Feed Intake and Liveweight Gain of Goats Fed *Urochloa* Grass

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Keywords: Coastal lowlands; crude protein; feed intake; Regression analysis; galla goats

Abstract

Crude protein and digestible dry matter are the most important components of a feed and determine animal performance. The natural pastures in Kenya are prone to great seasonal and spatial fluctuation in both quality and quantity. Consequently, there was need to explore other nutritious alternative feeds. Sixteen growing male Galla goats weighing 10 - 24 kg were used in a twelve weeks feeding trial in the coastal lowlands of Kenya. They were randomly allocated four grass diets consisting of *Urochloa brizantha* cvs. Piata and MG4, *U. hybrid* cv. Mulato II and *Chloris gayana* (Rhodes grass), which was used as the control. Regression analysis was conducted using daily weight gains as dependent variable against nutrient intake (dry matter, crude protein, acid detergent fiber, acid detergent lignin, neutral detergent fiber and ash). Crude protein intake gave a better prediction of daily gain ($R^2 = 0.89$, $P < 0.001$). Grass diet with high CP and digestibility values are most suitable for high ADG of Galla goats.

Introduction

Over many parts of Africa, rural communities depend heavily for their survival on agriculture and livestock that are amongst the most climate-sensitive economic sectors (Djikeng et al., 2013). Livestock plays a key role in our country Kenya; with the subsector contributing approximately 12% to the national Gross Domestic Product (Njarui et al, 2020). The effects of climate change however, have challenged the sustainability of the livestock sector. It is projected that the Kenyan population will reach 96 million with over 50% of the population living in urban areas by 2050 (FAO, 2017). Intensification of livestock production systems need to be a crucial strategy in meeting the increased demand for meat and milk that will be prompted by changes in population growth, urbanization and diminishing land sizes (Maina et al., 2019). This intensification of livestock production requires sustainable fodder production systems which are currently threatened by increased feed prices and prolonged drought (Fallis, 2015).

Forage grasses commonly found growing in the semi-arid regions of Kenya include Rhodes grass (*Chloris gayana*), Buffel grass (*Cenhcrus ciliaries*), Maasai love grass (*Eragrostis superba*), Panicum maximum, *Enteropogon macrostachyus* and Horse tail (*Chloris roxbhurgiana*) (Nguku et al., 2016). These grasses' nutritional and yield status decline with changing climatic conditions in the year making them not capable of meeting the needs of livestock (Gitunu et al., 2003; Nguku et al., 2016). *Brachiaria* syn. Urochloa species are native to eastern and Central Africa and are extensively grown as livestock forage in South America and East Asia (FAO, 2015). The annual dry matter yields ranges from 8-20 t/ha depending on moisture and nutrients (FAO,2015). *Brachiaria* grasses are among the most nutritious forages in the humid tropics; e.g. *B. brizantha* contains about 10% (range:5-16%) crude protein (CP) in dry matter, 66% neutral detergent fibre (NDF) and 58% in vivo organic matter digestibility (Heuze et al., 2016). Therefore, production of improved planted forages is a solution that can be pursued to alleviate the current situation.

Brachiaria syn Urochloa grass being climate smart fodder is being promoted by stakeholders in the livestock sector as an alternative fodder source. Literature provides little information on relationship among feed intake, daily gain and nutrient intake in goats/ruminants fed *Urochloa* grasses. This study therefore, was an attempt to provide more information feed intake and weight gains of goats fed these grasses.

Materials and Methods

The experimental design and data collection is the same as that used during this experiment; https://www.researchgate.net/publication/309242553_Change_in_growth_of_Galla_goats_fed_different_cultivars_of_Brachiaria_in_the_coastal_lowlands_of_Kenya

Chemical composition of feeds used

Mixed samples of the experimental diets were analyzed using the procedures outlined in this study; https://www.researchgate.net/publication/309242553_Change_in_growth_of_Galla_goats_fed_different_cultivars_of_Brachiaria_in_the_coastal_lowlands_of_Kenya

Statistical Analysis

The nutritive quality composition (DM, CP, OM, Ash, NDF, ADF, ADL, Ca, P) and digestibility of feeds were analyzed using the general linear model (GLM) procedures of the Statistical Analysis System (SAS, 2010). Values for feed intake and live weight gain were subjected to analysis of variance (ANOVA) in a completely randomized design using GLM procedures of the Statistical Analysis System (SAS, 2010) based on the following model: $Y_{ij} = \mu + T_i + e_{ij}$. Where; Y_{ij} = the $_j$th observation of the $_i$th treatment,μ = overall mean, Ti = the effect of the feed of the $_i$th grass treatment (1-4), e_{ij} = the residual error
Means were separated by least significance difference (LSD) (Steel and Torrie, 1981).

Multiple regression analysis followed the formula ($Y=b0 + b_1X + b_2X + b_nX$) daily gain as dependent variables against nutrient intake (dry matter, crude protein, Ash, NDF, ADL, DMD) (Rstudio).

Results

Table 1. Chemical composition (%) and digestibility (%) of feeds used in the feeding trial

Feeds	CP	NDF	ADF	ADL	Ash	DoMD	DMD	Ca	P
Maize germ	13.9	27.5	7.7	0.4	3.6	84.7	87.4	0.03	0.73
Piata	12.6	57.9	35.4	3.6	10.8	49.0	55.0	0.27	0.20
MG4	12.1	57.1	36.9	4.3	10.7	48.7	55.5	0.27	0.22
Rhodes	6.7	68.6	44.3	5.5	7.7	39.8	44.6	0.39	0.08
Mulato II	3.0	70.7	46.9	6.3	5.0	38.2	41.4	0.27	0.19
LSD (P<0.05)	0.8	2.6	1.5	2.9	0.7	32.8	4.1	0.03	0.15
CV (%)	3.0	1.6	1.6	25.6	3.5	2.3	2.6	4.1	18.9

Significance differences at (P<0.05) in CP content were highest in the variety Piata (12.6% DM) with Mulato II having the lowest CP (3.0% DM). This was also the case with digestibility with Piata and MG4 having high digestibilities compared with Mulato II and Rhodes.

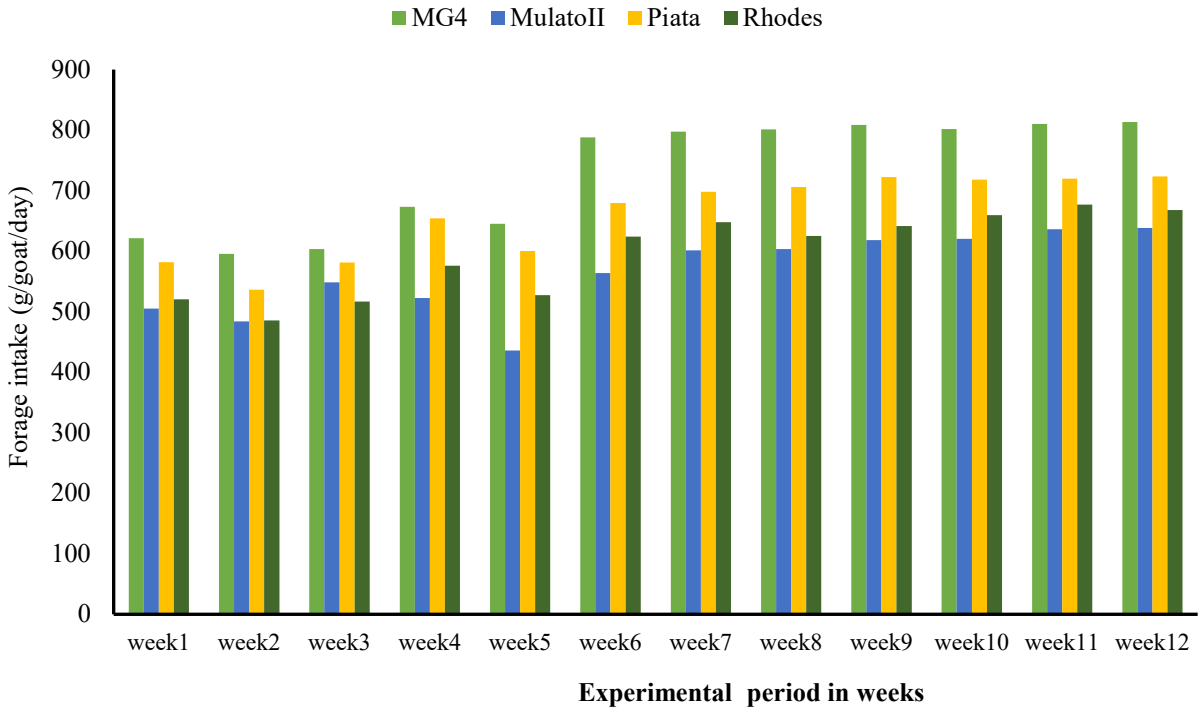

Fig.1. Average feed intake of goats on Experimental feed weekly

Experimental animals were given 100g of maize germ daily as supplements. Average feed intake ranged from 513-661g/day.

Table 2. Total and average weights gains and feed conversion ratios of the goats under the experiment

Feeds	IBW (kg)	FBW (kg)	ADWG (g/day)	AWC (kg)	FCR DM	FCR OM	FCR CP
MG4	16.00	19.47	41.3	3.47	16.0	9.6	2.1
Mulato II	15.63	15.80	2.0	0.17	259.5	113.8	8.5
Piata	15.25	19.05	45.2	3.80	13.4	7.6	1.8
Rhodes	15.87	16.68	9.6	0.81	56.2	26.6	4.1
LSD (P<0.05)		0.4	17.2	1.45	6.2	2.7	0.2
CV (%)		0.06	43.9	43.9	0.5	0.5	0.4

IBW=Initial body weight; FBW =Final body weight, ADWG =Average daily weight gain; AWC=Average weight change; FCR=Feed conversion ratio

Average daily gain (ADG) were highest in goats fed Piata (45.2g/day) and MG4 (41.3g/day) while goats fed Mulato II had the lowest ADG (2.0g/day)

Table 3: Results of multiple linear regression for Dry matter, Crude protein, ADF and NDF in predicting Average daily gain (n=16). [R^2 = .8491, R^2adj = .7943, F(4,11) = 15.48, p< .001]

Variable	Estimate	Std. Error	t-value	Pr (>|t|)

Constant	43.37922	9.78009	4.435	0.001*
CP	0.04728	0.50474	0.094	0.927
DM	0.25631	0.22855	1.121	0.286
ADF	-0.028896	0.73739	-0.392	0.703
NDF	-0.24179	0.44543	-0.543	0.598

Predictors: (Constant), CP, DM, ADF, NDF

Dependent variable: ADG

ADG = 43.37922 + 0.04728CP + 0.25631DM - 0.028896ADF - 0.24179NDF……(i)

ADG = 44.0337 + 1.4687NDF - 2.3560ADF……(ii)

ADG = 43.71597 + 0.79252CP - 0.11066DM……. …..(iii)

Discussion

Crude protein (CP;N x 6.25) in feeds serves two main functions in ruminants. The first is to supply N for the rumen microorganisms, and the second is to supply amino acids to the small intestines for absorption and use by the host ruminant animal. Amino acid supply comes from two sources, feed protein escaping microbial degradation and microbial protein (MP), derived from assimilating ruminal NH_3 (Broderick, 1994). Both amino sources are subsequently hydrolyzed and absorbed from the small intestine. It is the quantity of amino nitrogen, as well as the relative ratio of amino acids reaching the small intestine, that is important for optimum utilization. Until the minimum requirement for N is met in the rumen to satisfy microbial needs, ruminal fiber digestion is depressed, undigested residues accumulate in the rumen, and intake is depressed. For this reason, when dietary CP is below about 8% of the diet, CP content has a strong relationship with intake.

Brachiaria (Urochloa) hybrids Piata and MG4 were found to be better sources of protein when compared to Mulato II and Rhodes grass and this translated to higher weight gain ($P<0.05$). Average daily live weight gain was higher for goats fed on Piata (45.2g/day) and MG4 (41.3g/day) compared to those fed Mulato II (2.0g.day) and Rhodes grass (9.6 g/day)

Dry matter intake and crude protein intake positively and significantly contributed to daily gain, while crude fiber did not improve daily gain ($R^2 = 0.7827$). This shows that dry matter intake and crude protein are very important in determining feed intake. Animals eat to meet their energy and dry matter requirements and level of feed intake is determined by the dry matter content of the diet.

The equations developed from the study will enable nutritionists and ruminant farmers who may be interested in the inclusion of *Urochloa* grass spp in the diets of their animals to know the relationship between feed intake and weight gain of goats.

Acknowledgments

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