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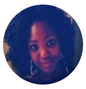

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Performance of Galla Goats Fed Different Cultivars of *Brachiaria* in the Coastal Lowlands of Kenya

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Abstract

Background: Inadequate quality and quantity of feed is the major constraint to livestock production in the arid and semi-arid regions of Kenya. The productivity of livestock in Kenya is strongly linked to feed resource availability. This study was therefore done to determine the chemical composition and dry matter digestibility of three *Brachiaria* cultivars namely; *Brachiaria brizantha* cvs. Piata and MG4, *Brachiaria* hybrid cv. Mulato II and their effects of live weight changes of Galla goats in the coastal lowlands of Kenya. They were compared with the commonly grown grass, Rhodes grass

Methods: Sixteen Galla goats ranging from 10-24 kg were randomly allocated to the four dietary treatments with four animals per treatment. Each goat was supplemented with 100 g/day of maize germ. Mineral licks and water were provided ad libitum.

Results: The cv. Piata had the highest ($P<0.05$) crude protein (CP) (12.60% of dry matter) while cv. Mulato II had the lowest (3.01% of dry matter) for the *Brachiaria* forages. When compared to the control (Rhodes grass), the control grass had a significantly higher CP content (6.74% of dry matter) than Mulato II but lower compared to cvs. MG4 and Piata at ($P<0.05$). The cvs. Piata and MG4 were also more digestible that Mulato II and Rhodes grass. There was no significance difference ($P>0.05$) on intake of grass among the goats and ranged from 513-661 g/goat/day. Average daily weight gain were higher ($P<0.05$) in goats fed Piata (45.21 g/day) and MG4 (41.28 g/day) than those fed Mulato II (1.99 g/day) and Rhodes grass (9.64 g/day). Likewise goats fed on Piata (3.80 kg) and MG4 (3.47 kg) had the highest ($P<0.05$) total weight gain compared with goats fed on Mulato II (0.17 kg) and Rhodes grass (0.81 kg).

Conclusion: Based on body weight changes and nutritive values, Piata and MG4 showed the greatest potential to address feed quality constraints to livestock production especially in the arid and semi-arid regions of Kenya.

Keywords: Chemical composition; Crude protein; Dry matter digestibility; Livestock production; Live weight gains

Introduction

Arid and semi-arid lands (ASALs) cover 80% of Kenya's landmass [1]. These areas are characterized by low rainfall, high temperatures, poor quality feed resources, and high incidences of livestock diseases [2]. The ASALs also support 60% of the livestock population and the largest proportion of wildlife [3]. According to Mbogoh SG and Shaabani [4], agro-pastoralism and pastoralism are the main economic activities in the ASALs and majority of the peoples attain their livelihoods from them. This is mostly based on cattle (the small East African Zebu - SEAZ and Boran), goats, sheep and camels, and thus constitutes a major source of Kenya's meat [5].

According to Njarui et al. [6], the productivity of livestock in Kenya is strongly linked to feed resources availability. The reason for this is that; feed is the major input factor in all livestock production systems and account for between 60–70% of the production cost. The same author goes on to say that, the productivity of ruminant livestock is considered low due to inadequate and poor quality feeds. There is a feed resource deficit for about 4-6 months in a year across many regions particularly during the dry season when there is limited pasture growth. Livestock is considered as one of the key asset for rural households in most parts of the world and it is a primary livelihood resource for rural communities. According to FAO [7] about 752 million of the world's poor keep livestock mainly to; generate cash income, produce food for subsistence use, manage risks and build up assets for security purposes. Another limitation of livestock production is that there is lack of suitable fodder crops that can produce green forage year [8]. This situation becomes severe in the areas that are constrained by low rainfall.

Most small ruminants in the ASALs suffer from nutritional stress [9]. Most of the grasses have low crude protein (CP) falling below 7% minimum level that is required for optimum microbial growth [10]. When this occurs, it prompts supplementation, which is not always possible for resource poor farmers [11]. There is a need, therefore, for pasture species that can improve the quality of the natural pastures and significantly increase the dry matter production that will enhance livestock productivity. One of these pastures has been found to be *Brachiaria* forages [12-14] report that apart from the good adaptability, tolerance and resistance of *Brachiaria* forages, the grasses have high forage quality and show high dry matter production making them capable of meeting the nutritional requirements of animals especially during the dry seasons.

Goats are found in many parts of Kenya and are an important

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source of income to many small-holder farmers. They are preferred to cattle as they can be converted to cash quicker. They also provide a higher offtake compared to cattle because of their shorter generation interval and higher prolificacy [15].

The full potential of the ASALs for livestock production can be exploited by expanding the forage resource base by introducing climate smart forage species which will be able to boost nutrient quality and quantity hence supplying the nutritive requirements of livestock. There have been several studies on climate smart *Brachiaria* grass species that have been developed elsewhere and could be the key to improvement of livestock production and could also serve as boost to composition and nutritive values of *Brachiaria* cultivars.

However, studies on feeding trial of goats by *Brachiaria* grasses are lacking and this study was done to determine its suitability on animal performance. The objective of this study was to evaluate the growth of Galla goats fed selected *Brachiaria* grasses cultivars.

Materials and Methods

Site

The feeding trial was conducted at the sheep and goat multiplication centre, Matuga (4° 9'6'S, 39° 32'40'E), in Kwale County, Kenya. The centre is located in a low altitude zone (60 m.a.s.l) coastal lowland 3 (CL3) agro-ecological zones, also referred to as the Coconut-cassava zone [16]. The average annual rainfall is 1100 mm while the relative humidity ranges from 70-80% and an average temperature from 22-30°C.

Management of animals

Galla goats, also known as Somali or Boran goats are indigenous to the arid and semi-arid regions of northern Kenya and are kept mainly for meat, although they also produce milk [15]. Sixteen Galla goat bucklings [16] were selected and divided into four groups of four animals each. The animals from each group were randomly assigned to four dietary treatments (*Brachiaria brizantha* cvs Piata and MG4, *Brachiaria* hybrid Mulato II and Rhodes grass) based on their age (6-12 months) and live weight (10-24 kg). They were then grouped into four replicates. The heaviest animals which were the oldest were in rep 1 ad the youngest goats with the least weight in rep 4. The goats were kept in well ventilated pens with each goat put in individual pen. Dry grass was used for beddings at night. Both the feeding and sleeping areas were disinfected before the goats were brought in. During this adjustment period, animals were dewormed against endoparasites and sprayed weekly against ectoparasites. Individual pens were cleaned every morning.

Feeds and feeding

The *Brachiaria* cultivars used for feeding were (*Brachiaria brizantha* cvs. Piata and MG4 and B. hybrid Mulato II). Chloris gayana (Rhodes grass) was used as the control grass. All animals received commercial concentrate supplements (100 g/day) made of maize germ that was purchased to last the whole experiment. This was given before the basal diets were offered at 7.00 a.m. in the morning. Water and mineral blocks were provided ad libitum. The grasses were harvested 5 cm above ground. The harvested grasses was allowed to dry for 3 days, baled into hay and transported to Matuga. The harvested forages were chopped (5 cm length) using a motorized chaff cutter before feeding. Chopping the forages into 5 cm lengths was useful as it prevented diet selection by the goats.

Data collection

After an adaptation period of 14 days, daily feed offers and refusals, respectively, were weighed and recorded for a period of 12 weeks (from 20th April to 13th July 2016). Animals were weighed on a weekly basis at around 9 a.m. (fasting weight) using a portable electronic weighing scale.

Daily feed dry matter (DM), organic matter (OM) and crude protein (CP), were calculated as the difference between feed offer and refusal corrected for the respective contents in the original sample [17]. Feed conversion ratio was obtained by dividing the feed intake and average daily gain.

Chemical composition of feeds used

Small amounts of herbage were taken from each bale used for feeding and composite sample of about 2 kg constituted for analysis. The samples were grinded to pass through 1-mm screen. The samples were then analysed in duplicates for chemical composition at the Animal and Nutrition Laboratory at KALRO- Muguga.

Ash

Ground dried samples were weighed and then ignited in a furnace at 600°C for 2 hours, to oxidize all organic matter. Ash was the determined by weighing the resulting inorganic residue [18].

Calcium

The samples were ignited at 550°C to burn all organic material. The remaining minerals are digested in 6 M HCl to release calcium, which is then determined using a spectrophotometric assay based on reaction of calcium with o-cresolpthaleincomplexone (CPC) in alkaline solution. The Calcium was then calculated as follows;

% Calcium=(C x V x DF)/(W x 10)

Where, C: Concentration calcium in measure solution (mg/litre), V: Volume of solution (in litres, i.e., 0.025 (L)), DF: Dilution factor (normally, i.e., 1), W: Weight of the sample (g), and 10: Factor to convert g/kg to % [19,20].

Phosphorous

Feed material was ashed following digestion in hydrochloric acid. Molybdovanadate reagent is added which results in a characteristic yellow colour after reacting with phosphorus, which was measured spectrophotometrically. Percentage of phosphorous is calculated;

% Phosphorus=(C x V x DF)/(W x 10)

Where, C: Concentration phosphorus in measured solution (mg/litre), V: Volume of solution (in litres, i.e., 0.025 L), DF: Dilution factor (normally, i.e., 1), W: Weight of the sample (g), and 10: Factor to convert g/kg to % [21].

In vitro dry matter digestibility

The samples were incubated under anaerobic conditions with rumen microorganisms for 48 hours at 39°C, under anaerobic conditions. This was then followed up by a 24 hour acid-pepsin digestion phase at 39°C, also under anaerobic conditions. Following this 72 hour incubation, residual plant materials was later collected, filtrated and oven dried (105°C for 12 hours).

The IVDMD was calculated using the formula;

%IVDMD=(1-wd-wb/ws)*100

Where; wd: Weight of dry plant residue, wb: Weight of dry residues from blank, and ws: Dry weight of original plant sample [22,23].

Crude protein

The Nitrogen content of the feed is the basis for calculating the crude protein (CP). The method established by Kjeldahl converts the nitrogen present in the sample to Ammonia which is determined by titration [24]. Assuming that the average nitrogen content of proteins is 16% multiplying the nitrogen content in% obtained via Kjeldahl analysis with 6.25 gives an approximate protein content of the sample.

CP=6.25 x %N where CP is crude protein and N is nitrogen.

Crude fibre

Fibre analysis was done using the Ankom fibre method which is a modification of the Van Soest System [19-25] of forage analysis. The carbohydrates in a feed sample are retrieved in two fractions; Crude fibre, Nitrogen free extractives (CF, NFE) of the proximate analysis. The fraction, which is not soluble in a defined concentration of alkalis and acids, is defined as crude fiber (CF). This fraction contains cellulose, hemicellulose and lignin. Sugars, starch, pectins and hemicellulose etc. are defined as nitrogen-fee extractives (NFE). This fraction again is not determined chemically it is rather calculated by subtracting CP, EE and CF from organic matter.

Data Analysis

Chemical composition (DM, CP, OM, Ash, NDF, ADF, ADL, Ca, P) of feeds over 12 weeks were analysed using the general linear model (GLM) procedures of the Statistical Analysis System [26]. Means were compared using least significance difference (LSD) option of SAS [20]. Data from experiments on feed intake and live weight gain were subjected to analysis of variance (ANOVA) in a completely randomised design using GLM procedures of the Statistical Analysis System [27] based on the following model:

$Yij=\mu+ Ti +e_{ij}$

Where Yij=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

Results

Feed composition

Chemical composition of feeds used in this experiment is presented in Table 1. There were significance differences (P<0.05) in the CP content, *In vitro* dry matter digestibility (IVDMD), Acid detergent fibre (ADF) content, acid detergent lignin (ADL) content, Ash, Ca and P content for all the forages. The cv. Piata had the highest CP content (12.6% of DM) while cv. Mulato II had the lowest (3.0% of DM). Rhodes grass had a significantly higher CP content (6.74% of DM) compared to Mulato II but significantly lower when compared to cvs. Piata and MG4. In vitro dry matter digestibility (IVDMD) was highest in cvs. MG4 (55.47%) and Piata (54.96%) and lowest in Mulato II (41.36%). Rhodes grass had IVDMD (44.62%) which was lower than that of cvs. Piata and MG4 but not significantly different to that of cv. Mulato II (Figure 1).

The cv. Mulato II had the lowest ash content (5.04%) for the forages while cv. Piata (10.77%) had the highest. Rhodes grass had a significantly higher ash content (7.72%) when compared to Mulato II but lower when compared to cvs. Piata and MG4. Mulato II had the highest NDF, ADF and ADL content while cv. Piata had the lowest in all the three components. Rhodes grass had the highest Ca content (0.39%) than the *Brachiaria* cultivars. Rhodes grass had the lowest P content (0.08%) for all the forages while MG4 had the highest (0.22%).

Intake

Total feed intake for the period are shown in Figure 2. There was no significance difference (P>0.05) in the feed intake in all the weeks among the goats. The average intake ranged from 513-661 g/goat/day.

Body weight gain and conversion ratio

Results from live weight gain (LWG) and feed conversion ratio (FCR) are shown in Table 2. Average daily weight gain (ADWG) differed significantly in the four treatments (P<0.05). Bucklings fed Piata (45.21 g/day) and MG4 (41.28 g/day) had the highest ADWG while those fed Mulato II had the lowest (1.99 g/day). Bucklings fed Rhodes grass had a similar ADWG (9.64 g/day) with those fed Mulato II but lower when compared to those fed Piata and MG4. The total live weight gain also was higher in goats fed Piata (3.80 kg) and MG4 (3.47 kg) compared to those under Mulato II (0.17 kg) (P<0.05). Feed conversion ratio (FCR) for DM, OM and CP was significantly different (P<0.05) in the four diets. Piata and MG4 had the lowest FCR meaning the animals were efficient utilizers of feed and this is observed by the high body weight gain. Figure 1 shows the average weekly live weight of the goats during the experimental period. Goats fed Piata and MG4 maintained the highest weights during the entire period.

Discussion

Feed quality/composition

Reported that Crude protein (CP) and digestible dry matter (DDM) are the most important component of a feed. In this study, two cultivars of *Brachiaria brizantha* (Piata and MG4) were found to be better sources of protein compared to cultivar Mulato II and Rhodes grass [28]. Piata and MG4 met the required minimum of 7.5% suggested as necessary for optimum rumen function by Van PJ [29]. Crude protein requirement for small ruminants for maintenance is 9.6%, 11.2% for pregnant ewes and does, 11.7% for kid finishing

Feeds	CP	NDF	ADF	ADL	Ash	DoMD	DMD	Ca	P
MG4	12.1	57.05	36.85	4.34	10.68	48.74	55.47	0.27	0.22
Mulato II	3	70.72	46.93	6.26	5.04	38.22	41.36	0.27	0.19
Piata	12.59	56.98	35.43	3.65	10.77	49.02	54.96	0.27	0.2
Rhodes	9.64	68.75	44.28	5.5	7.72	39.83	44.62	0.39	0.08
Maize germ	13.94	27.5	7.73	0.41	3.56	84.67	87.36	0.03	0.73
LSD (P<0.05)	0.82	2.57	1.5	2.86	0.73	32.85	4.05	0.03	0.15
CV (%)	3	1.6	1.6	25.6	3.5	2.3	2.6	4.1	18.9

CP: Crude Protein; NDF: Neutral Detergent Fiber; ADF: Acid Detergent Fiber; ADL: Acid Detergent Lignin; DoMD: Dry Organic Matter Digestibility; DMD: Dry Matter Digestibility; Ca: Calcium; P: Phosphorous.

Table 1: Chemical composition and *in vitro* digestibility of feeds used in the experiment.

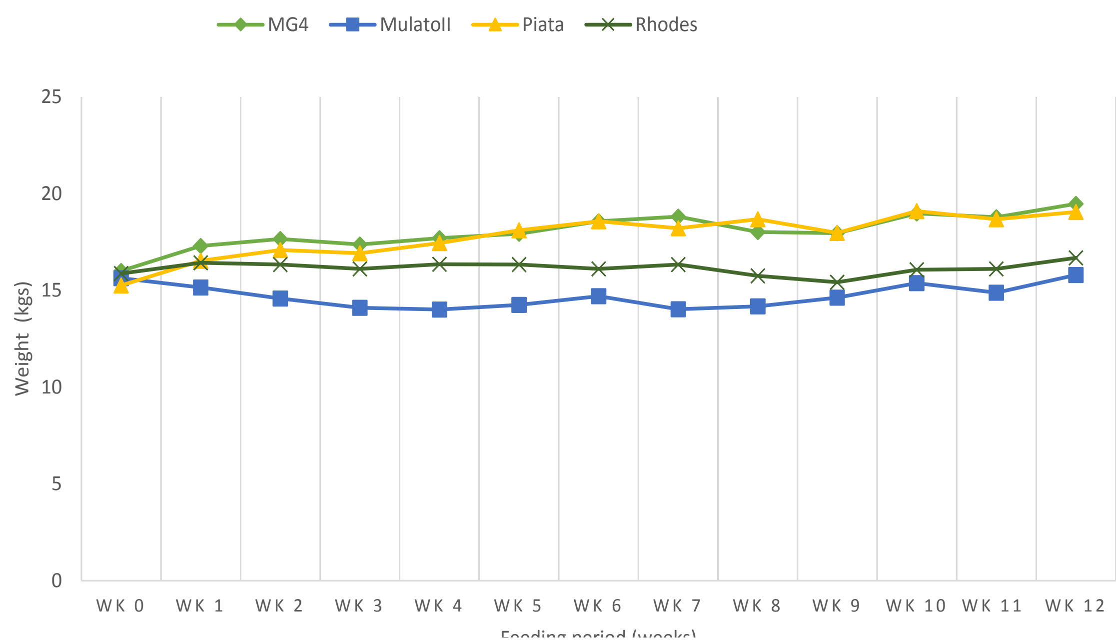

Figure 1: Average weekly weights of goats during the experimental period.

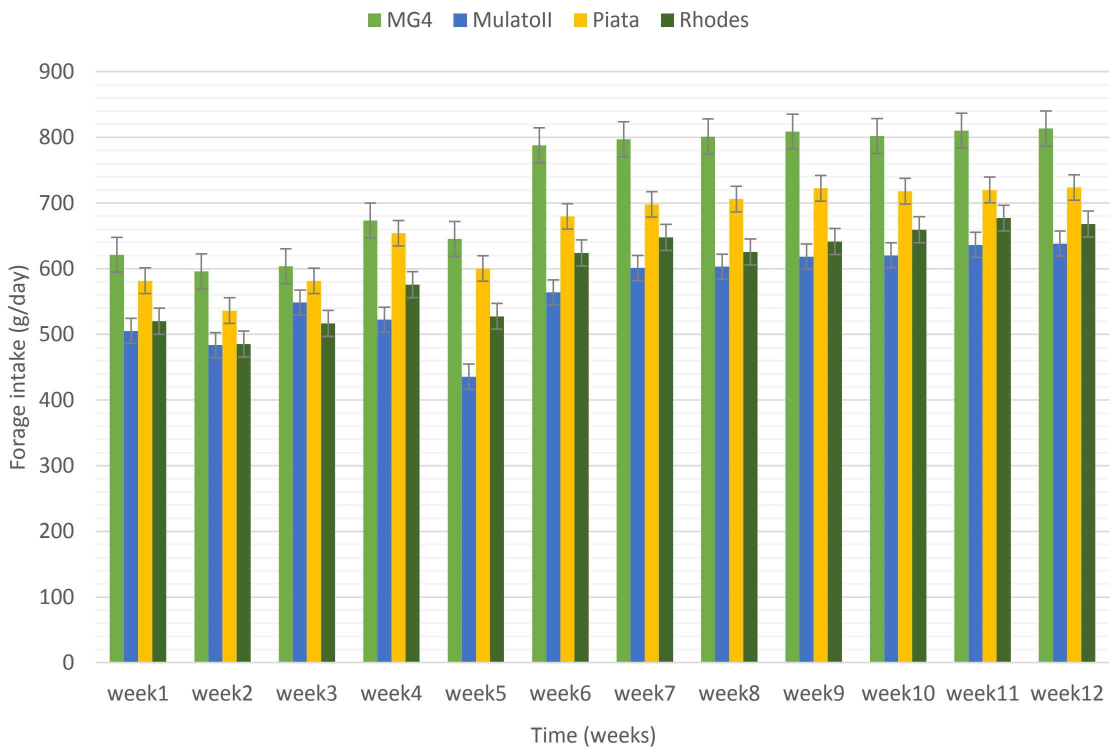

Figure 2: Average weekly feed intakes by goats for the four dietary treatments.

as prescribed [30]. These requirements were only met by cvs. MG4 and Piata. The 7.0% requirement for the satisfactory development of ruminal cellulolytic bacteria as quoted by Van PJ [29] was only met by cvs. Piata and MG4. The CP content of Mulato II in the present study is lower than that reported by Nguku SA [31] of 7-12.8% and that reported by Vendramini et al. [32] of 10-14% crude protein in Thailand on poor soils and 12-17% crude protein on better soils in Florida, USA.

The CP content of Mulato II was low compared with that obtained in semi-arid region of Eastern Kenya 12% and in Central highlands of Kenya of 15% [33]. This attribute to poor management of the grass at harvesting and baling. Generally Mulato II has higher CP than Piata

Feeds	IBW (Kg)	FBW	ADWG (g/day)	AWC (Kg)	FCR DM	FCR OM	FCR CP
MG4	16	19.47	41.28	3.47	15.98	9.57	2.12
Mulato II	15.63	15.8	1.99	0.17	259.48	113.83	8.51
Piata	15.25	19.05	45.21	3.8	13.36	7.57	1.83
Rhodes	15.87	16.68	9.64	0.81	56.19	26.6	4.13
LSD (P<0.05)		0.375	17.22	1.45	6.2016	2.7399	0.2341
CV (%)		0.06	43.9	43.9	0.475	0.458	0.373

IBW: Initial Body Weight; FBW: Final Body Weight; ADWG: Average Daily Weight Gain; FCR: Feed Conversion Ratio.

Table 2: Live weight gain and feed conversion ratio of Galla goats fed Brachiaria cultivars and Rhodes grass.

and MG4 when cut at the same stage of growth. In other sites where it was well managed its CP content was high. Another factor that could have led to the low CP of Mulato II was that it was established in the coastal area. Due to the high temperatures in the coastal area, the grass grew very fast and accumulated fibrous content very fast. This has a negative impact on its digestibility as well as the quality. Establishment of grasses in the coastal area done by Ondiko et al. [34] confirm this theory as the grasses had very low CP (3-6%) when cut at 12 weeks.

Cultivar Mulato II and Rhodes grass digestibility ranged between (41 and 44%). This is lower than that reported by [35] that the digestibility of cultivated tropical grasses lie between 50 and 65%, while that of temperate grasses is slightly higher and ranges between 65 and 80%. Lord et al. [36] reports that the age of cutting forage crops has an influence on the *in vitro* digestibility, and is a function of the chemical constituents of forages. These results agree with Njarui DMG, et al. [37] who reported that the proportion of potentially digestible components decline as the fibrous content increases (Table 1).

According to Morais et al. [38], when the quality of supplement and supplementation frequency remain the same, the difference in weight gains of an animal will be based on the quality of the roughage. As the four groups of Galla goats had received the same amount of the commercial concentrate, the major factor which influenced differences in their weights might have been the quality of roughages; where Piata and MG4 had higher CP content than Rhodes and Mulato II.

Live weight gains

Bucklings fed cvs. Piata and MG4 had the highest average weight gain. This was also the case with Average daily weight change (ADWG). The ADWG for Piata and MG4 were higher than those reported by Njarui et al. [37] for Kenya dual purpose goats fed different forage legumes. Another study done by Sani I [39] on German Alpine crosses of goats when supplemented with Tithonia, Calliandra and Sesbania had high ADWG of up to 82.7 g/day for Tithonia and Calliandra of 57.3 g/day. Goats under Sesbania for this experiment had a lower ADWG of 39.3 g/day. Piata and MG4 had higher ADWG when compared to Sesbania in this experiment.

Average weight gain was highest (P<0.05) in animals under Piata (3.80 kg), this could have been due to the high content in the feed. The average live weight gain obtained in this study was higher than that obtained by Sani I [39] of 2.55 kg when cotton seed cake was fed in combination with *Brachiaria* ruziziensis fed to Yankassa sheep. It was also higher than that obtained by Nyako HD, et al. [40] when cotton seed cake was fed with *Digitaria decumbens* (Pangola grass).

Bucklings under Mulato II had the lowest gain and this could be attributed to the low CP content in the diet. This was also the case with ADWG. Feed conversion ratio (FCR) values were different for the four dietary groups of goats. The FCR for DM showed that for the goats to gain 1 g of live weight per day it should eat 15.98 g of MG4, 13.36 g of Piata, 259.48 g of Mulato II and 56.19 g of Rhodes grass. A smaller FCR indicates how efficient a feed is and FCR also showed that diets that had low CP had poor FCR [39].

Conclusion

An average daily weight gain of 45.21 g/day was obtained on Galla goats fed B. brizantha cv. Piata compared to 9.64 g/day for those in the control group (fed Rhodes grass). This showed an increase in daily weight gain by 78.68% for animals on Piata over those fed Rhodes grass. This could bring about greater economic gains in terms of profit to livestock farmers due to increased daily and total live weight gain when animals are fed cv. Piata relative to the lower daily gain and total live weight gain as well as economic gain when fed Rhodes grass. From the results and findings in this study, it is recommended that cvs. Piata and MG4 should be integrated in both grazing as well as cat and carry feeding systems for better growth and live weight gain of goats.

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Conflict of Interest

Author declared no conflict of interest.

References

1. Mganga KZ, Musimba NKR, Nyangito MM, Nyariki DM, Mwangombe AW (2010) Improving hydrological properties of degraded soils in semi-arid Kenya. Journal of Environment Science Technology 3: 217-225.
2. Kahi AK, Wasike CB, Rewe TO (2006) Beef production in the arid and semi-arid lands of Kenya: constraints and prospects for research and development. Outlook on Agriculture 35: 217-225.
3. Ngugi RK, Nyariki DM (2003) Rural livelihoods in the arid and semi-arid environment of Kenya: Sustainable alternatives and challenges. Agricultural Human Values 22: 65-71.
4. Mbogoh SG, Shaabani SB (1999) Socio-economic study on characterization of recommendation domains for pasture improvement in pastoral and agro-pastoral production systems in Kenya. Part II Consultancy Report. Nairobi, Kenya.
5. Herlocker D (1999) Rangeland Resources in Eastern Africa: Their Ecology and Development, GTZ, Germany Technical Co-operation, Nairobi.
6. Njarui DMG, Gatheru M, Wambua JM, Nguluu SN, Mwangi DM, et al.. (2011) Feeding management for dairy cattle in smallholder farming systems of semi-arid tropical Kenya. Livestock Research for Rural Development 23: 05.
7. Food and Agriculture Organisation (FAO) (2012) Searchable Catalogue of Grass and Forage Legumes. Rome, Italy.
8. Leeuw PN, Mohamed-Saleem MA, Nyamu AM (1992) Stylosanthes as forage and fallow crop. Proceedings of the regional workshop on the use of Stylosanthes in west Africa held in Kaduna Nigeria.
9. Bruinsma J (2003) World agriculture: towards, a FAO perspective. Rome, Italy: Earthscan, FAO.

10. Wambui CC, Abdulrazak SA, Noordin Q (2006) The effect of supplementing urea treated maize stover with Tithonia, Calliandra and Sesbania to growing goats. Livestock Research for Rural Development. 18: 64.

11. Gitunu AM, Mnene WN, Muthiani EN (2003) Increasing the productivity of livestock and natural resources in Semi-Arid areas of Kenya: A case study from the Southern Kenya rangelands. Proceedings for end of programme conference, Agriculture/livestock research support programme, phase at KARI, Nairobi, Kenya.

12. Machogu C (2013) A comparative study of the productivity of Brachiaria hybrid cv. mulato ii and native pasture species in semi-arid rangelands of Kenya. University of Nairobi, Kenya.

13. Lascano CE, Euclides VBP (1996) Nutritional quality and animal production of Brachiaria pastures. In BaJW Miles, Brachiaria: Biology, Agronomy, and Improvement 106-118.

14. Brighenti AM, Sobrinho FS, Costa TR, Rocha WSD, Martin CE, et al.. (2008) IntegraçãoLavoura-Pecuária: A Cultura do GirassolConsorciada com Brachiaria Ruzizienses.

15. Ahuya CO, Okeyo AM (2006) Sustainable genetic improvement of goat meat and milk production in Kenya: a case of the Meru and Tharaka-Nithi Dairy and Animal Healthcare community-based Breeding Programme. Nairobi, Kenya.

16. Jaetzold R, Schmidt H (1983) Farm management handbook of Kenya. Nairobi: Kenya Ministry of Agriculture.

17. Balehegn M, Eik LO, Tesfay Y (2014) Replacing commercial concentrate by Ficus thonningii improved productivity of goats in Ethiopia. Tropical Animal Health and Production 46: 889-894.

18. AOAC (Association of Official Analytical Chemists) (1990) Official Methods of Analysis of the AOAC, 15th edn. AOAC, Arlington, Virginia, USA: 1298.

19. Tietz NW (1995) Calcium determination. Clinical Guide to laboratory Tests, 3 Auflage. Philadelphia, Pa: WB Saunders Company.

20. AOAC (2000) Official methods of analysis of AOAC (17thedn) AOAC, Gaithersburg, MD, USA.

21. ISO 6491 (1998) Animal feeding stuffs -Determination of phosphorus content – Spectrometric method. Geneva, Switzerland.

22. Tilley JMA, Terry JA (1963) A two-stage technique for the in vitro digestion of forage crops. J Brit Grassl Soc 18: 104-111.

23. Harris, LE (1970) Methods for Chemical Analysis and Biological Evaluation of Animal Feed. Center for Tropical Agriculture, Feed Composition Project, University of Florida: 183.

24. AOAC (Association of Official Analytical Chemists) (1995). Official Methods of Analysis of AOAC, 16th edn. Washington, USA. AOAC International: 1141.

25. Soest VPJ (1967) Development of a comprehensive system of feed analysis and its application to forages. Journal of Animal Science 26: 119-128.

26. SAS (2010) Statistics Version 9.3 SAS Institute, Inc., Cary, NC, USA.

27. Steel RGD, Torrie JH (1981) Principles and Procedures of Statistics. (2ndedn) Auckland, New Zealand: 236.

28. Afzal J, Ullah MA (2007) Assessment of productive potential and utilization of rangelands and sown pastures in Peshawar Plateau. Annual Report of the National Agriculture Research Centre, Islamabad.

29. Van PJ (1994) Nutritional Ecology of Ruminants. 2nd Edition. New York, USA: Cornel University Press: Ithaca 50-65.

30. National Research Council (NRC) (2007) Nutrient Requirements for various classes of sheep and goat, Update 2007. National Academy Press, Washington, DC.

31. Nguku SA (2015) An Evaluation of Brachiaria grass cultivars productivity in semi-arid Kenya. Kitui, Kenya.

32. Vendramini J, Sellers B, Sollenberger LE, Silveira M (2011) Mulato II (Brachiaria sp.) SS AGR 303, Florida, USA: UF/IFAS Extension.

33. Nyambati EM, Chelimo EJ, Ayako W, Njarui DMG (2016) Nutritive responses of Brachiaria genotypes to fertilization and re-growth interval in the cool sub-humid highlands of central Kenya. Climate Smart Brachiaria grasses for improving livestock production in East Africa, end of project workshop.

34. Ondiko CN, Njunie MN, Njarui DMG, Auma E, Ngode L (2016) Establishment and growth of Brachiaria grass cultivars in the coastal region, Kenya. Climate Smart Brachiaria grasses for improving livestock production in East Africa, end of project workshop.

35. De Gues, RT (1977) Production Potentialities of Pastures in the Tropics and Subtropics. Zurich: Centre D'Etude De 1'Azote 53.

36. Lord CJJ, Agulilu A, Molinari G (1974) Fibrous carbohydrate fractions and in vitro true and apparent digestibility of ten tropical forage grasses. Agricultural University of Puerto Rico 58: 293-304.

37. Njarui DMG, Mureithi JG, Wandera FP, Muinga RW (2003) Evaluation of Four Forage Legumes as Supplementary feed for Kenya dual-purpose goat in semi-arid region of Eastern Kenya. Tropical and Subtropical Systems 3: 65-71.

38. Morais JAS, Queiroz MFS, Keli A (2014) Effect of supplementation frequency on intake, behaviour and performance in beef steers grazing Marandú grass. Animal Feed Science and Technology 189: 63-71.

39. Sani I (2009) Effect of different protein supplements on the performance of Yankassa sheep fed Congo grass (Brachiaria ruziziensis).

40. Nyako HD, Kibon A, Yahaya MS (2012) Effect of different supplement on the performance of Yankasa rams fed Pangola grass in Adamawa State, Nigeria. Proceeding of the 17th Annual Conference of Animal Science Association of Nigeria (ASAN), Abuja, Nigeria: 9-13.

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