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Feeding Behavior, Voluntary Intake and Digestibility of Various Summer Fodders in Sheep and Goats

Nasrullah,[1] Muhammad Abdullah,[2] Masroor Elahi Baber,[2] Makhdoom Abdul Jabbar[3] and Jalees Ahmad Bahtti[2]

[1]*Department of Livestock Management, Faculty of Veterinary and Animal Sciences, Lasbela University of Agriculture water & Marine Sciences, Uthal, Balochistan*

[2]*Department of Livestock Production, University of Veterinary and Animal Sciences, Lahore*

[3]*Department of Food and Nutrition, University of Veterinary and Animal Sciences, Lahore*

Abstract.- Study was conducted to compare the voluntary intake and digestibility of sheep and goats fed janter (*Coriandrum sativum*), guar (*Cyamopsis tetragonolba*), and cowpea (*Vigna sinesis)* in small ruminants. For this purpose,90 female animals, 45 sheep and 45 goats, were randomly selected and divided equally in six groups having three replicate (n=15) in each species under 2×3 factorial arrangements. Three fodders (jantar, guar and cowpea) were randomly fed to their respective replicates in both goats and sheep. Results showed that eating time was significantly higher in goats than sheep. Ruminating time was statistically ($P<0.05$) different between sheep and goats. Sheep and goats showed different eating pattern on offered fodders. Drinking time was lower while playing, resting and others activities were higher in goats than sheep. Dry matter, crude protein, neutral detergent fiber, acid detergent fiber digestibility was higher ($P<0.05$) in sheep than goats fed on various summer fodders. Dry matter digestibility was varied in both species on all fodders.

Key words: Summer fodders, feeding behavior, digestibility, performance, sheep, goats.

INTRODUCTION

Small ruminant rearing is very important and usually of livelihood for people inhabiting forest regions or the regions not suitable for crop cultivation and cattle production (Daskiran *et al*., 2006). Small ruminants make very valuable contribution, especially to the poor in the rural areas. This includes high quality nutrients from animal origin in the form of meat and milk, fiber, skins, slaughtered regularly for social and religious occasions and is stable source of household income. While their socio-economic importance is widely recognized, potential contribution is constrained by inefficient use of potentially important breeds, inefficient and inappropriate production systems and poor feeding management. Sheep and goats production system in Pakistan is still traditional grazing just on fodders and forages. This system of production is hindering animal productivity and considerable loss to income of small ruminants farming communities which directly influence the economy of country and the interest of farmers for future farming. Furthermore farmers also face the limitations of availability of sufficient land and technical know how. Such limitations can depress or delay supply response, even in the face of favorable prices. Small ruminant production has the potential to become an economically viable option for small full-time farmers and the growing number of part-time farmers in the country. Several factors support this assumption including increasing demand, lower cost of production compared with other livestock, and the ability of small ruminants to effectively utilize poor quality forage.

Feeding behavior and feed intake of small ruminants on different fodders varies and can affect their performance. Feeding behaviors can also affect the efficiency and cost of raising animals. Feeding rate, duration of feeding and feed intake (Rauw *et al*., 2006) feeding frequency, and activity level are different among species. Many other factors have a role in maintenance and growth as well, with multiple factors influencing maintenance, growth and weight gain in animals, behavioral variability may have a large role in affecting efficiency and performance. Increasing positive behaviors and decreasing negative behaviors will result in better

* Corresponding author: bangulzai74@yahoo.com

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productivity (Abijaoude *et al*., 2000). In Pakistan, mostly people raise livestock on fodders in rural and urban areas. One of the bottlenecks for fodder scarcity is replacing fodder cultivation by cash crops to meet the demand of human beings. Another problem which is hindering the livestock production is the scarcity and fluctuation of the quality and quantity of animal feed throughout the year. The availability of required fodder species and fodder production depends mainly on the climate and on the soils (Bruzon, 2007). The quality of fodders varies due to seasonal change. There are two major seasons of fodder crops *i.e.,* summer (Kharif) and winter (Rabi). Winter fodder crops are mainly berseem (*Trifolium alexandrinum*), oats (*Avena sativa*), mustard (*Brassica* spp.), and secondarily shaftal (*Trifolium resupinatum*), lucerne (*Medicago sativa*), vetch (*Vicia* species), barley (*Hordeum vulgare*) and rye grass (*Lolium perenne*). The summer fodders are Jantar (*Coriandrum sativum*), cowpeas (*Vigna sinesis*), maize (*Zea mays*), guar (*Cyamopsis tetragonoloba*), sorghum (*Sorghum bicolor*) and millet (*Pennisetum americanum*). Understanding on the nutritional value of these fodders utilize for feeding of goats and sheep in Pakistan lacking, the present study was conducted to assess the voluntary intake and digestibility of the summer fodders guar, cowpea and jantar. A secondary aim was to compare intake and digestibility of these fodders stuck between goats and sheep. Information obtained would indicate if any differences exist among fodders or between animal species, which could be utilize in additional studies and will be useful in practice.

MATERIALS AND METHODS

Experimental animals and design

Ninety animals consisting sheep (n=45) and goats (n=45) were selected from the flock maintained at Small Ruminants Research and Training Center, UVAS, Pattoki. Sheep (17 months ±21 days of age and 32.5±0.28 kg body weight) and goats (18 months ±17 days of age and 32.3±0.26kg body weight) of approximately similar age and body weight. Experiment was conducted as a 2 (species) x 3 (fodders) factorial design. Animals of each species were divided in 3 groups, which were further subdivided in 3 replicates of 5 animals each. All replicates were housed in the same open-sided cement-roofed shed, with fresh water available *ad libitum.*

Replicates within each group were fed on jantar, cowpea and guar, respectively. These 3 fodders were grown in the Kasur district (longitude 73.85, latitude 31.02, altitude 186 m) in Pakistan during May 2010. Fodders, at the full-bloom growth stage during the time of the experiment, were cut daily with hand clippers and fed to animals as such. chemical composition of these fodders are given in Table I. Before the start of experiment all the animals were provided adjustment period of one week and were treated for internal and external parasites. The animals were weighed initially and thereafter at fortnightly intervals. The duration of experiment was one month.

Table I.- Chemical composition of offered summer fodders.

Fodders	DM%	CP%	NDF%	ADF%
Guar	17	17	52.5	42.5
Cowpea	20	19	56.5	47.2
Jantar	18	20	61.5	52.5

Housing

All animals were kept in one shed in separate pens. Each replicate of experimental animals were kept separate according to treatment groups in pens having facility of mangers. The plastic buckets were placed in each pen for the availability of fresh drinking water.

Feeding

The fed was offered twice in day to the animals in the morning at (8.00AM) and evening at (4.00 PM) daily throughout the study period.

Data recording and measurement

Chopped fodders were offered 30% of body weight to animals in each group daily in the morning and evening and left over were measured the next morning throughout the study period to calculate voluntary feed intake. The body weights of all animals were taken initially and thereafter at fortnightly intervals. Two animals from each group of sheep and goats were selected randomly for

feeding behavior studies. The feeding behavior were recorded thrice a week (Saturday, Monday and Thursday) for sheep and likewise for goats in following week after refreshing of the daily feed (at 8.00 AM) The first seen activity was recorded as the determined activity (Mahmut *et al.,* 2005). The recorded activities were eating, ruminating, drinking, resting, standing and playing for twenty four hours. When animal utilized 3 minutes during the activity then it was considered as the determined activity.

Digestibility

At the end of feeding trial one animal from each replicate was selected randomly and kept in separate pens for determination of apparent digestibility of the respective fodders. Animals were fed (30% of body weight) the same fodders that they had received during the intake study. Total faecal output was manually collected from the floor for 5 days and stored in covered buckets for each animal. Daily output from each animal was weighed and a 25% sample was dried in a forced oven at 70°C for 24 h.

Laboratory analysis

Proximate analysis of feeds and fecal samples were conducted according to the procedures of AOAC (2000), whereas, neutral and acid detergent fiber analyses were done according to the procedures described by Van Soest *et al.* (1991).

Statistical analysis

The data were analyzed through two-way ANOVA technique under factorial arrangement using SAS 9.1.3 portable software. The difference among treatment means were tested through LSD test (Steel *et al.*, 1997).

RESULTS AND DISCUSSION

Feeding behavior

The feeding behavior in goats and sheep fed on different summer fodders guar (*Cyamopsis tetragonolba*), cowpea (*Vigna sinesis*) and Jantar (*Coriandrum sativum*) are given in Table II. The eating and ruminating time was significantly different ($P<0.05$) among both species. This might be inherent to individual species (goats and sheep) and eating mood of the species. The eating time of goats and sheep was also different on offered fodders. It may be the type and composition of fodders and the preference of both species. Similar to our findings, Mahmut *et al.* (2005) and Domingue *et al.* (1991) found that goats spend more time on eating and less time on ruminating per 24 h than those of sheep. However, Hadad and Obedat (2007) reported no difference in time spent on eating and ruminating between sheep and goats. This may be due to difference in age, size and diet offered to animals in both studies The drinking time in sheep and goats was similar ($P>0.05$) while, standing time, playing, resting and other activities *i.e.*, walking one place to other for rest, defecation and urination (mins/24 h) were higher in goats than sheep. These findings are consistent to reported literature (Mahmut *et al*., 2005; Hadad and Obeidat, 2007).

Nutrient intake

Dry matter (DM) intake of sheep was higher ($P<0.05$) than goats fed different summer fodders (Table III). The lower DM intake in goats may be due to its liking for succulent part of feed which have low dry matter compared to other parts of feed. These findings are consistent to Larbi *et al.* (1991) who reported higher DM intake in sheep than goats on whole-plant, leaf and stem fractions. Crude protein (CP), neutral detergent fibre (NDF) and acid detergent fibre (ADF), were also higher ($P<0.05$) in sheep than goats. The higher nutrients intake in sheep is attributed to more DM intake and grazing behavior, whereas lower nutrients intake in goats was due to lower DM intake in present study. The DM and nutrients intake were also different when fed with different fodders. This variation is attributable to preference of animals with respect species and quality/palatability of fodders. These findings are in line with the findings of Saleem *et al*. (2005) who reported difference in voluntary intake of sheep and goats on different foliage. Sheep consumed better *Cassia fistula* than goats, while intake in goats was more on other plants like *Schinus molle, Chorissia speciosa* and *Eucalyptus camaldulensis.*

Average daily gain and efficiency

The average daily weight gain, feed efficiency and cost of gain/kg was similar ($P>0.05$)

Table II.- Feeding behavior (mean ± SE) in terms of time spent by goats and sheep fed different summer fodders on different activities.

Min/24 h	Goats			Sheep		
	Guar	Cowpea	Jantar	Guar	Cowpea	Jantar
Eating	337.50±1.44 [a]	316.0±2.30 [bc]	333.00±2.30 [a]	311.00±1.15 [c]	294.0±3.46 [d]	320.00±1.73 [b]
Ruminating	410.00±2.88 [c]	404.00±2.88 [c]	391.50±2.02 [d]	438.50±2.02 [b]	446.50±1.44 [b]	434.00±2.30 [b]
Drinking	9.16±0.44	9.66±1.76	10.16±0.44	11.66±1.45	10.66±0.88	10.66±1.20
Standing	306.50±4.33 [d]	316.50±0.28 [c]	300.0±0.57 [d]	353.66±2.60 [ab]	356.50±2.59 [a]	347.0±1.73 [b]
Playing	49.00±2.30 [b]	52.33±2.60 [ab]	57.83±5.49 [a]	32.5±1.32	35.83±0.92	32.50±1.25
Resting	260.33±1.76 [b]	269.50±1.80	268.50±0.86	242.16±1.16	243.83±0.92	246.16±1.16
Others	67.50±6.06 [b]	72.0±4.04 [ab]	79.00±0.57 [a]	50.5±0.86	52.66±0.88	49.66±0.33

[a,b,c]Means in the same row with different superscripts differ at $P<0.05$.

Table III.- Nutrient intakes (mean ± SE) of goats and sheep fed different summer fodders.

Nutrient	Goats			Sheep		
	Guar	Cowpea	Jantar	Guar	Cowpea	Jantar
Dry matter (g/d)	728.64±4.91 [d]	768.86±2.97 [c]	788.55±2.33 [b]	784.64±5.85 [b]	818.86±4.86 [a]	823.85±0.97 [a]
Crude protein (g/d)	123.86±0.83 [f]	148.75±0.49 [d]	159.52±0.42 [b]	134.07±0.93 [e]	157.03±0.82 [c]	165.70±0.18 [a]
Neutral detergent fiber (g/d)	386.58±2.41 [f]	423.51±1.98 [d]	478.14±1.61 [b]	408.28±3.38 [e]	462.80±2.74 [c]	503.56±0.64 [a]
Acid detergent fiber (g/d)	309.06±2.11 [f]	359.91±1.48 [d]	412.17±1.27 [b]	334.09±2.43 [e]	386.50 [c] ±2.29	427.83±0.57 [a]

+Means in the same row with different superscripts differ at $P<0.05$.

Table IV.- Average daily weight gain, feed efficiency and cost of production (mean ± SE) of summer fodders for goats and sheep fed on different summer fodder.

Nutrient	Goats			Sheep		
	Guar	Cowpea	Jantar	Guar	Cowpea	Jantar
Daily weight (g/d)	18.00±0.76	17.55±3.13	20.22±0.88	20.44±2.32	22.44±3.95	18.88±1.11
Feed efficiency	0.016±0.00	0.016±0.00 [a]	0.018±0.00	0.018±0.00	0.019±0.00	0.017±0.001
Cost Rs /kg gain	403.28±17.27	381.06±81.02	370.89±15.66	311.00±1.15	305.54±50.13	407.11±25.39

+Means in the same row with different superscripts differ at $P<0.05$.

Table V. - Nutrient digestibility (%, mean ± SE) of summer fodders in goats and sheep.

Nutrient	Goats			Sheep		
	Guar	Cowpea	Jantar	Guar	Cowpea	Jantar
Dry matter (g/d)	60.13±2.23 [b]	68.98±1.99	66.08±0.32	67.43±1.28	68.66±0.73	69.29±1.35
Crude protein (g/d)	66.34±2.86 [b]	75.33±1.81	76.10±1.35	73.11±1.71	75.78±0.35	78.56±1.56
Neutral detergent fiber (g/d)	67.75±1.97	69.64±1.66	67.53±0.13	62.95±2.10	67.35±0.75	67.53±1.60
Acid detergent fiber (g/d)	61.78±2.16	63.37±2.33	60.65±0.27	58.71±1.63 [b]	63.95±0.84 [ab]	65.65±2.06 [a]

+Means in the same row with different superscripts differ at $P<0.05$.

between both species and as well as with respect to offered fodders (Table V). Our results are inconsistent to the findings of Haddad and Obeidat (2007) who reported that feed cost per kilogram

weight gain for kids was better than that for lambs. They explained that, although, growth rate of *Awasi* lambs was better than *Baladi* kids, yet kids showed better performance due to better feed conversion efficiency than lambs. The difference in results of both studies is diet, duration of experiment, breed and size of animals. Both species attained marginal weight gain on all offered fodder (*Guar*, cowpea and *Jantar*). The cost per kg gain was very high in both species which suggest that feeding only fodder increases cost of production in sheep and goats, however, both species showed marginal weight gain which can be increased by supplement feeding with these fodders.

Nutrients digestibility

Nutrients digestibility (DM, CP, NDF and ADF) were similar among fodders (Table VI). Both sheep and goats showed similar (P>0.05) DM and CP digestibility. Our findings of our study are consistent to Brown and Johnson (1985) who reported similar DM digestibility in sheep and goats. Similar NDF and ADF digestibility in both species are in line with those reported by Lindberg and Gonada (1997) who reported no difference in goats and sheep with respect to fiber digestibility. DM digestibility was similar in goats and sheep fed cowpeas and guars are in partial agreement to the findings of Larbi *et al*. (1991) who reported voluntary intake and digestibility was same in sheep and goats fed whole-plant leaf and stem fractions of *Pennisetum purpureum* Schum. Consistent to our results, higher nutrient digestibility in sheep were reported by Below and Olajide (2010) who fed three dietary treatments consisted of soybean meal alone (control diet, A), 50% soybean meal + 50% Mucuna seed meal (diet B) and 100% Mucuna seed meal diet C.

CONCLUSIONS

Among studied summer fodders, both sheep and goats performed better on Jantar fodder. Nutrients intake of both animal species was better on Jantar and cowpea than guar while nutrient digestibility was similar in both sheep and goats on Jantar, cowpea and guar. For sustainable animal production further research is required**.**

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