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Influence of creep diet on blood profile of West African dwarf lambs raised in humid tropical environment

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Abstract

A 70-day feeding trial was carried out to determine the influence of creep diets on haematological and biochemical blood profile of West African dwarf lambs maintained in a humid tropical environment. Nine lambs at 6 weeks of age were completely randomized into three equal groups and each subsequently subjected to one of three nutritional regimens from 6 to 16 weeks post-partum (point of weaning). Lambs in group 1 (control) suckled their dams only (diet A). Groups 2 and 3 lambs, were in addition to suckling, given supplementary rations formulated to contain 10.0% Soya bean and groundnut cakes (diets B and C) in concentrate mix, respectively. Animals in supplemented groups were offered concentrate diets at 3% of their body weights throughout the trial. Except for MCH, PCV and MCHC, there were no significant differences (P>0.05) in values of other haematological parameters measured. AST and creatinine values were however similar (P>0.05), but significant differences (P<0.05) existed in values of other blood biochemical indices measured. Results of this study showed that creep feeding of lambs stabilizes haematological and biochemical blood profile which is indicative of normal health and nutritional status of the animals.

Keywords: Creep feeding, blood profile, WAD lambs

Introduction

Small ruminants such as sheep and goats play important role in the livestock sub-sector of the Nigerian agricultural economy (Lakpini *et al*., 2002). Gatenby (2002) reported that in the tropics, the highest density of sheep is found in semi-arid areas. Here sheep flocks are large and often cover long distances to graze different places in different seasons of the year. In the humid tropics flocks are usually small and remain in one place. It has been estimated that, of the 200 million sheep in Africa, only about 20 million, or 10%, are in humid and sub-humid area. Nigeria hosts about 21,230 million sheep (Adu *et al*., 1979) with over 70% in the Sahelo Savanna regions where three out of the four breeds of sheep (Balami, Yankasa and Ouda) predominate (Adu and Ngere, 1979). Gatenby (2002) also reported sheep population to be about 20 million in Nigeria. According to Ademosun (1993), Nigeria has an estimate of 22.1 million sheep distributed throughout the country, with the highest frequency occurring in the northern part of Nigeria (Dipeolu *et al*., 1998). A study by Adu and Ngere (1979) revealed that about 66.8% of the nation's rural households keep small ruminants between 2-10 animal per household, thus underscoring the importance of sheep to Nigerian livestock farmer. Sheep production in Nigeria is based mainly on roughages, agro-industrial by-products and natural pastures. However, inadequate supply of feed both in quality and quantity especially in the dry season, is a constraint to increased production of

sheep (Ademosun, 1988; Onifade *et al*., 2007). The primary system of sheep management in Nigeria is the extensive type, also known as traditional method of rearing sheep. Here, sheep are kept mainly by small peasant farmers, who often lack the basic knowledge of sheep management and production (Charray *et al*., 1992). This system is also characterized by free grazing, stall feeding, shepherded grazing and tethering method of feeding, without any supplementary feeding with concentrate (Ruth, 1991). This system is very laborious, especially where large numbers of animals are involved. There is high incidence of disease outbreak, feeding is inadequate both in quantity and quality which results to poor performance of animals. Random mating is common, there is no provision for rudimentary health care and proper record keeping. All these factors results in low growth rate, low productivity, high rate of disease infestation and high mortality rate of pre-weaned lambs (Patrick and Sibylle, 1992). Blood are complex fluids of variable composition, containing a large variety of dissolved and suspended organic and inorganic substances, often with a number of different types of cells (Banerjee, 1998). It serves as an important and reliable medium for accessing the health status of individual animal. According to Banerjee (1998), the functioning of blood in the transport of hormones and metabolites, thermoregulation and general hemostatic are made possible by its constituents, and any alteration could have serious consequences. The purpose of investigating blood composition, it to have a way to distinguish normal status from state of stress, which could be as a result of nutritional, environmental and physical factors. Study of the haematological and serum biochemical values of WAD sheep will serve as baseline information for comparison in condition of nutrient deficiencies, physiology, and health status of WAD sheep which will help to improve its production and management.

Materials and methods

Experimental site

The experiment was carried out at the Sheep and Goat Unit of Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Umudike is located within Latitude 5º 28' North, longitude 7º 32' East and on an altitude of 122m above sea level. The area falls within the Tropical Rainforest zone. Annual rainfall averages 2177mm. The monthly ambient temperature range between 20ºC and 36ºC, and Relative Humidity between 50 and 59%, depending on season (NRCRI, 2004).

Experimental animal and management

Nine (9) West African dwarf lambs aged 6 weeks of age were used in this study: The animals were randomized into 3 groups of 3 animals each and each lamb housed in the same pen with their dams. At the corner of each pen, creep accessible only to the lambs was provided for the lambs in treatment 2 and 3. The lambs, after suckling their dams also had access to the creep ration provided at the corner of the pen, in a creep. Two diets were formulated and fed to the experimental animals. Both diets were formulated from maize offal, Brewers Dried Grain, palm kernel cake, molasses etc as shown in Table 1. Before the trial, the lambs were dewormed and weekly weights subsequently taken till the termination of the experiment.

Experimental design

Nine WAD lambs were completely randomized into three (3) equal groups. Each group consisting of three (3) animals were subjected to three different nutritional regimens. Animals in Group 1 were maintained on suckling from their dam and basal diet (forage sward). Group 2 and 3, in addition to suckling from their dam,

received creep diet supplementation formulated to contain 10% of soybean cake and groundnut cake, respectively.

Experimental diets

Two creep diets B and C were formulated from Maize offal, wheat offal, Brewers' Dried Grain etc. to contain 10% of soybean cake and groundnut cake respectively (Table 1). The supplements were offered to experimental animals at 3% of their body weight. Diet A, the control consists of forage sward.

Table 1: Components of ingredients in the experimental rations

Ration	Ingredients	% inclusion
A (basal diet)	*Forage sward	-
B + basal diet	Maize offal	50
	Brewer's Dried Grain	20
	Soybean cake	10
	Groundnut Cake	0
	Palm Kernel Cake	15
	Molasses	2
	Bone meal	2
	Common Salt	1
	Total	**100.00**
C + basal diet	Maize offal	50
	Brewer's Dried Grain	20
	Soybean cake	0
	Groundnut Cake	10
	Palm Kernel Cake	15
	Molasses	2
	Bone meal	2
	Common Salt	1
	Total	**100.00**

Panicum maximum, Andropogon gayanus, Centrosema pubescens, Calapogonium mucuniodes, Aspilia

Table 2: Proximate composition of experimental diets

Parameter	Diet A	Diet B	Diet C	SEM
Dry matter	50.72^{b}	90.68^{a}	91.17^{a}	6.73
Ash	2.56^{b}	8.85^{a}	9.19^{a}	1.22
Crude fibre	8.95	8.67	8.32	0.58
Ether extract	2.16	3.47	3.31	0.61
Crude protein	7.92^{b}	20.77^{a}	21.69^{a}	2.14
Nitrogen free extract	29.08^{b}	49.27^{a}	50.31^{a}	3.50
*Gross Energy, Mj/kg	2.27	3.09	3.99	0.64

^{a,b,c} Means across rows with different superscripts differ significantly at p<0.05; SEM= Standard error of the mean*Gross Energy (GE) of the diets was determined using regression equation of Nehering and Haelein (1973).

Parameters of study

Haematological and biochemical blood parameters

Method of Uko *et al.* (2000) was adopted in collecting blood for haematological and biochemical values of experimental animals. This was achieved by puncturing the jugular and allowing free flow of blood into labeled sterile universal bottles. Pooled samples per treatment group were divided into two volumes. An initial 10 ml was collected over labeled sterile universal bottles containing 1.0mg/ml of Ethylene diamine tetra-acetic acid (EDTA) and 0.1mg/ml Heparin. This was used to determine the haematological component according to the method of Ajagbonna *et al.* (1999) and Uko *et al.* (2000). Another 10ml was collected over labeled sterile sample bottles without coagulant and used to

determine the biochemical components (Ajabonna *et al*., 1999; Uko *et al.*, 2000).

Haematological parameters

Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), Haemoglobin (Hb), Packed Cell Volume (PVC), Red Blood Cell Count (RBC), White Blood Cell Count (WBC), neutrophils, monocytes, eosinophil and lymphocytes.

Biochemical parameters

This include: Total protein, globulin, albumin, glucose, urea, creatinine, Serum Glutamate-Oxaloacetate Transminase and Serum Glutamate-Pyruvate Transminase.

Duration of experiment

The experiment lasted for 10 weeks. Feeding of experimental diets to animal groups commenced on the 6th week post-partum and ended at 16th week post partum.

Statistical analysis

Data obtained in the study was subjected to Analysis of Variance Procedure (ANOVA) (Steel and Torrie, 1980) appropriate for Completely Randomized Design. Significant means were separated using Duncan's Multiple Range Test (Duncan, 1955).

Results and discussion

Experimental diet

The proximate compositions of the diets used in this study are presented in Table 2. The energy and crude protein content of creep diets (B and C) were comparable but higher than that of control diet A. The crude protein content of the creep diets met the 20-25% range recommended for nursing lambs (NRC, 1981), hence the protein requirements of animals in groups 2 and 3 were adequately satisfied. However, animals in group 1 subsisted on a far less crude protein diet which nevertheless satisfied the minimum CP (7%) required for rumen motility and function (Milford and Minson, 1966).

Haematological indices of WAD lambs fed experimental diets

Haematological indices of West African dwarf (WAD) lambs used in this experiment are summarized in Table 3. The study revealed significant ($P<0.05$) differences in Mean Corpuscular Haemaglobin (MCH), Packed Cell Volume (PCV) and Mean Corpuscular Haemaglobin Concentration (MCHC). The MCH, PCV and MCHC were significantly higher ($P<0.05$) in animal in group 2 (fed diet containing 10% Soybean cake) followed by those in group 3 (fed diet containing 10% groundnut cake).The lambs in the control group had the least values. The PCV obtained in the present study (26.00 to 33.50) fell within the normal range (28.47 to 30.25%) as reported for sheep (Banerjee, 2007; Rusuff *et al*., 1954; Bianca**,** 1955**).** Theresult of this study contrast with the report of Schalm *et al.* (1975) and Njidda *et al.* (2014) that adult sheep have higher PCV values than lambs.

Table 3: Haematological parameters of WAD lambs fed experimental diets

Parameter	T_1	T_2	T_3	SEM
Hb(g/dl)	10.30	12.40	11.75	0.48
WBC ($10^3/\mu l$)	14.80	11.70	14.85	0.80
RBC ($10^6/\mu l$)	6.55	7.83	7.45	0.30
Neutrophil (%)	74.00	81.00	85.00	2.33
Lymphocyte (%)	26.00	19.00	15.00	2.33
MCV (fl)	40.55	47.70	45.00	1.98
MCH (pg)	15.72^c	15.85^a	15.77^b	0.02
PCV (%)	26.00^c	36.50^a	33.50^b	1.58
MCHC (g/dl)	39.62^a	34.21^c	35.09^b	0.19

^{a,b,c} Means across rows with different superscripts differ significantly at $p<0.05$; SEM= Standard Error of the Mean.

The value of the haemoglobin (10.30 to 12.40) obtained in this study fell within the normal range (9-15) reported for sheep (Banerjee, 2006) and also the mean value of 12.2g/dl reported by Njidda *et al*. (2014). Higher haemoglobin value obtained from animals in group 2 relative to those of other groups suggest higher oxygen carrying capacity of the blood of animals in group 2. Generally, increase in the Hb concentration is associated with greater ability to resist disease infection while low level is an indication of disease infection and poor nutritional status (Tambuwal *et al.*, 2002; Cheesbrough, 2004). The higher RBC counts may be associated with conditions that predispose the production of more red blood cells in the body (Polycythemia) or impaired pulmonary function, while low RBC counts may be associated with iron deficiency, internal bleeding, some types of anaemia or some vitamin deficiency. The RBC values (6.55 in T_1 to 7.83g/dl in T_2) obtained in this study agrees with the range (6.49 to 9.31) reported by Njidda *et al.* (2014), for same species. The values of MCH and MCHC were significantly ($P<0.05$) higher in creep fed groups (B and C) compared to those of control group (A). MCV, MCHC and MCH are very important in the diagnosis of anemia and also serve a useful index of the capacity of the bone marrow to produce red blood cells (Awodi *et al*., 2005). Hence, higher value from creep supplemented groups reveals that creep feeding exerts great influence on the haematology of lambs and can help to improve their physiology and health status. The MCV, MCH and MCHC values of 40.55 – 47.70fl, 15.77 – 15.85Pg and 34.21 – 39.62% were higher than the values reported by Banerjee (2006). Higher value obtained from this study could be as a result of better management, age, health status, method of blood collection, ambient temperature and physiological status of the experimental animals (Schalm *et al.,* 1975; Dacie, 1991, Sherman and Mary, 1994).

Serum and biochemical values of WAD lambs fed experimental diets

The biochemical values of experimental lambs are summarized in Table 4. There were significant ($P<0.05$) differences in all biochemical parameters measured in the present study except for AST and Creatinine (Table 4). Serum biochemical indices are used to determine the level of heart attack, liver damage and evaluate protein quality and amino acid requirements in animals as reported by Harper *et al.* (1979). The urea level in this study shows that animals in group 3 have the highest value (44.26) followed by similar values ($P>0.05$) of 35.83 and 35.77 obtained for groups 1 and 2, respectively. The urea value obtained from this study exceeded the range of 8 to 20 mg/dl (Banerjee, 2007) in matured domestic animals and 5.28 mg/dl for free ranging desert big-horn sheep. Higher level of serum urea has been attributed to excessive tissues protein catabolism associated with protein deficiency (Oduye and Adedevon (1976). Probable reason for the high value obtained in this study could owe to the fact that the lambs were still young and have a poorly developed digestive system which may not be efficient in the utilization of the protein contained in their feed. It may also be possible that the feedstuff may have contained some anti-nutrient factors which the young lambs were unable to manage. Creatinine values (1.33 – 1.46mg/dl) obtained in the present study were similar to the normal range of 1-2mg/dl reported by Banerjee (2006). Since creatinine levels relate to renal health as a measure of by-product of muscle metabolism excreted unchanged by the kidney, the values obtained in the current study suggest that the muscle conformation and meat characteristics of the WAD lambs as a meat breed is not affected. Hence, better carcass characteristics are expected from the sheep use in this study.

Table 4: Serum biochemical profile of WAD lambs fed the experimental diets

Parameter	T_1	T_2	T_3	SEM
ALT	74.00[a]	60.50[ab]	45.00[b]	5.57
AST	32.00	31.00	31.00	1.08
Albumin	2.29[b]	3.13[a]	2.65[ab]	0.15
Globulin	1.88[b]	2.23[a]	2.26[a]	0.06
Total protein	4.17[b]	5.35[a]	4.91[ab]	0.21
Urea (Mg/dl)	35.83[b]	35.77[b]	44.26[a]	1.56
Creatinine (mg/dl)	1.33	1.33	1.46	0.03

[a,b,c] **Means across rows with different superscripts differ significantly at p<0.05; SEM= Standard error of the mean**

Conclusively, this study showed that creep feeding of lambs would lead to improve haematological and biochemical blood profile. Haematology and biochemical indices have been found to be valuable in monitoring physiological changes in farm animals. These parameters are thus, very important in determining the physiological status of farm animals. Normal ranges of values indicate that the vital physiological process has been maintained and were normal and the animals are in good health. Creep feed therefore remains a veritable tool in the management of our ruminant stocks. It will help to increase the growth, survivability and over-all productivity of our indigenous sheep and goat thereby helping in solving the problem of animal protein deficit in Nigeria and other developing economies of the world.

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