# EFFECT OF NUTRIENT RESTRICTION AT THE STARTER PHASE ON HAEMATOLOGICALAND SERUM BIOCHEMICAL INDICES OF FINISHER BROILERS

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**Abstract**
*A 9-week experimentwas conducted to investigate the effect of feeding low-quality diet at the starter phase on blood profile of finisher broilers. Day-old broiler chicks (80) of Anak strain were randomly distributed into two groups, 1 and 2, 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 standard broiler diet for 4weeks and then placed on standard broiler finisher diet for the next 5weeks, while broilers in group 2 received a* low quality *diet based mainly on palm kernel cake and wheat offal for the first 4weeks and then placed on standard broiler finisher diet for the remaining 5weeks 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 subjected to statistical analysis using t-test as outlined by Snedecor and Cochran (1978). The exception of haemoglobin (HB), red blood cells (RBC) and platelets which were significantly (P<0.05) different, other haematological indices were similar (P>0.05). Similarly, with the exception of albumin, globulin, AST andALP which were significantly (P<0.05) different, there were no significant differences in the serum biochemical indices (P>0.05) measured. 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 (Udedibie, 2003). There is therefore need for alternative sources of feedstuffs or alternative methods of feeding poultry in the country. One possible way of reducing cost of poultry production 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 contemporary unretarded animal (Lawrence and Fowler, 1997). 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 (Lesson 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 ratios in the production of heavy weight broilers. Udedibie and Adibe (2014) also demonstrated that the principle of compensatory growth could be applied gainfully in the production of starter broilers. However, information on the effect of the phenomenon of compensatory growth on haematological and serum biochemical indicesof the birds is non-existent in the available literature. Haematological and serum biochemicalindices are used to evaluate the health status of farm animals and to determine stress due to environmental, nutritional and/or pathological factors (Nwosu and Stephen, 2005 and Esonu *et al.*, 2006). Therefore, this study was aimed at investigating the effects of restricted growth followed by compensatory growth on haematological and serum biochemical indices of broilers.

## 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, 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 was also formulated for the finisher phase of the trial. Broilers in group 1 were given a standard broiler diet for 4 weeks and then placed on a standard broiler finisher diet for the next 5 weeks while broilers in 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**

Three birds were randomly selected from each replicate at the end of the feeding trial for the determination of haematological and serum biochemical indices. Blood (2ml) was collected from each bird into 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 analyzed within 3 hours after collection at the Federal Medical Center, Owerri. Haematological and serum biochemical parameters, haemoglobin (HB), packed cell volume (PCV), red blood cell (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), neutrophil, lymphocyte, monocyte, eosinophil, basophil and platelets, serum total protein, albumin, serum glucose, serum urea, aspartate transminase (AST), alkaline phosphate (ALP) and other serum biochemical activities were determined by respective standard procedures as outlined by Monica (1984). Data collected were subjected to statistical analysis using t-test as outlined by Snedecor and Cochran (1978).

**Results and Discussion**

Ingredient composition of the experimental diets is shown in Table 1. Results obtained from this study revealed no significant ($p>0.05$) differences in the haematological indices except in those of HB and RBC where treatment 2 was significantly higher ($p<0.05$) than treatment 1. Although both values fall within the range of standard values reported by 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 observations of Madubuike and Ekenyem (2006) who reported that RBC, PVC 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 analysed, except albumin and ALP which were significantly ($p<0.05$) higher in treatment 2. Albumin of birds in treatment 2 (3.90g/dl) was significantly higher than that of treatment 1 (2.10 g/dl), but deviated from the normal reference range reported by Bounus *et al.* (2000) to be between 1.1 and 2.1 g/dl. ALP of treatment 2 (1416.02 IU/l) also deviated out of range of the normal, as reported by Bounus *et al* (2000) to be between 17.305 IU/l. AST and ALPare 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) (Ologhobo and Fetuga, 1993; Onwukwe, 2000 and Owen *et al.*, 2009). As such, the poor quality diet consumed by the birds at the starter phase might have had some hepatoxic effects on those birds.

**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 albumin which were higher in group 2. Since haematological and serum biochemical indices are used to assess the response of animals to their external and internal 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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Table 1: Ingredient Composition of the Experimental Diets

| Ingredients (%) | Diet 1 (standard) | Diet 2 (low quality) | Diet 3(finisher) |
|---|---|---|---|
| Maize | 50.00 | 25.00 | 60.00 |
| Soya bean 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 |
| Salt | 0.25 | 0.25 | 0.25 |
| Vit/min premix* | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 |
| Total | 100.00 | 100.00 | 100.00 |
| Calculated chemical composition (%dm) | | | |
| Crude protein | 22.86 | 20.94 | 19.38 |
| Crude fibre | 3.01 | 6.13 | 3.50 |
| Ether extract | 3.73 | 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 | 76.05 | 88.60 |

* To provide the following per kg of feed: vitamin A, 12,000 IU; vitamin $D_3$2,500 IU; vitamin E, 8mg; vitamin K32mg; vitamin B13mg; vitamin $B_2$ 5mg; vitamin $B_6$ 4mg; vitamin$B_{12}$ 8mg, niacin, 15mg; panthothenic acid, 6mg; folic acid, 4mg; manganese, 8mg, zinc, 0.05mg; iron, 29mg, copper, 3mg; iodine, 1.2mg, selenium, 0.16mg; cobalt, 2mg

Table 2: Haematological Indices of the Experimental Broilers

| Indices | Treatment 1 (Standard) | Treatment 2 (poor quality diet) | SEM |
|---|---|---|---|
| HB (g/dl) | $11.67^a$ | $12.37^b$ | 0.13 |
| PCV (%) | 35.58 | 37.77 | 1.80 |
| RBC ($x10^6$/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 ($x10^3$/ul) | $10.33^a$ | $16.67^b$ | 2.36 |
| WBC ($x10^3$/ul) | 75.77 | 78.07 | 2.56 |
| Lymphocytes (%) | 81.67 | 81.00 | 1.41 |
| Monocytes (%) | - | - | - |
| Neutrocytes (%) | 18.33 | 19.67 | 6.18 |
| Basophils (%) | - | - | - |
| Eosinophils (%) | - | - | - |

$^{ab}$ Means within a row with different superscripts are significantly different ($P<0.05$)

**Table 3:** Serum Biochemical Indices of the Experimental Broilers

| Parameters | Treatment 1 (standard diet) | Treatment 2 (poor quality diet) | SEM |
|---|---|---|---|
| Calcium (mg/dl) | 10.30 | 10.33 | 1.35 |
| Inorganic Phosphate(mg/dl) | 3.78 | 4.46 | 0.37 |
| 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 |
| Glob (g/dl) | $2.41^{a}$ | $1.08^{b}$ | 0.27 |
| Chol(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 |
| $HCO_3$(Mmol/l) | 27.67 | 28.00 | 0.56 |
| Urea(mg/dl) | 4.90 | 5.57 | 0.35 |
| Creatinine(mg/gl) | 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 (IU/l) | 8.33 | 9.00 | 0.76 |
| AST (IU/l) | $40.33^{b}$ | $46.33^{a}$ | 1.12 |
| ALP(IU/l) | $997.92^{a}$ | $1416.02^{b}$ | 37.20 |

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