



Full Length Article

Foraging Preferences of Free-Ranging Sheep and Goats on the Native Vegetation of Rangelands of Pubbi Hills in Pakistan

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ABSTRACT

Foraging preferences of free ranging sheep and goats were studied on the native vegetation of Rangelands of Pubbi hills. Bite count through direct observation of the grazing animals was used to investigate the diet consumed by the free ranging sheep and goats. Sheep mainly grazed (57% of the diet composition) on the seeded pods of Phulai (*Acacia modesta*). The second largest component of sheep diet was *Cymbopogon jwarancusa* (18%), which constituted the largest component (39%) of the goat diet. Grazing potential of the area can be improved by planting/reseeding native palatable trees, shrubs and grasses such as Sakkar (*Ehretia laevis*), Peeli Buti (*Abutilon indicum*), Gangir (*Grewia populafolia*) and Buffel grass (*Cenchrus ciliaris*) etc. © 2010 Friends Science Publishers

Key Words: Forage preferences; Free-ranging ruminants; Grazing potential; Bite counts

INTRODUCTION

Pakistan has total land area of 79.61 million ha (Mha) and about 65% of this is rangelands. Five different types of range ecological zones (sub alpine & temperate, sub tropical humid, sub tropical sub humid, tropical arid & semi arid deserts plains & mediterranean) have been described in Pakistan (Khan & Mohammad, 1987). These rangelands are the major feed source of about 97 million heads of livestock. Precipitation varies from 125 mm to over 1500 mm per annum. About 60 to 70% of monsoon rains are received during the months of July to September, while the winter rains are received from December to February (Khan, 1987). Rangelands are an important component of the natural resource base. It is contributing to the ecological stability to some of the important ecosystems of the country. These are a source of forage for free ranging, native and domestic animals, as well as a source of wood products, water and wildlife Rangelands provide 60% of feed for sheep and goats; about 40% for horses, donkeys and camels and only 5% for the cattle and buffaloes (Zafaruddin, 1985).

Livestock sector has emerged as a leading sub-sector of the agriculture sector in Pakistan. Pakistan has a wealth of 135 million heads of livestock, which accounts for 11.3% of the GDP (MINFAL, 2008-2009) and it engages about 30-35 million people in rearing livestock in the rural areas, who derive around 30-40% of their income from livestock husbandry. So, rangelands contribute massively by providing forage to livestock in various ecological zones

throughout the country.

The Potohar plateau of Pakistan is a tract of 1.82 Mha that lies 32° 33' to 34° 03' N 71° 39' to 73° 37' E. Being situated to the mouth of the Salt Range, it is bordered by the Jhelum and Indus rivers. Ecologically, it is located in the sub tropical, semi arid to sub humid zone. It contains dry, sub tropical broad leaved thorn forests. Due to undulating topography, the livestock grazing is common in the area. Large herds of cattle and goats graze throughout the area. As the livestock is the main component of rural economy, people tend to increase livestock number, which leads to overgrazing of the rangelands. The overgrazing pressure has decreased the carrying capacity of rangelands and most of the area is infested with unpalatable plants such as *Heteropogon contortus*, *Cymbopogon jwarancusa*, *Desmostachya* sp., *Prosopis* etc. These rangelands are not only grazed by the local animals but also grazed by the nomadic livestock in winter coming from alpine pastures (Arshad Ullah *et al.*, 2007).

Sheep and goats can be produced successfully even in rangelands with vegetation of low nutritive value, but they have to move long distances to cover their dietary needs. Sheep prefer grazing, but when feed is scarce they rely on browsing. Sheep and goats spend about 10 h for feed intake during 24 h divided into four to seven periods. Between the periods they ruminate in total for about 8 h (Jensen, 1993). Sheep are more selective than the larger ruminants, because of their narrow bite and split upper lip (Sanson *et al.*, 2005). To be successful browser, the animals have to reach as high

as possible. Sheep browse at a mean height of 0.7 m in the dry season (Ouedrago Kone *et al.*, 2006).

MATERIALS AND METHODS

Six-month to one-year old five animals of sheep (Grace/Pahari breed) as well as goats (Kaghani breed) were randomly selected from the transhumant flock for determining diet composition in the mid of December 2007. Animal grazed exclusively on native plants of sub-tropical, semi-arid rangelands of Pabbi Hills, Kharian without any supplemental feeding. Natural vegetation consisted of scrub forest having mostly thorny trees, shrubs and grasses. In general, rangeland was in degraded ecological status due to inappropriate use and unintentional mismanagement.

The transhumant flocks locally called “*Bakarwals*” start moving from Grace Meni Marg (a place in district Astore, Northern Areas) to Taabit in the mid of August. After about a week of traveling on foot and mule back, they arrive at Taabit, where they halt for few days and then move towards Kori Pattaka, Muzaffarabad (AJ&K) and stay there for about a week. After five-days journey from Kori Pattaka, they reach to Lower Topa, Murree and spend two nights over there. From Lower Topa, they move to Rawat and finally reach Pabbi Hills, Kharian in late September, where they stay until winter is over. After about seven-month stay at Pabbi Hills, Kharian, they move back to Astore in the end of March by following the same route and stay there for about three months during the summer.

During winter, animals grazed from 8:30 a.m. through sun set without taking rest. However, they take some rest in the afternoon during the summer grazing, while in Astore area. Animals were watered twice a day during winter, first, at about 10 to 11 a.m. and second, after sun set. In summer, they are watered once a day only due to snow consumption. In Pabbi hills, rain water collected from the adjoining catchment area was used for livestock watering, whereas in mountainous area spring water is used for this purpose. Animals were grazed exclusively on rangelands but oats, dry lucerne and coarsely pounded wheat grain locally called “*Dalya*” was also fed only to weak and exhausted animals.

To investigate the feeding behavior of animals, the direct observation and bite count method was used in this study (Kone, 2008). Bite-count was used for determining botanical composition of diets consumed by the free-ranging sheep and goats. Five animals were observed for two 30-min periods in the morning and afternoon. Therefore, 10 observations (replications) on sheep, as well as goat were recorded. Observations on bite count of sheep were made intermittently at three-week intervals during the winter starting from 14 December 2007 through 22 February 2008, whereas bite counts on goat were made only within two-days period from 21-22 February 2008. Bites were distinguished from the exploratory mouthing by the occurrence of distinct head movement and watching the animal carefully and as closely as possible.

RESULTS AND DISCUSSION

During winter, sheep mainly grazed (57% of the diet composition) on the seeded pods of Phulai (*A. modesta*) (Table I). They spent about 60% of the grazing time in exploring seeded pods underneath the tree buried in the debris of fallen leaves/small twigs. Contrary to this, goat grazed only 7% on the seeded pods of Phulai (Table I). This low composition was due to difference in grazing time. Goat bites were counted on 21-22 February 2008 when grasses started sprouting due to favourable temperature and soil moisture conditions, otherwise goats also kept grazing on the seeded pods as did the sheep during the winter (December & January) when grasses were in dormant stage. Similarly Schacht and Malecjek (1990) and Yiakolaki *et al.* (2007) reported consumption of leaf litter of deciduous woody species by the goats. Herder also shed pods and leaves of Phulai by shaking the tree vigorously or lopped the twigs from the inaccessible top of the tree for animal grazing. Both the animals relished only on seeded pods and did not consume the empty ones. Jasra and Hanjra (2007) also reported that *Salvadora* its fallen leaves are the important feed source for both sheep and goat during late winter and early spring.

The second largest component of sheep diet was *C. jwarancusa* (18%), which is generally considered as an unpalatable grass, particularly when it becomes dry at maturity. It formed bulk of the available forage and sheep did not show any aversion from its grazing despite being dried in dormant period. Furthermore it was invariably grazed both by sheep and goats when in tender stage as it constituted the largest component (39%) of the goat diet (Table II). It is reported that grasses were the major component of the Taddy goat and Thalli sheep during early spring (Jasra & Hanjra, 2007). It was observed that sheep and goat did not show any selectivity except seeded pods of Phulai during winter. They grazed indiscriminately on the plants that came on their way with exemption to mesquite (*P. juliflora*) leaves.

An average rate of 12 and 20 bites per minute was recorded in sheep and goats, respectively indicating that goat is more agile and active than the sheep and are fitter in utilizing the difficult terrain like that of Pabbi Hills. Contrary to this Papachristou (1997) reported that sheep had higher bite rate than goat i.e., 21 and 17 bites per minutes, respectively. This might be due to the vegetation type and season of grazing.

CONCLUSION

Grazing potential of the study area may be improved by planting native palatable trees and shrubs. *Cenchrus ciliaris* in the semi-arid areas of Pabbi Hills and *Pennisetum purpureum* in the irrigated condition of Pothwar Plateau may be grown to mitigate forage shortage. *Saccharum spontaneum* in early vegetative growth stage may be cut,

Table I: Bite counts of sheep grazed on Pabbi Hills during winter 2007-2008

Plant species	Bite counts observations										Total counts	% of diet composition
	1	2	3	4	5	6	7	8	9	10		
Pods of <i>A. modesta</i>	140	183	346	115	212	361	375	--	79	238	2,049	57.33
Leaves of <i>A. modesta</i>	--	--	--	46	47	26	6	16	--	--	141	3.94
<i>Carissa spinarium</i>	--	8	--	--	--	--	--	--	--	--	8	0.22
<i>Abutilon indicum</i>	--	14	--	--	--	--	--	--	--	10	24	0.67
<i>Justacia adhatoda</i>	16	--	9	10	2	1	--	--	--	2	40	1.12
<i>Capparis spinosa</i>	5	--	--	31	--	--	--	95	185	--	316	8.84
<i>Gymnosporia royaleana</i>	--	--	3	6	25	--	--	--	--	--	34	0.95
<i>Zizyphus numularia</i>	--	2	--	--	2	--	--	--	--	1	5	0.14
Pods of <i>Prosopis juliflora</i>	--	--	--	--	--	--	--	10	--	--	10	0.28
<i>Chrysopogon aucheri</i>	13	2	1	37	--	--	--	--	8	--	61	1.71
<i>C. jwarancusa</i>	71	47	42	93	61	86	18	110	52	55	635	17.77
<i>Cynodon dactylon</i>	50	--	--	--	--	--	--	116	55	--	221	6.18
<i>Eleusine flagellifera</i>	5	--	--	--	7	--	--	--	--	--	12	0.34
<i>Panicum antidotale</i>	--	11	--	--	--	1	--	--	--	--	12	0.34
Sarmukh—an unidentified half shrub	--	--	6	--	--	--	--	--	--	--	6	0.17
Total:	300	267	407	338	356	475	399	347	379	306	3,574	100.00

Table II: Bite counts of goat grazed on Pabbi Hills during early spring 2008

Plant species	Bite counts										Total counts	% of diet composition
	1	2	3	4	5	6	7	8	9	10		
Pods of <i>A. modesta</i>	115	--	--	1	73	90	--	160	--	--	439	7.48
Leaves of <i>A. modesta</i>	31	3	13	21	7	312	12	55	10	154	618	10.53
<i>Ehretia laevis</i>	85	54	5	175	70	163	--	--	--	--	552	9.41
<i>Carissa spinarium</i>	--	19	--	--	--	--	--	--	--	--	19	0.33
<i>Abutilon indicum</i>	--	234	152	--	12	--	3	--	--	--	401	6.84
<i>Justacia adhatoda</i>	--	7	22	13	--	--	71	62	--	--	175	2.98
<i>Grewia populifolia</i>	--	45	162	5	41	--	--	--	--	--	253	4.32
<i>Capparis spinosa</i>	--	--	--	--	--	--	62	--	29	29	120	2.05
<i>Gymnosporia royaleana</i>	102	21	15	213	13	16	--	27	--	45	452	7.70
<i>Zizyphus numularia</i>	--	--	30	--	4	--	--	--	--	--	34	0.58
<i>Z. mauritana</i>	100	--	22	--	--	--	--	--	--	--	122	2.08
<i>Chrysopogon aucheri</i>	--	5	--	--	3	--	9	--	--	--	17	0.29
<i>C. jwarancusa</i>	3	203	233	1	540	--	325	273	475	250	2,303	39.24
<i>Cynodon dactylon</i>	--	--	--	--	--	--	3	--	131	93	227	3.87
<i>Eulaliopsis binata</i>	--	--	--	--	--	--	--	--	--	30	30	0.51
<i>Ipomea pescapri</i> —a climber	43	--	--	24	--	--	--	--	--	--	67	1.14
Chau—an unidentified forb	--	35	3	--	--	--	--	--	--	--	38	0.65
Total:	479	626	657	453	763	581	485	577	645	601	5,867	100.00

chopped, preserved and mixed with the pods of Phulai in the ratio of 1:3, respectively for feeding to the animals during the time of feed shortage, particularly during the winter.

REFERENCES

Arshad Ullah, M., J. Afzal and M. Anwar, 2007. Determining Range Vegetation Cover and Composition of Pabbi Hills Kharian Range, District Gujrat. *J. Appl. Sci.*, 7: 2321–2326

Jasra, A.W. and S.H. Hanjra, 2007. Forage selection by taddy goat and sheep on Thal Ranges. *Pakistan J. Agric. Res.*, 20: 71–74

Baumont, R., S. Prache, M. Meuret and Morand Fehr, 2000. How forage characteristics influence behavior and intake in small ruminants: A review. *Livestock Prod. Sci.*, 64: 15–28

Economic Survey, 2009. *Agriculture: Pakistan Economic Survey*. Government of Pakistan, Finance Division, Economic Adviser's Wing, Islamabad, Pakistan

Khan, C.M.A. and N. Mohammad, 1987. *Rangelands in Pakistan*, pp: 13–22. United States-Pakistan Workshop on Arid lands Development and Desertification Control, PARC, Islamabad, Pakistan

Khan, S.R.A., 1987. *Rangelands in Pakistan*, pp: 29–35. United States-Pakistan Workshop on Arid lands Development and Desertification Control. PARC, Islamabad, Pakistan

MINFAL, 2009 *Agricultural Statistics of Pakistan, 2008-2009*. Ministry of Food, Agriculture and Livestock, Government of Pakistan

Ouédraogo-Koné, S., C.Y. Kaboré-Zougrana and I. Ledin, 2006. Behaviour of goats, sheep and cattle on natural pasture in the sub-humid zone of West Africa. *Livestock Sci.*, 105: 244–254

Papachristou, T.G., 1997. Foraging behavior of goats and sheep on Mediterranean kermes oak scrublands. *Small Rumin. Res.*, 24: 85–93

Sanon, H.O., C. Kaboré-Zougrana and J. Ledin, 2005. Behaviour of goats, sheep and cattle and their selection of browse species on natural pasture in a Sahelian area. *Small Rumin. Res.*, 67: 64–67

Schacht, W.H. and J.C. Malechek, 1990. Botanical composition of goat diets in thinned and cleared deciduous woodland in Norther Brazil. *In J. Range Manage.*, 43: 523–529

Yiakoulaki, M.D., M.P. Zarovali and V.P. Papanastasis, 2009. Foraging behavior of sheep and goats grazing on Silvopastoral Systems in Northern Greece. Nutritional and foraging ecology of sheep and goats. *Option Mediterraneennes*, 85: 79–84

Zaffaruddin, 1985. Constraints and strategy for development of rangelands in Pakistan. *Pakistan Agric.*, 11: 20–23

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