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Effect of Feeding varying levels of *Microdemis puberula* and *Alchornea cordifolia* on the body size and carcass component of West African Dwarf Goats (WAD).

B. I. UMOH, B. I. OKON, I. O. JAMES and E. S. JACOB

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ABSTRACT

Sixteen West African Dwarf (WAD) goats of mixed sex, averaging 8.2 kg body weight, were used in a study to determine the effects of varyi .g levels of *Microdemis puberula (Mbom)* MP, and *Alchornea cordifolia (Ntabit)* AC on body size and carcass components. Final and slaughter weights increased (P<0.05) for animals in 75%:25%. AC:MP browse mixture group compared with others which were lower and similar. Average daily gains (g/d) were (5.89, 11.96, 15.54 and 0.89)g respectively for groups of goats on the four different levels of browse plants. Overall gains and average daily gains significantly increased (P<0.05) for goats on 75%:25% AC:MP and 50%:50% AC:MP compared with other treatment groups.

Browse mixtures of 75:25%, AC:MP and 50%:50% AC:MP resulted in breast and shoulder weight increase respectively. Growth rate of body parts and organ weights were higher for animals on TRT_2 and TRT_3. It could therefore be deduced that feeding mixed forages in the proper proportion motivated increasing growth rate in WAD goats as against feeding sole forage.

KEY WORDS: *Microdemis puberula (Mbom)*, *Alchornea cordifolia (Ntabit)*. West African Dwarf Goats, Body weight, Carcass components, mixed sex, Models.

INTRODUCTION

The need for animal protein in Nigeria calls for contributions from different species of livestock. Inspite of the large population of chickens and other animal species, protein supply to the teaming population in Nigeria has remained very low. The current need for animal protein in Nigeria, like in any other developing countries of the World has posed an enormous challenge to the Nigerian livestock farmers. Consequently, diversifying attention to the improvement of goat production could contribute towards meeting the protein needs of the Nigerian populace. The WAD goats are indigenous to the Southern part of Nigeria. They are kept mainly for meat, skin and reproduction. They constitute the bulk of the Nigerian goat population and are managed under extensive, low input, traditional husbandry system. The decline in the index of livestock production in Nigeria derives largely from lack of feeds. Inadequate or unbalanced feeding is a major constraint to livestock production in the tropics (Ugherughe et. al., 1988). Feed supply is inadequate in quantity and quality and this is responsible for the low livestock productivity in the tropics (Odenyinka, 1999). Most of the livestock are exposed to the traditional system of management in which the major feed sources are grass; browse species, crop residues and hay (Miller et al., 1963). Umoh and Halilu (1992) reported that the value of browse mixture depends on the chemical composition and digestibility of plant materials and the absence of anti-nutritional factors. Browse plants constitute variable feed resources, and may be valuable as supplement to poor quality roughage.

Tropical shrubs contain appreciable, quantity of condensed tannins in their biomass, which affect palatability, intake and digestibility of the foliage (Oji and Isilebo, 2000). The chemical characteristics of browse plant obtained by Oji and Isilebo (2000) suggested that browse plants are potentially high in crude protein and mineral but low in condensed tannins. Most goat producers in the tropics incorporate browse plants such as *Microdemis puberula, Alchornea cordifolia, Leucaena leucocephala, Gliricidia sepium, Ficus exasperata, Palisota hirsule. Maniophyton fulvum, Linga edulis, Grewia pubescens, Militia thonningii* and *Dialium guineense* as fodder.

Kibon and Holms (1989) suggested that low cost supplement such as cereal grain, acacia

B. I. UMOH, Department of Animal Science, University of Uyo, Uyo - Nigeria
B. I. OKON, Department of Animal Science, University of Calabar, Calabar - Nigeria
I. O. JAMES, Department of Animal Science, University of Uyo, Uyo - Nigeria
E. S. JACOB, Department of Animal Science, University of Uyo, Uyo - Nigeria

seed, leguminous fodder could be used to boost animal production. Improving the nutritive value of these forages can be achieved by addition of the deficient nutrient to correct the nutrient inbalance. However, the nutritive composition of most of the forages could be determined.

The research was initiated to study the nutrient composition of the forages used in this study as sole or mixed feed at varying levels, and to assess their effect on the performance of WAD goats. The study also aimed at generating models for the prediction of body parts and organ weights of these animals.

MATERIALS AND METHODS

Sixteen West African Dwarf (WAD) goats of mixed equal sexes (2 males and 2 females), (8-12 months of age) with average weight of 8.2kg were randomly divided into flour groups for the study. The study lasted for 56 days. Animals were given prophylactic treatments for endo- and eetoparasites. '*Microdemis puberula* (Ntabit) MP. And *Alchornea cordifolia* (Mbom) AC. were collected daily from the swampy area of the town and fed as follows: 100% MP (TRT_1). 25%MP and 75% AC (TRT_2). 50% MP and 50% AC (TRT_3) and 100% AC (TRT_4). Trace mineralized salt and water were available at all times. Individual weights were measured prior to commencement of the study and before feeding and at weekly intervals, and at the end of the trial. Daily feed intake, daily left over feed and daily gains were recorded. Intake was calculated as difference between feed offered and refused corrected for dry matter content. Three animals from each treatment group were randomly selected for slaughter to evaluate carcass characteristics. Carcass measurements included pre-slaughter weight; dressing percentage, yield grade and warm carcass weight.

The proximate composition of the experimental diets was analysed according to the Association of Official Analytical Chemist, A.O.A.C. (1980) procedure for dry matter (DM). Crude protein (CP), crude fibre (CF). ether extract (EE), ash and nitrogen free extract (NFE).

All chemical analyses were carried out on a dry matter basis and details of data collected were analysed by the analysis of variance procedure for personal computers (SAS, 1986). Duncan's Multiple Range test was used to determine differences among means (Steel and Torrie, 1980). The data obtained from carcass components were also fitted to the simple linear function Y = a + bx. Each of the periodic body weight measurements constitutes the independent variable x, while dependent variable y was the carcass and organ components.

RESULTS AND DISCUSSION

The chemical composition of the forages used is shown in Table 1. Dry matter varied for all the forages. The highest DM was recorded for diet TRT_2 (66.2%). Diets TRT_1 had the lowest (44.99%) DM. Dry matter is an important factor in the utilization of roughage by ruminant livestock and is a critical determinant of energy intake and roughage by ruminants (Devendra and Burns, 1983). Crude protein ranged between 8.76% and 13.13%. This was slightly different from CP

Table 1: Chemical composition of forages and forage combinations (DM basis)

PARAMETERS	DM (%)	CP (%)	Ash (%)	EE (%)	CF (%)	Ca (%)	P (%)
MP 100% (TR_1)	49.99	13.13	12.00	5.18	10.20	0.36	0.64
MP: DC 75:25% (TR_2)	66.16	8.76	8.00	5.51	11.10	0.32	0.36
AC:MP 50:50(TR_3)	52.83	11.39	8.00	3.68	5.02	0.32	0.06
AC 100% (TR_4)	54.84	10.51	6.00	2.98	5.13	0.48	0.04

Table 2: Least Square means of weights, feed intake and feed efficiency

Parameters	TR_1 MP 100%	TR_2 AC:MP 75:25	TR_3 AC:MP 50:50	TR_4 AC 100%
No. of animals	4	4	4	4
Initial weight (kg)	7.10± 1.0	9.40± 0.0	7.53± 1.20	8.40± 0.0
Final weight (kg)	7.73± 0.15[b]	10.07± 0.58[a]	8.40± 1.3[b]	8.90± 0.2[b]
Total gain (g)	330± 0.08[b]	670± 0.29[a]	870± 0.65[a]	50± 0.80[b]
ADG (g/d)	5.89± 0.01[a]	11.96± 0.01[b]	15.54± 0.02[a]	0.89± 0.02[b]
Feed intake (g/d)	487.41± 1.14	487.72± 182	464.8± 151	400.2± 167
Feed efficiency %	3.66	2.45	3.34	2.23

[abc] Means in the same row with different superscripts are different ($P<0.05$)

Table 3: Least square means of weights, parts and organs of WAD goats fed varying levels of *Alchornea cordifolia* and *Microdemis puberula*

PARAMETERS	TR_1	TR_2	TR_3	TR_4
Final weight (kg)	8.40±0.6[b]	10.00±0.2[a]	8.30±0.3[b]	8.90±0.2[ab]
Slaughter weight [1](kg)	8. 00±0.1[b] (95.24)	9.70±0.2[a] (97.00)	8.00±0.2[b] (96.39)	8.30±0.7[b] (93.26)
Dressed weight (kg)	3.30	3.60	3.27	3.13
Dressed percentage %	39.29	36.00	39.40	35.17
Breast	0.06 ± 0.0[b] (0.71)	0.13±0.1[a] (1.3)	0.12±0.1[a] (1.44)	0.08±0.01[b] (0.89)
Head	1.03±0.02 (12.26)	1.13± 0.15 (11.3)	1.00± 0.1 (12.05)	1.43±0.4 (16.07)
Loins	0.45±0.05 (5.36)	0.45± 0.05 (4.5)	0.40± 0.1 (4.8)	0.35±0.02 (3.9)
Liver	0.11±0.03 (1.31)	0.15± 0.09 (1.5)	0.14± 0.03 (1.7)	0.17±0.02 (1.9)
Shoulder	1.00±0.2[b] (11.90)	1.13± 0.2[a] (11.3)	1.50 ± 0.1[a] (18.05)	1.10±0.4[b] (12.34)
Tail	0.03 ±0.01 (0.37)	0.02± 0.01 (0.36)	0.03± 0.02 0.36	0.03±0.01 (0.33)
Lungs	0.11 (1.31)	0.12 (1.43)	0.10 1.19	0.11 (1.31)
Heart	1.034± 0.11 (1.62)	0.03± 0.01 (0.30)	0.04± 0.01 0.48	0.04±0.01 (0.45)

[abc] Means in the same row with different superscripts are different ($P<0.05$)
[1]Dressed weight was obtained after skinning and removal of recommended parts.

reported by Ademosun et al. (1985); Oyenuga (1976); Oji et al. (2002).

Although there were no significant differences ($P<0.05$) among the least square means for initial weight, and feed intake Table 2. Final weight increased significantly ($P<0.05$) for TRT_2 compared with other groups. The performance of animals in TRT_1. TRT_3 and TRT_4 was similar ($P>0.05$). Total gain and average daily gain increased ($P<0.05$) for animals that received mixed forages (TRT_2 and TRT_3). Low growth rate is acknowledged to be the major limiting factor in goat production and the plane of nutrition can markedly improve weight gain, the degree of response varies with breed type (Devendra and Bonds, 1983). The improvement in final weight gain in this study for animals that received mixed forages supports the above predication. However, the present result disagrees with findings of Okello et. al., 2000 who reported loss in weight with negative growth rate for goats fed on leucaena leaves supplemented with elephant grass. Increased in weight gain observed for animals in TRT_3 and TRT_3 may have been possible due to the proportion of each forage included in the diet to provide nutrients that are critical determinants of growth in ruminants. The performance of animals in TRT_1 and TRT_4 was lower and similar (P.>0.05). Again this present finding supports the report of Okello et al., 2000 in which the authors observed that goats on elephant grass alone lost weight. They further explained that the negative growth recorded by goats fed on elephant grass alone was attributed to the insufficient amount of energy and protein in the sole feed. The best growth rates recorded in this study were 11.96 g/d and 15.54 g/d for TRT_2 and TRT_3 respectively. The growth rates are however lower than values obtained in WAD goats (Zemmelink et al., 1985; Reynolds, 1989; Ademosun et al., 1985). The present study supports the report of Ademosun et al (1985) that CP of 14.85% would be enough for the maintenance of sheep and goat. The condition score for all the animals ranged from 1.5-2 on a scale of 5. Generally, energy content of the experimental diets was low. The study was conducted at the onset of the rainy season, and the forages may have been deficient in energy, which is responsible for their slow performance. Feed efficiency improved non-statistically ($P>0.05$) for TRT_2. (2.45%) and TRT_4 (2.34%) compared with values obtained for the animals in TRT_1 (3.66%). TRT_3. (3.34%). Feed efficiency is the ratio expressing the number of units of feed required for one unit of production by an animal.

Feed intake was similar for all the groups

Table 4: Body weight prediction from carcass using Linear Regression

$y = + b_1x_1$

Parameter	Prediction equation	r.	R^2	T	SEE
		TRT_1			
BODY PARTS OBTAINED FROM KILLED FLOOR					
Head	HD= -6.37 + 0.75bw	0.98***	0.96	5.20	0.041
Shoulder	SH= -6.36 + 0.75bw	0.98***	0.96	5.20	0.041
Loins	LN= -2.05 + 0.25bw	1.00	1.00	-	-
Breast		-	-	-	-
Rib		-	-	-	-
Leg	LG= -6.33 + 0.75bw	0.98***	0.96	5.19	0.12
ORGANS OBTAINED FROM KILLED FLOOR					
Stomach wt.	SW=13.13 – 1.00bw	- 0.96***	0.923	-3.46	0.082
Stomach vol.[1]	SV=24.60-1.75bw	- 0.97***	0.942	-4.04	0.123
Liver	LV= -0.097 + 0.025bw	0.87***	0.75	1.73	0.333
Heart	HT=0.037 + 0.0bw	0.0	0.0	0.0	1.0
Intestine	-	-	-	-	-
Lungs	LU= -0.14 + 0.025bw	0.87***	0.750	1.73	0.041
		TRT_2			
BODY PARTS OBTAINED FROM KILLED FLOOR					
Head	HD=0.385+0.077bw	0.28*	0.077	0.289	0.208
Shoulder	SH=0.037+0.170bw	0.61**	0.377	0.778	0.171
Loins	LN=0.102+0.041bw	0.45*	0.206	0.509	0.063
Breast	BR=0.0015+0.077bw	0.28*	0.077	0.289	0.021
Rib	-	-	-	-	-
Leg	LG=0.385+0.077bw	0.28*	0.077	0.289	0.207
ORGANS OBTAINED FROM KILLED FLOOR					
Stomach	SW=0.704+0.605bw	0.45*	0.206	-0.51	0.378
Stomach vol	SV=0.154+0.130bw	-0.75**	0.502	-1.13	0.956
Liver	LV=0.054+0.000654bw	0.14	0.019	0.137	0.037
Heart	HT=0.038-0.0005bw	0.052	0.003	-0.05	0.008
Intestine	INT=0.537-0.0587bw	0.98***	0.974	-6.16	0.074
Lungs	LU=-0.027+0.017	0.61**	0.377	0.778	0.017
		TRT_3			
BODY PARTS OBTAINED FROM KILLED FLOOR					
Head	HD= -2.263+0.395bw	0.99***	0.987	8.66	0.073
Shoulder	SH= -2.26+0.395bw	0.99***	0.987	8.66	0.073
Loins	LN=0.127-0.0052bw	0.99***	0.987	8.66	0.073
Breast	BR=0.127-0.0052bw	0.12	0.013	-0.12	0.016
Rib	-	-	-	-	-
Leg	LG= -2.26+0.395bw	0.99***	0.987	8.66	0.016
ORGANS OBTAINED FROM KILLED FLOOR					
Stomach WT.	SW=7.04+0.605bw	0.99***	0.994	-13.3	0.016
Stomach vol.	SV=6.66-0.236bw	0.600**	0.355	-0.74	0.114
Liver	LV=0.122+0.026bw	0.12	0.013	0.115	0.008
Heart	HT=0.137+0.021bw	0.92***	0.842	0.309	0.003
Intestine	-	-	-	-	-
Lungs	LU=0.404+0.0605bw	0.99***	0.994	13.28	0.002
		TRT_4			
BODY PARTS OBTAINED FROM KILLED FLOOR					
Head	HD=2.81-0.154bw	0.44*	0.193	-0.49	0.41
Shoulder	SH=2.14-0.0714bw	0.19	0.036	-0.19	0.605
Loins	LN=0.166+0.0203bw	0.46*	0.216	0.525	0.063
Breast	BR=0.0699+0.0008bw	0.08	0.006	0.075	0.016
Rib	-	-	-	-	-
Leg	LG=0.298+0.066bw	0.99***	0.987	8.66	0.013
ORGANS OBTAINED FROM KILLED FLOOR					
Stomach wt	SW=1.13+0.105bw	0.39*	0.158	0.433	0.396
Stomach vol.	SV=4.704sw-0.032bw	0.79**	0.622	-1.28	0.041
Liver	LV=0.039+0.014bw	0.77**	0.594	1.21	0.019
Heart	-	-	-	-	-
Intestine	INT=0.935-0.038bw	0.43*	0.188	-0.48	0.127
Lungs	LU= -0.054+0.018bw	0.80***	0.645	1.35	0.022

[1]Stomach volume was obtained by emptying the stomach content and filling the stomach with kno volume of water.

*** (P<0.001) ** (P<0.01) * (P<0.05).

According to Umoh and Halilu (1992) animals are surrounded by much more abundant, although poor quality forage in the humid tropics, hence, these forages cannot satisfy the animal's nutrient requirement. A single browse plant fed to any animal scarcely supplies all the needed nutrients.

Table 3 compares Least square means of animal body parts, and organs from various treatments. The overall mean weights of slaughter, dressed, body parts and organs expressed as percentage of body weight are shown in parenthesis. Dressed weight was not different (P>0.05) among the experimental groups. Dressing percentages were 39.3%, 36.0%, 39.4% and 35.2%, while head weights were 1.03, 1.1, 1.0 and 1.4 for goats in TRT_1, TRT_2, TRT_3 and TRT_4 respectively. Although neither dressing percentages nor head weights were significantly (P>0.05) influenced by the treatment, dressing percentages for TRT_1 and TRT_3 were similar, but none-statically higher compared with those of TRT_2 and TRT_3 which were lower. There were no well-established trends in the response to the treatments. Breast weights of the slaughtered animals were influenced (P>0.05) differently. Breast weights of animals were similar but significantly (P<0.05) higher for animals in TRT_2 and TRT_3 compared with values obtained for TRT_1 and TRT_4. Shoulder weight followed the same trend as described for breast weight. Accordingly, there is an instant denial of associative influence derived from feeding mixed forages. Similarly, values for loins, liver, lungs and heart were not affected (P>0.05) by the treatments. According to Barton and Kirton (1961) the legs and the loins of ruminant animals could be used with success in estimating the bone, muscle and fat of the carcass since leg relates late developing while loin is early developing. Since there was no significant differences (P>0.05) in weights of loins and legs among treatments, it is therefore reasonable to deduce from the results that the different diets used in the study affect the development of the body parts equally.

Three animals per treatment were randomly selected for slaughter to estimate the growth rate of body parts, carcass components and organs. Predicting equations, correlation coefficients (r), predicting power (r^2) and standard error of the estimate (SEE) are represented in table 4. Models for the prediction of body parts and organ weight of WAD goats fed single or mixed brows plants were generated from data obtained from the growth estimators obtained from various animals during slaughter.

The regression coefficients or growth coefficients give estimates of the growth rate of the various body parts and organs. Using the predicting functions, periodic increase in growth rate was recorded for body parts; head, shoulder and loins of animals in TRT_2, (Table 4). A fluctuating rate of growth was observed for the organs studied in TRT_1. The regression coefficients (b values) for stomach weight and stomach volume were observed to decline (b=-1.0, b=-1.7 respectively. This observation supports the claim that feeding sole forage to an

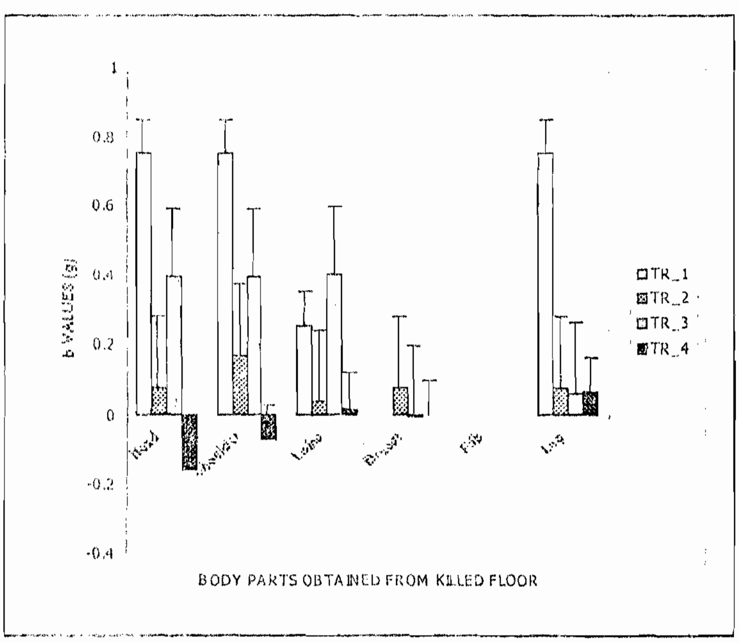

Fig. 1: Regression coefficient values showing growth rate of various body parts

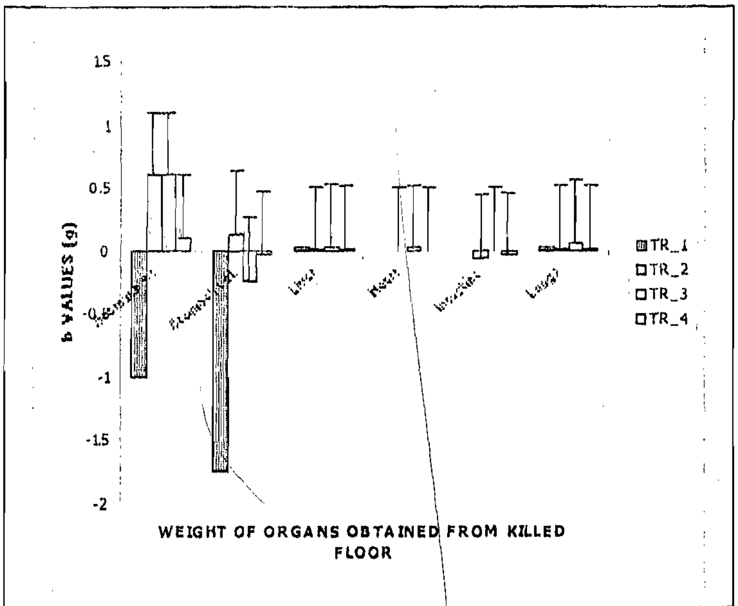

Fig. 2: Regression coefficient values showing growth rate of various organs

animal may not furnish the animal with the required nutrient necessary for growth, hence the resulting depression in the growth rate of the animals. The regression coefficient of body parts in TRT_2 and TRT_3 indicates a steady positive increase in the growth rate of the body parts of the animals. A similar trend was observed for the organ weights obtained from animals in these treatment groups. The present finding suggests that animals in TRT_2 and TRT_3 benefited from the associative effect of mixed forages. A fluctuating trend of increase in growth rates of body parts and organs were observed for growth indicators in TRT_4. The high negative regression coefficient in TRT_4 revealed a negative growth response of animals to the experimental diet. Under this feeding method, the animals were denied the associative effect derived when animals have access to mixed forages. With the exception of rumen volume and intestine, (b= -0.03, b= -0.04) respectively, all of the regression coefficients obtained for the organs; stomach weight, liver and lungs (b=0.11, b=0.01and b=0.02) respectively, slowly increased in growth rate.

The predicting ability (r^2 values) for the body parts and organs were high for the animals in TRT_1, except for other organs that were observed to have low coefficient of determination (r^2), TRT_2. The size of the coefficient of determination values indicating the best curve were high (above 99%) for body parts; head, shoulder, while breast (r^2=0.013) was low in TRT 3. The parameter was high for the organs; stomach weight, intestine and lungs, but ranged between (1.3-35%) for stomach volume and liver for animals in TRT_3. This predicting power (r^2) was generally low for both body parts and organs of the animals in TRT_4. This could be attributed to the fact that these animals could not meet their nutrient requirement from the single forage that they consumed during the period of the study.

Correlation coefficient for each fit for body parts of the animals in TRT_1 is above 98%. Stomach weight and stomach volume showed strong negative correlation coefficient (r^2 = -0.96 and -0.97) respectively. In TRT_2, body parts and organs were non-significantly correlated with the exception of intestine (r = 0.99). Correlation coefficients (r values) of the body parts and organs of the animals (TRT_3) were significantly ($P<0.001$) higher compared with other groups, with exception of breast and liver. For TRT_4, significant but fluctuating correlation coefficients were recorded for legs, stomach volume, liver and lungs. The low SEE values indicate the efficiency of the independent variable (body weight) in estimating growth rate of body parts and organ weights in this study. Based on the results obtained in this study, various body parts, organs and carcass components were highly correlated with live weight across all diets suggesting that all the diets did not severely alter the allometry of growth.

Figures 1 and 2 present the growth rate of body parts and organs respectively. Except in few cases, the growth pattern of body parts and organs tended to be favoured by other factors rather then feed alone.

In conclusion, it can be presumed that feeding more than one forage that are mixed in an acceptable proportion could furnish critical nutrients required for effective growth of the animals. Because of the inherent nutrient deficiencies, poor quality pastures cannot sustain effective animal growth or even maintenance when fed alone. The provision of supplementary feedstuff would enhance the productivity of goats in the humid tropics. The results from this study also suggest that protein and energy supplements should be incorporated in the diets to enhance body condition of the animals and performance.

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