diet for the remaining 5 weeks. Feed and water were provided *ad libitum.* Vaccination and other routine management practices were carried out.

Blood collection and analysis

The birds were randomly selected from each replicate at the end of the feeding trial for the determination of haematological and serum biochemical indices. Blood (2mls) was collected from each bird into the bijou bottles. One contained Ethylene Diamine Tetra-Acetic Acid (EDTA) as anti-coagulant and the other was without EDTA for serum biochemical analysis. Blood was analysed within 3 hours after collection at the Federal Medical Center, Owerri. Haematological and serum biochemical parameters, haemoglobin (HB), Packed cell volume (PCV), red blood cells (RBC), mean corpuscular haemoglobin (MCH) neutrophil, lymphocyte, monocyte, eosinophil, basophil and platelets, serum total protein, albumin, serum glucose, serum urea, aspartate transaminase (AST), alkaline phosphate **(**ALP**)** and other serum biochemical activities were determined by respective standard procedures as outlined by Monica (1984). Data collected were analysed using SPSS statistical model (2013). Means were also separated using the same SPSS software.

Table 1 presents the ingredient composition of the experimental diets.

Table 1: Ingredient composition of the experimental diets

Ingredients (%)	Diet 1 (standard)	Diet 2 (low-quality)	Finisher diet Diet 3
Maize	50.00	25.00	60.00
Soybean meal	28.00	14.00	20.00
Fish meal	2.00	2.00	2.00
Blood meal	2.00	2.00	2.00
Palm kernel cake	7.00	21.00	4.00
Wheat offal	7.00	32.00	8.00
Bone meal	3.00	3.00	3.00
Vit/min premix	0.25	0.25	0.25
Salt	0.25	0.25	0.25
L – lysine	0.25	0.25	0.25
L – methionine	0.25	0.25	0.25
Total	100.00	100.00	100.00
Calculated chemical composition (% dm)			
Crude protein	22.86	18.94	19.38
Crude fiber	3.01	6.13	3.50
Ether extract	3.74	4.27	3.79
Ash	3.20	3.37	3.28
ME(Mcal/kg)	2.70	2.40	3.00
Feed cost (N/kg)	95.80	76.40	88.60

Results and Discussion

Table 2 presents the result of the haematological indices of the experimental birds while the result of the serum biochemical indices of the birds is shown in Table 3. Results obtained from the study revealed no significant ($P<0.05$) differences in the haematological indices analysed, except in those of HB and RBC where treatment 2 was significantly ($P<0.05$) higher than treatment 1, although both values fail within the range of standard values as reported by Ogbuewu, *et al.*, (2023); Mitruka and Rawnsley, (1977). This could be as a result of increased nutrient utilization by birds in treatment 2, as they recovered from high fiber diet at the starter phase. This is in agreement with the observation of Madubuike and Ekenyem (2006), who reported that RBC, PCV and HB values of birds increased with increasing dietary inclusion of leaf meals; a high fiber feedstuff. Similarly, there were no significant ($P<0.05$) differences in the serum biochemical indices analyzed, except albumin and ALP, which were significantly ($P<0.05$) higher in treatment 2. Albumin value of birds in treatment 2 (3.90g/d) was significantly ($P<0.05$) higher than that of treatment 1 (2.10g/d), but deviated from the normal reference range reported by Bounous *et al*., (2000) to be between 1.1 and 2.1g/d. ALP of treatment 2 (1416.02IU/1) also deviated out of range of the normal as reported by Bounous *et al.*, (2000) to be between 17.305 IU/I. AST and ALP are enzymes commonly found in the liver and leaks out into the general circulation when liver cells are injured. It has also been observed that a high value of ALP, suggests increased activity of the liver due to the presence of toxic substances (as in treatment 2 containing high PKC) (Okere, *et al*., 2024). As such, the poor diet consumed by the birds at the starter phase might have had some hepatoxic effects on those birds.

Table 2: Haematological Indices of the Experimental Broilers

Indices	Treatment 1 (standard)	Treatment 2 (low quality)	SEM
HB (g/dl)	11.67[a]	12.37[a]	0.13
PCV (%)	35.58	37.77	1.80
RBC (x10/ul)	2.50[a]	2.70[b]	0.06
MCV (fl)	143.87	139.97	6.63
MCH (pg)	46.83	45.77	1.19
MCHC (g/dl)	32.60	32.73	1.58
PLT (x10/ul)	10.33[a]	16.67[b]	2.36
WBC (x10/ul)	75.77	78.97	2.56
Lymphoctes (%)	81.67	81.00	1.41
Monocytes (%)	-	-	-
Neutrocytes (%)	18.33	19.67	6.18
Basophils (%)	-	-	-
Eosinophils (%)	-	-	-

[abc] Means within a row with different superscripts are significantly (P<0.05)

Table 3: Serum Biochemical Indices of the Experimental Broilers

Parameters	Treatment 1 (Standard Diet)	Treatment 2 (low-quality Diet)	SEM
Calcium (mg/dl)	10.30	10.33	1.35
Inorganic phosphate (mg/dl)	3.78	4.46	0.35
Glucose (mg/dl)	167.69	152.24	5.18
Total protein (g/dl)	4.51	4.98	0.63
Albumin (g/dl)	2.10[a]	3.90[b]	0.63
Globulin (g/dl)	2.41[a]	1.08[b]	0.27
Choline (mg/dl)	123.78	119.67	4.27
TG (mg/dl)	50.00	47.42	2.21
HDL (mg/dl)	57.42	66.41	2.25
LDL (mg/dl)	56.37	44.44	3.62
CL (Mmol/l)	103.57	104.00	1.13
Na (Mmol/l)	140.57	140.80	1.62
K (Mmol/l)	4.38	4.16	0.19
HCO (Mmol/l)	27.67	28.00	0.56
Urea (mg/dl)	4.90	5.57	0.35
Creatinine (mg/dl)	0.09	0.10	0.03
TB (mg/dl)	0.15	0.15	0.02
CB (mg/dl)	0.04	0.06	0.01
ALT (lU/L)	8.33	9.00	0.76
AST (lU/L)	40.33[a]	46.33[b]	1.12
ALP (lU/L)	997.92[a]	1416.02[b]	37.20

[abc]Means within a row with different superscripts are significantly different (P<0.05)

Conclusion

The results of this study revealed not much difference in the haematological and serum biochemical indices of the two groups of broilers with exception of ALP and which were higher in group 2. Since haematological and serum biochemical indices are used to assess the response of the animal to their internal and external environment, it is therefore concluded that the poor quality diet given to the broilers in group 2 at the starter phase had limited deleterious effects on their internal physiology at the finisher phase when given a good quality diet.

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