ISSN 0189-0514
J. Anim. Prod. Res. (2019) 31(1):66-73

National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ng Url:journals.napri.gov.ng

EFFECT OF VARYING LEVELS OF ENERGY AND PROTEIN ON HAEMATOLOGICAL PARAMETERS OF ROSS BREED BROILER CHICKENS

[1]Yunana, Y. L., [2]Kabir, M. and [2]Mallam, I.
[1]Department of Animal Science, Bayero University, Kano
[2]Department of Animal Science, Ahmadu Bello University, Zaria, Kaduna State
[*]Corresponding Author: lininacayunana@yahoo.com; +2348167771135

ABSTRACT

The experiment was carried out to ascertain the effect of feeding combination of high, normal and low energy and protein on haematological parameters of Ross breed broiler chickens. Total of six diets of different combinations of energy and protein namely; high energy and high protein (HEHP), high energy and low protein (HELP), normal energy and high protein (NEHP), normal energy and low protein (NELP), low energy and high protein (LEHP) and low energy and low protein (LELP) were fed to broiler chickens of Ross breed for a period of 8 weeks. Data collected were subjected to GLM Procedure of SAS (1992). Results obtained showed significant ($p<0.05$) differences in all the parameters studied both at starter (week 4) phase and finisher phase (week 8).There was significant ($p<0.05$) difference in the white blood cell count (WBC) at week 4. But birds fed HELP (3100kcal/kg and 22% CP) were similar to those fed (LELP, LEHP, NELP) except for HEHP and NEH. The results obtained for RBC followed similar trends with that of WBC while PCV, Hb, and TP had slight differences in terms of the trends. The results of the finisher phase (week 8), higher WBC (9.40) was obtained in NELP while the highest RBC, PCV, Hb were found in LEHP although similar with NEHP the highest TP was found in HEHP. The study showed that low energy and low protein diets could be fed to broilers chicken as long as proper management practices are put in place.

Keywords: Energy levels, protein levels, high, low, normal, Haematology, Broilers.

INTRODUCTION

The poultry industry in the developing countries is facing some challenges, one of which is increase in the cost of feed because of high prices of protein and energy sources (Abbas, 2013). Livestock feed costs in developing countries are a continuing challenge. Protein and energy are two important components of food that generates a lot of interest and challenges to nutritionists.

A major concern of modern poultry enterprise is to reduce feed cost for optimal economic returns because feed constitutes approximately 70% of the total production cost Ogundipe (2002). One way to reducing the feed cost is through improvement in the feed efficiency of birds. In formulating a broiler's diet, the main emphasis is placed on the crude protein (CP), because it is one of the major cost components of the poultry diets. Dietary crude protein level could possibly be reduced if there were adequate of the minimum levels of amino acids needed to support growth and muscle of broilers Boling *et al.* (1998).

Haematology refers to the study of the numbers and morphology of the cellular elements of the blood-the red cells (erythrocytes), white cells (leucocytes), and the platelets (thrombocytes) and the use of these results in the diagnosis and monitoring of disease (Merck Manual, 2012). Haematological studies are useful in the diagnosis of many diseases as well as investigation of the extent of damage to blood (Togun *et al.*, 2007). Haematological studies are of ecological and physiological interest in helping to understand the relationship of blood characteristics to the

environment (Ovuru and Ekweozor, 2004) and so could be useful in the selection of animals that are genetically resistant to certain diseases and environmental conditions (Mmereole, 2008). Haematological parameters are good indicators of the physiological status of animals (Khan and Zafar, 2005). The objective of the study was to determine the effect of varying levels of energy and protein (NENP, NEHP, HENP, HEHP, LEHP and HELP) on haematological parameters of Ross breed broiler chickens.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Poultry Unit of Animal Science Department, Ahmadu Bello University, Zaria. Zaria is located within the northern guinea savannah zone of Nigeria: latitude 11^0 12'N and longitude 7^0 33'E at an altitude of 640 meters above sea level (IAR Meteorological Unit, 2013). The climate is characterised by a well defined dry and wet seasons. The dry season last from mid-October to April and consist of a period of low relative humidity with strong, cold and dry weather followed by overcastting dust particles. The wet season begins in late April/early May and ends in late September to early October. The total annual rainfall is from 617-1365mm with a 50 year average of 1041mm and most of rainfall is between July and September (Akpa *et al*., 2002).

Experimental Materials

Two hundred and seventy (270) broiler of Ross breed, conical feeders, drinkers, weighing scale, Stoves, charcoal pots, kerosene lamps, bulbs, wood shavings, buckets ropes for hanging feeders, brooms, dust parkers, lab coats.

Experimental Plan

Two hundred and seventy (270) broiler day old chicks of the same breed Ross were raised using a deep litter system under the same environment but placed on diet with varying levels of protein and energy. A 2×3 factorial arrangement in a complete randomized design, the birds were placed under six treatments with each treatment having three replications with 10 chicks per replicate.

Brooding

Before the arrival of the day old chicks, the pens were cleaned and disinfected, covered with wood shavings, the brooding house was covered with feed bags as well as nylon bags. Temperature of 30-35^{0}C was maintained in the brooding house using coal pot, lanterns and stoves for 2 weeks.

Feeding and Management of Experimental Birds

On arrival, the birds were weighed and also vaccinated against Newcastle diseases. Glucose was added to their water to relieve them from stress. Throughout the experimental period (0-8weeks) birds were fed with the 6 experimental diets. The ration was formulated with appropriate composition as shown in Tables 1 and 2. Birds were also given antibiotics and multi-vitamins (Neocryl and keprocryl) anti-stress (vitalyte and vitamin C) with proper vaccination against common poultry diseases to ensure good health and better production throughout the experimental period.

Table 1: Composition of broiler starter diets containing varying levels of energy and Proteins

ME(Kcal/kg)	**2700**		**2900**		**3100**	
CP (%)	**22**	**24**	**22**	**24**	**22**	**24**
Maize	33.00	32.70	54.50	49.00	54.00	50.00
Maize offal	25.00	21.00	7.00	6.50	2.00	2.00
Rice offal	2.00	2.00	1.00	1.00	1.00	-
SBM	17.50	19.00	16.00	18.00	17.00	19.00
GNC	17.00	20.00	17.00	21.00	19.00	20.00
Palm oil	-	-	-	-	3.00	5.00
Fish Meal	2.20	2.00	1.20	1.20	0.70	0.70
Bone Meal	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	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
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
Premix	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Analysis						
MEKcal/kg	22.21	2700.06	2904.00	2900.88	30096.68	3097.40
CP	23.25	24.04	21.92	24.04	21.94	23.35
CF	1.04	3.54	3.50	3.75	3.69	3.35
Ca	0.90	1.03	0.96	0.95	0.93	0.94
Ph	0.63	0.89	0.76	0.77	0.71	0.71
Methionine	1.38	0.63	0.57	0.59	0.56	0.57
Lysine	1.38	1.44	1.24	1.35	1.25	1.31

SBM = Soybean meal, GNC = Groundnut cake, CP = Crude protein, CF = Crude fibre, Ca = Calcium, Ph =Phosphorus, Premix: each 2.5kg of Biomix broiler finisher contains; vitamin A 8,5000,000 (iu); vitamin D3 1500000 (iu); vitamin E 10000 (mg); vitamin K 1500 (mg); vitamin B1 1000 (mg); vitamin B2 4000 (mg); Naicin 20000 (mg); Pantothenic acid 5,000 (mg); vitamin B6 1,500 (mg); vitamin B6 10 (mg); folic acid 500 (mg); biotineH2 750 (mg); chlorine chloride 175000 (mg); cobalt 200(mg); copper 3000 (mg); iodine 1000 (mg); iron 20000; manganese 40000(mg); selenium 200 (mg); zinc 30000 (mg);anti-oxidant 1250 (mg).

Table 2: Composition of Broiler finisher Diets Containing varying levels of energy and protein

ME (Kcal/kg)	**2700**		**2900**		**3100**	
% CP	**19**	**21**	**19**	**21**	**19**	**21**
Maize	35.70	34.00	56.00	57.50	62.00	59.00
Maize offal	26.00	25.70	7.00	5.00	4.70	4.70
Rice offal	4.00	3.00	3.70	1.50	1.00	1.00
SBM	14.00	16.00	14.00	14.20	14.00	14.00
GNC	15.00	16.00	14.00	16.50	14.00	17.00
Palm oil	2.00	2.00	2.00	2.00	1.00	1.00
Fish Meal	2.00	2.00	2.00	2.00	1.00	1.00
Bone Meal	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	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
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
Premix	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Analysis						
MEKcal/kg	2708.02	2701.28	2900.82	2918.54	30096.85	3094.88
CP	19.18	21.26	19.26	21.04	19.01	20.99
CF	3.78	3.51	4.13	3.7	3.4	3.36
Ca	1.03	1.03	0.97	0.97	0.93	0.94
Ph	0.91	0.91	0.79	0.76	0.72	0.73
Methionine	0.61	0.62	0.56	0.57	0.55	0.55
Lysine	1.26	1.32	1.17	1.20	1.12	1.17

SBM = Soybean meal, GNC = Groundnut cake, CP = Crude protein, CF = Crude fibre, Ca = Calcium, Ph = Phosphorus, Premix: each 2.5kg of Biomix broiler finisher contains; vitamin A 8,5000,000 (iu); vitamin D3 1500000 (iu); vitamin E 10000 (mg); vitamin K 1500 (mg); vitamin B1 1000 (mg); vitamin B2 4000 (mg); Naicin 20000 (mg); Pantothenic acid 5,000 (mg); vitamin B6 1,500 (mg); vitamin B6 10 (mg); folic acid 500 (mg); biotineH2 750 (mg); chlorine chloride 175000 (mg); cobalt 200(mg); copper 3000 (mg); iodine 1000 (mg); iron 20000; manganese 40000(mg); selenium 200 (mg); zinc 30000 (mg);anti-oxidant 1250 (mg).

Proximate Analysis

The Six (6) experimental diets (both starter diets and finisher) were analysed for crude protein (CP), crude fibre (CF), ash, dry matter (DM), and ether extracts (EE) as described by (AOAC, 2005). The proximate analysis was carried out in the Biochemical Laboratory of the Animal Science Department, Ahmadu Bello University, Zaria as shown in Table 3.

Table 3: Proximate Analysis of diet fed from 0-8weeks

(ME Kcal/kg)	**2700**		**2900**		**3100**	
% CP	**22**	**24**	**22**	**24**	**22**	**24**
% DM	92.36	94.86	94.12	93.13	92.70	94.18
% CP	23.84	23.76	24.07	23.96	23.86	23.90
% CF	9.77	9.19	8.37	10.01	10.12	8.76
% EE	5.39	6.02	5.88	5.39	6.03	6.20
% Ash	6.38	5.72	6.18	7.40	7.39	6.90
% NFE	54.52	55.31	55.50	53.24	52.59	54.24
Finisher Phase						
Protein level % CP	**19**	**21**	**19**	**21**	**19**	**21**
% DM	95.11	94.20	95.13	93.68	93.17	93.15
% CP	20.46	20.31	19.88	19.69	20.11	20.20
% CF	10.56	9.87	10.03	9.36	9.87	8.57
% EE	4.56	4.39	4.70	4.38	7.52	59.05
% Ash	7.28	6.36	7.20	4.00	6.91	59.11
% NFE	57.14	59.07	58.39	54.18	7.05	60.00

DM: Dry matter, CP: Crude Protein, CF: Crude Fibre, EE: Ether Extracts, NFE: Nitrogen Free Extracts

Haematological parameters

1ml of blood was collected from the jugular vein in vials with 2mg ethylene-diamine tetra-acetic acid (EDTA) for haematology. The blood samples were taken from the birds at the 4th and 8th week of age; 3 birds per treatment making a total of 18 blood samples to evaluate for Total Protein (TP), Pack Cell Volume (PCV), Haemoglobin (Hb) count, and Red Blood Cell (RBC) all at the Pathology Laboratory of the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria.

Statistical analysis

Data collected were subjected to Analysis of Variance (ANOVA) using the General Linear Model (GLM) procedures of SAS (1992) means were compared using least squared mean test.

RESULT AND DISCUSSION

Table 4 shows the haematological indices of broiler chickens fed varying levels of energy and proteins at 4 week. The result obtained showed that the haematological indices were all affected significantly ($p<0.05$) at week 4. But birds fed HELP (3100kcal/kg and 22% CP) found to be highest in terms of white blood cell (WBC) but similar to others except for NEHP (5.20). There was no significant ($p<0.05$) difference amongst the combinations (HELP, LEHP, and LELP) for Red blood cell count (RBC) birds fed NELP show significantly ($p<0.05$) higher than

those fed HELP which is the lowest though NELP is the highest, it is similar to those fed with HELP. For PCV and Hb, HELP and NEHP birds were similar and significantly ($p<0.05$) higher than others.

The significant ($p<0.05$) differences obtained on the effect of varying levels of energy and protein is in agreement with the research of Bashar *et al*. (2010) who reported significant differences in haematological indices (PCV, Hb, WBC, RBC) measured on birds fed varying levels of protein and energy.

The results also agreed with the report of Dairo *et al*. (2010) who reported higher haematological indices particularly RBC and Hb on birds fed on HELP at 4^{th} and 5^{th} week.

The results obtained simply show that there is a threshold above and below which the protein and energy concentration as a nutrient is not justifiable (Si *et al*., 2001) hence no much differences were seen on those birds feed LELP and those fed HEHP because some fed on LELP performed better for some parameters than those fed on HEHP.

Some haematological indices of broiler chickens fed varying levels of energy and protein at week 8 is presented in Table 5. In the 8th week however, WBC was significantly ($p<0.05$) higher for birds fed with NELP than for those fed with HELP which were significantly ($p>0.05$) the lowest while birds fed (LELP, LEHP, NEHP, HELP, and HEHP) were similar. For RBC count, LEHP were significantly ($p<0.05$) higher than NEHP but LEHP and NELP were similar. The LELP and HEHP were also similar to each other. The PCV had significantly ($p<0.05$) higher values than birds fed HEHP and NEHP. However birds fed HEHP, HELP, NELP and LEHP were similar for PCV. For The Haemoglobin (Hb) count had significantly ($p<0.05$) higher values for birds fed with LEHP than those fed with NEHP (8.63) which was the lowest. The Total Protein (TP) obtained in birds fed with HEHP had significantly ($p<0.05$) higher value than those fed with NELP, LELP, LEHP, NEHP and HELP.

Lower WBC was found in birds fed HELP which means that they birds are exposed to high risk of disease infection, while those with highest white blood counts (NELP) are capable of generating antibodies in the process of phagocytocis and have high degree of resistance to diseases (Soetan *et al*., 2013) and enhance adaptability to local environmental and disease prevalent conditions (Kabir *et al*., 2011).

Result of the red blood cell in this study is similar with the work of Isaac *et al.* (2013) who reported higher RBC in animals fed NEHP. Thus, a reduced red blood cell count implies a reduction in the level of oxygen that would be carried to the tissues as well as the level of carbon dioxide returned to the lungs

The result obtained for packed cell volume (PCV) was in agreement with the report of Isaac *et al.* (2013) who reported higher packed cell volume on birds fed LEHP. Packed Cell Volume is involved in the transport of oxygen and absorbed nutrients. This means that higher packed cell volume obtained in LEHP will give a better transportation and thus will result in an increased primary and secondary polycythemia. Similarly, LEHP gave higher values for Hb which is consonant with the result of Maton *et al.* (1993). The implies that LEHP will give higher haemoglobin which helps in physiological function and transportation of oxygen to tissues of the birds for oxidation of ingested food so as to release energy for the other body functions as well as transport carbon dioxide out of the body of birds (Maton *et al.*,1993).

Table 4: Some haematological indices of broiler chickens fed varying levels of energy and proteins at 4 week.

(ME Kcal/kg)	2700		2900		3100		SEM	LOS
CP %	22	24	22	24	22	24		
WBC(10^6 mm)	7.97^{a}	7.40^{a}	7.67^{a}	5.20^{c}	8.00^{a}	6.80^{b}	0.35	*
RBC(10^6 mm)	4.43^{ab}	4.43^{ab}	4.33^{b}	4.85^{a}	4.63^{a}	4.23^{c}	0.11	*
PCV (%)	26.67^{b}	27.00^{b}	26.33^{c}	29.00^{a}	28.33^{a}	25.67^{c}	0.67	*
Hb(g/100 g)	8.87^{b}	8.97^{ab}	8.73^{b}	9.65^{a}	9.40^{a}	8.53^{b}	0.22	*
TP(g/dl)	3.67^{ab}	4.07^{a}	3.73^{a}	3.70^{ab}	3.60^{b}	3.13^{c}	0.17	*

^{abc}:Means on the same row with different superscripts differ significantly ($p < 0.05$), SEM: standard error of mean * : significance p>0.05).LOS: Level of significance, PCV: Packed cell volume Hb: Haemoglobin count, TP : Total Protein, WBC: White Blood Cell count, RBC: Red Blood Cell count, CP: Crude Protein

Table 5: Some haematological indices of broiler chickens fed varying levels of energy and proteins at 8 week.

(ME Kcal/kg)	2700		2900		3100		SEM	LOS
% CP	19	21	19	21	19	21		
WBC(10^6 mm)	5.93^{b}	6.20^{b}	9.40^{a}	6.60^{b}	4.27^{b}	6.97^{b}	0.53	*
RBC (10^6 mm)	4.47^{b}	5.63^{a}	5.40^{a}	4.27^{c}	4.83^{ab}	4.67^{b}	0.32	*
PCV (%)	27.00^{b}	34.00^{a}	32.67^{a}	26.00^{b}	29.00^{a}	33.00^{a}	2.60	*
Hb(g/100 g)	8.87^{b}	11.30^{a}	10.83^{a}	8.63^{b}	9.63^{a}	11.00^{a}	0.86	*
TP(g/dl)	3.20^{b}	3.00^{b}	2.73^{c}	3.20^{b}	3.20^{b}	3.67^{a}	0.18	*

^{abc}:Means on the same row with different superscripts differ significantly ($p< 0.05$), PCV: Packed cell volume, Hb:Haemoglobin count, TP : Total Protein, WBC: White Blood Cell count, RBC: Red Blood Cell count, CP: Crude Protein, SEM: standard error of mean, * : significance (p>0.05), LOS: Level of significance

CONCLUSION AND RECOMMENDATIONS

It can be concluded that with adequate balance of calorie and protein low energy and low protein combination diet could be fed to broiler chickens for a good haematological performance.

Birds placed on low dietary levels considerably did well in haematological indices which are vital for the survival of birds for continue and increase productivity.

Birds given lower and normal dietary levels could do well possibly even better than those given high dietary levels which are costly.

Adequate economic analysis is required to be done by the farmer using the cost/kg production of meat from the table to know which feed is the most profitable for the farmer.

REFERENCES

Abbas, T. E. (2013). The use of *Moringa oleifera* in poultry diets. *Turkish Journal of Veterinary and Animal Science*, 37:492-496.

Akpa G. N., Asiribo, E. O., Alawa, J. P., Dim, N. I., Osinowo, O. A. and Abubakar, B. Y. (2002). Milk production by Agro pastoral Red Sokoto Goats in Nigeria. *Topical Animal Health and Production*, 36(6):525-533.

AOAC (2005). Official Method of Analysis of Association of Official Analytical Chemists International (18th ed.), Washington D.C.

Bashar, Y. A., Tukur, H. M., Sekoni, A. A. and. Hassan, W. A. (2010). Nutrient Retention and Haematological Indices of Broiler Starters Fed Lablab Seed Meal as the Source of Protein. *Nigerian Journal of Basic and Applied Science*, 18(2):285-291

Boling, S. D. and Firman, J. D. (1998). Digestible lysine requirement of female Turkeys during the starters period. Poultry Science, 77:547-551. http://ps.fass.org/cgi/reprint/77/4/547

Dairo, M. D., Bamidele, J. O. and Adebimpe, W. O. (2010). Disease surveillance and reporting in two South-western states in Nigeria: Logistic challenges and prospects. *Journal of Public Health and Epidemiology*, 2(6):125-129.

Institute for Agricultural Research (IAR) Meteorological Unit (2013). Ahmadu Bello University, Zaria

Isaac, L. J., Abah, G., Akpan, B. and Ekaette, I. U. (2013). *Haematological properties of different breeds and sexes of rabbits. Proceedings of the 18th Annual Conference of Animal Science Association of Nigeria*. Pp.24-27.

Kabir, M., Akpa, G. N., Nwagu, B. I., Adeyinka, I. A. and Bello, U. I. (2011). *Sexual dimorphism, breed and age characteristics of rabbits in Zaria, Nigeria. Proceedings of the 16th Annual Conference of Animal Science Association of Nigeria*. Pp.133-137.

Khan, T. A., and Zafar, F. (2005). Haematological Study in Response to Varying Doses of Estrogen in Broiler Chicken. *International Journal of Poultry Science,* 4(10):748-751.

Maton, A., Hopkins, R. L. J., McLaughlin, C. W., Johnson, S., Warner, C. W., LaHart, D., and Wright, J. D. (1993). *Human Biology and Health*. Englewood Cliffs, New Jersey, USA: Prentice Hall.

Merck Manual (2012). *Haematologic reference ranges*. Mareck Veterinary Manual. Retrieved from http://www.me-rckmanuals.com/

Mmereole, F. U. C. (2008). The Effects of Replacing Groundnut Cake with Rubber Seed Meal on the Haematological and Serological Indices of Broilers. *International Journal of Poultry Science*, 7(6):622-624.

Ogundipe S. O. and S. A. Sanni (2002). Economics of poultry production in Nigeria. A training manual NAPRI/ABU Zaria (abstract).

Ovuru, S. S. and Ekweozor, I. K. E. (2004). Haematological changes associated with crude oil ingestion in experimental rabbits. *African Journal of Biotechnology, 3*(6):346-348.

SAS (1992). SAS, SAS/STAT Software: Changes and Enhancements Release 6.07. SAS Technical Report P-229, SAS Institute, Inc., Cary, NY.

Si, J., Fritts, C. A., Burnham, D. J. and Waldroup, P. W. (2001). Relationship of dietary lysine level to the concentration of all essential amino acids in broiler diets. *Poultry Science*, 80:1472-1479.

Soetan, K. O., Akinrinde, A. S. and Ajibade, T. O. (2013). Preliminary studies on the haematological parameters of cockerels fed raw and processed guinea corn (*Sorghum bicolor*). *Proceedings of 38th Annual Conference of Nigerian Society for Animal Production*. Pp. 49-52.

Togun, V. A., Oseni, B. S. A., Ogundipe, J. A., Arewa, T. R., Hammed, A. A., Ajonijebu, D. C. and Mustapha, F. (2007). Effects of chronic lead administration on the haematological parameters of rabbits–a preliminary study. *Proceedings of the 41st Conferences of the Agricultural Society of Nigeria*. Pg. 341.