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Nutrient intake and digestibility of West African dwarf lambs fed creep diets formulated from different nitrogen sources

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Abstract

A study was conducted to investigate the nutrient intake and digestibility of creep fed West African dwarf lambs maintained in a humid tropical environment. Nine lambs were completely randomized into three groups and each placed on different nutritional regimen from 6 to 16 weeks post-partum. Lambs in group 1 (control) ate forage sward suckled their dams (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 in concentrate mix, respectively. Feed intake and coefficients of digestibility for all nutrients evaluated were affected (P<0.05) by dietary treatment. Dry matter (12.66), crude protein (50.63), nitrogen free extract (44.20) and energy (37.56) digestibility were significantly lower (P<0.05) in T_1 *but similar (P>0.05) in groups 2 (76.12, 85.94, 94.72 and 82.01) and 3 (74.89, 84.87, 94.45 and 80.42) while ether extract and crude fiber differed (P<0.05) in treatment 1, 2 and 3. Creep supplemented groups generally recorded better nutrient intake and digestibility. This study showed that creep feeding leads to the production of well nourished lambs with animals in group 2 (fed creep containing 10% Soya bean) showing better result in terms of parameters measured compared to those of group 3 (fed creep containing 10% groundnut cake). Thus, Soybean is a better nitrogen source for creep feeding lambs compared to groundnut cake.*

Keywords: Nutrient intake, digestibility, creep diet, lambs, nitrogen sources

Introduction

Creep feed is that normal feed given to young animals behind a barrier (or creep) which allows them access to the feed but excludes the dam (Banerjee, 1998). Creep feeding therefore, is the practice of providing suckling animals with supplementary feed to which their dams do not have access to (Banerjee, 2007). It is the practice of self-feeding of concentrates to young animals in separate enclosure away from their dams (Gatenby, 2002). Desta (2010) maintained that such supplemental feed should be of high quality and should be able to make up for any shortfall in intake from suckling. This means that such lambs will still be suckling milk and grazing but will have extra supplements to make up any shortfall in their intake. Creep feed can be in many forms, including dry hay, silage, or pasture, but is most commonly in the form of a grain mix. The most common objective of creep feeding is to increase the growth rate of suckling animals. Other benefits include producing a more uniform lamb crop, reducing weaning stress on the lamb, and allowing young and/or thin ewes to enter the post nursing period in better condition. Creep feeding will also reduce the feed requirements of the ewe herd while maintaining or improving the performance of the suckling lambs. Creep feeding of lambs will also help in quick and proper development of the rumen and enhance early consumption of solid feed thereby helping in the over-all improvement of sheep production in Nigeria.

However, not much work has been done on the utilization of creep diets by our indigenous sheep and goat. Hence, this work was aimed at investigating the utilization of creep feed by WAD lambs fed diets from two nitrogenous sources.

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 20°C and 36°C, 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 the dam. At the corner of each pen, creep accessible only to the lambs was provided. The lambs from groups 2 and 3, after suckling their dams also had access to the creep ration provided at the corner. 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.

Parameters of study

Each treatment group comprising three WAD lambs was transferred to and housed in separate metabolic cages with facilities for collecting faeces and fed the designated diets for 2 days. During each 2-day feeding period, drinking water was provided *ad libitum*. Sample of each diet was collected and used for dry matter (DM) determination and proximate composition analysis.

Faecal samples not contaminated with urine were collected and bulked for each animal. A sub-sample from each animal was dried in forced draft oven at 100 – 150°C for 48 hours and used for DM determination. Another sample was dried at 60°C for 48–72 hours for determination of proximate composition. Apparent co-efficient of digestibility for nutrients was determined using the formular below:

$$\frac{\text{Nutrient in feed} - \text{nutrient in faeces}}{\text{Nutrient in feed}} \times 100$$

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.

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.

Chemical analysis

Proximate analysis was carried out on test diets – A, B and C. The diets were analysed for Dry Matter (DM), Crude Protein (CP), Crude Fibre (CF), Ether extract (EE), Nitrogen Free Extract (NFE) and ash (A.O.A.C, 1990). The Gross Energy (GE) of the samples was determined using regression equation of Mcdonald *et al.*,

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 feed

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	8.32	8.67	0.58
Ether extract	2.16	3.47	3.31	0.61
Crude protein	7.92^{b}	20.77^{a}	19.69^{a}	2.14
Nitrogen free extract	29.08^{b}	49.27^{a}	50.31^{a}	3.50
*Gross Energy	2.26	3.92	3.89	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 Mcdonald *et al.* (2011).**

(2011):
GE (MJ/Kg) = 0.0226CP + 0.0407EE + 0.0192CF + 0.0177NFE
Where CP = Crude Protein, CF = Crude Fibre, NFE = Nitrogen Free Extract, EE = Ether Extract.

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 diets

The proximate compositions of the diets used in this study are presented in Table 2. The energy (3.92 and 3.89) and crude protein content (20.77 and 19.69) of creep diets (B and C) were comparable (P>0.05) but higher (P < 0.05) than that of control diet A. The crude protein content of the creep diets met the 14-18% 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, 1996).

Nutrient intake and digestibility

Table 3, shows s the nutrient intake and digestibility of WAD lambs fed the three diets. The intake and coefficients of digestibility for all nutrients evaluated were affected (P<0.05) by dietary treatment. Dry matter (12.66), crude protein (50.63), nitrogen free extract (44.20) and energy (37.56) digestibility were significantly lower (P<0.05) in T_1 but similar (P>0.05) in groups 2 (76.12, 85.94, 94.72 and 82.01) and 3 (74.89, 84.87, 94.45 and 80.42) while ether extract and crude fiber differed (P<0.05) across the three (3) groups.

The significantly lower DM digestibility recorded with increased DM intake for lambs in group 1 was due to corresponding increase in the DM output of same animals. The reduced DM digestibility with increased DM intake is in line with the findings of McDonald *et al.* (1995) that DM digestibility is negatively correlated with DM intake. The non-significant relationship in DM digestibility in the other two treatments (T_2 and T_3) could be attributed to delayed retention time of DM consumed by creep fed lambs thereby underscoring the importance of creep feeding.

Table 3: Nutrient intake and digestibility of wad lambs fed experimental diets

Parameter	T_1	T_2	T_3	SEM
Nutrient Intake				
Dry Matter	241.41[c]	510.97[a]	478.36[b]	8.79
Ether Extract	10.06[b]	20.30[a]	21.11[a]	1.79
Crude Fibre	113.28[b]	172.87[a]	166.74[a]	9.58
Crude Protein	46.77[c]	69.82[a]	62.23[b]	3.44
NFE	194.03[a]	61.96[b]	58.31[b]	22.34
Energy	16.87	16.79	15.90	0.22
Digestibility				
Dry matter digestibility (%)	12.66[b]	76.12[a]	74.89[a]	10.48
Ether extract digestibility (%)	60.98[c]	75.52[a]	69.49[b]	2.13
Crude fibre digestibility (%)	5.88[c]	12.74[a]	7.98[b]	1.05
Crude protein digestibility (%)	50.63[b]	85.94[a]	84.87[a]	5.81
Nitrogen free extract digestibility (%)	44.20[b]	94.72[a]	94.45[a]	8.40
Energy digestibility (%)	37.56[b]	82.01[a]	80.42[a]	7.29

[a,b,c] Means on same row with different superscripts differ significantly at p<0.05; SEM= Standard Error of the Mean

CP digestibility was significantly higher (P<0.05) in creep supplemented groups. Increased creep consumption increased dry matter (DM) as well as crude protein (CP) intake; which nevertheless enhanced the availability and digestibility of other nutrients (Malau-Aduli *et al*., 2004b). It is possible that the creep diets may have supplied more nutrients, and the feeds being better utilized, were able to confer better weight gain, higher feed efficiency. The present study therefore underscores the relevance of creep feeding lambs. This observation is in line with findings of earlier investigators (Bajhau and kennedy, 1990; Kumar, 2003; Malau-Aduli *et al*., 2004; Rastogi *et al*., 2006; Olomola *et al*., 2008; Mude *et al*., 2010; Ebuzor and Ahamefule, 2013).

The protein digestibility coefficients were similar (P>0.05) for diets 2 and 3 and significantly higher (P<0.05) than the value for diet 1. The higher crude fibre in diet 1 may have caused low feed retention (residence) time thereby not allowing enough time for digestive enzymes to hydrolyze the protein components of the diet (Frandson, 1981; McDonald *et al.,* 1995). Pattern of NFE and Energy digestibility were similar to that of DM. It could be deduced from this that the factors that affected DM digestibility affected these nutrients since they are also components of the DM.The crude fibre digestibility of diet 2 was significantly higher (P<0.05) than that of diet 3 followed by that of diet 1. The least crude fibre digestibility coefficient recorded for suckling lambs fed forage sward (T_1) could be because of the higher fiber content of the diet and also the nature, source and composition of the dietary fibre. The lambs may have found it difficult to digest fibre from forage sward compared to those in concentrate mix. The digestibility coefficients of crude fibre here were lower than that of other nutrients. This could be because rumens of the lambs were yet not well developed to degrade fibre components of their diets. The fat digestibility coefficient was significantly higher (P<0.05) in creep fed group (T_2 and T_3) compared to the control (T_1). It decreased with decrease in energy concentration. This trend agreed with the results obtained by Ojewola and Longe (1999) which indicated a positive correlation between dietary energy and fat utilization since fat is a contributor to energy (McDonald *et al*., 1995; Olomu 1995). The NFE digestibility values (44.20, 94.72 and 94.45 from animal in group 1, 2 and 3 respectively) were higher than that of other nutrients probably because NFE being the sugar component of carbohydrate was more efficiently digested by enzymes (McDonald *et al*., 1995; Okeudo, 2000). The NFE digestibility coefficients (94.72 and 94.45) for diet 2 and 3 were significantly greater (P<0.05) than that of diet 1 (44.20). This could be attributed to the fact that the carbohydrate of creep diets were more hydrolysable compared to that of forage sward.

Similarly, the gross energy digestibility (utilization) in this study decreased with increase in dietary fibre and a decrease in the dietary energy. This decrease in energy digestibility with increase in dietary fibre gave credence to the report of Ojo *et al*. (2005) that dietary fibre was inversely related to energy utilization.

In conclusion, the digestibility coefficients for all nutrients in the creep diets (2 and 3) were better than that of diet 1. Therefore, creep supplementation to nursing lambs will help improve the utilization of dietary nutrients.

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