

Grazing behaviour and foraging strategy of goats in semi-arid region in India

G.S. SOLANKI

*Faculty of Applied Science, North Eastern Regional Institute of Science & Technology
Nirjuli-791109, Arunachal Pradesh, India; E-mail: gss@nerist.ernet.in*

Abstract: The study was conducted in semi arid region, at Rajkot in Gujarat, India. The observations were recorded on free grazing indigenous goats of Zalabadi breed. Time spent in various activities during day from 08 to 18 hours was recorded in different seasons. The entries for grazing, walking, standing and sitting activities were made at every five minutes interval. Out of the available time in the field, goats spent 62.4% time for grazing, 19.2% for sitting, 10.6% in standing and 7.8% in walking. Goats in their grazing activities as well as in forage selectivity pattern exhibited marked diurnal periodicity. There were two peaks for the grazing, one in morning and the other in the evening. The evening peak was more pronounced than morning one. More number of plant categories were grazed in morning than in evening hours. The plant species preferred in morning were different than the plant species in evening.

Resumen: El estudio se llevó a cabo en la región semiárida de Rajkot en Gujarat, India. Las observaciones fueron registradas en cabras nativas de la raza Zalabadi que pastorean libremente. Se hizo un registro del tiempo dedicado a las diferentes actividades durante el día entre 0800 y 1800 en diferentes estaciones del año. Los registros de las actividades de pastar, caminar, estar de pie y estar recostadas se hicieron a intervalos de cinco minutos. Del total de tiempo disponible en el campo, las cabras ocuparon 62.4% para el pastoreo, 19.2% para estar recostadas, 10.6% para estar de pie y 7.8% para caminar. Tanto para sus actividades de pastoreo como para el patrón de selectividad en el forrajeo las cabras mostraron una marcada periodicidad diurna. Hubo dos picos para el pastoreo, uno por la mañana y otro al anochecer. El pico del anochecer fue más pronunciado que el matutino. Un mayor número de categorías de plantas fueron consumidas por la mañana que en horas del anochecer. Las especies de plantas que fueron preferidas en la mañana también difirieron de las especies del anochecer.

Resumo: O estudo foi conduzido numa região semi-árida, em Rajkot, no Gujarat, Índia. As observações foram registadas em cabras indígenas da raça Zalabadi, pastando livremente. O tempo despendido nas várias actividades, durante o dia, das 08H00 às 18H00, foi registado durante as várias estações. Os registos para os pastoreio, o passeio, bem como as actividades de permanência em pé ou deitadas foram registadas em cada intervalo de cinco minutos. Em relação ao tempo disponível no campo, as cabras gastam 62,4% do tempo a pastar, 19,2% deitadas, 10,6% em pé, paradas, e 7,8% em andamento. As cabras nas suas actividades de apascentamento, bem como no padrão de selecção de alimentos, exibem uma periodicidade diurna marcada. Houve dois picos na actividade de pastagem, um de manhã e outro à tarde. O pico da tarde foi mais pronunciado do que o da manhã. Um maior número de categorias de plantas foi pastado de manhã do que nas horas da tarde. As espécies de plantas preferidas de manhã foram diferentes das espécies preferidas na parte da tarde.

Key words: Grazing behaviour, diurnal periodicity, forage preference, selectivity pattern.

Introduction

Under the intensive grazing system, animal encounters multifaceted problems *viz.*, climatic influences, pasture type and condition, and grazing competition with co-inhabitants in the grazing field. Animals first react to the environmental influences by changing their activity pattern in field in order to avoid climatic stress. Secondly, in the pasture animal adopt foraging strategy by changing its ingestive behaviour to meet nutrient requirement. Lastly for the survival among fellow competitors in the same grazing land, they select a feeding niche whereby competition for food material could be avoided and feed requirement can be fulfilled. Thus animals' strategy of changing their behaviour must be regarded as their adaptation. Most of the studies conducted on grazing animals and their behavioural aspect were correlated with climate and ingestive behaviour (Distal & Provenza 1991; Maleckeck 1990; Penning 1985; Solanki 1994; Tixier *et al.* 1997), climate and time budget for activities (Backer & Loharman 1992; Greaves *et al.* 1991; Goniez-castro *et al.* 1991; Saini & Sharma 1986; Sanchez Rodriguez *et al.* 1990; Solanki 1994); and grazing interactions with sympatric species were studied by Berwick (1974); Bohra *et al.* (1992); Ghosh *et al.* (1984, 1987a, b); Solanki (1998).

Goats, being highly adapted and a dominating livestock category, contribute significantly in economy of the semi-arid regions, though they are maintained by free grazing system. The study conducted by the author on grazing and foraging pattern are compiled so that a sound animal production system and system for grazing land management can be developed for such regions.

Materials and methods

Experiments were conducted in the grazing land around the Rajkot town situated at lat. N 22°19 and long. E 70°08 and at 138 m above mean sea level. Climate is semi arid with 590 mm average rainfall. The mean maximum and minimum temperature ranges from 36-44°C and 7.5-23.5°C, respectively. The grasses namely, *Dichanthium annulatum*, *Aristida royleana*, *Indigofera cordifolia*, *Cenchrus ciliaris*, *Melanocenchrus jacquemontii*, *Tridax procumbens* were dominating the area. The bushes of *Zizyphus numularia*, *Calotropis pro-*

cera were common and *Acacia nilotica* trees were sparsely distributed.

A mixed herd containing fifteen indigenous goats (BW 14.3–2.65 kg) of Zalabadi breed maintained to conduct the grazing experiments. Study for time oriented activities was conducted in three seasons *viz.*, summer (April-May), monsoon (July-August), and winter (November-December) so that an annual pattern can be inferred on combining these seasonal data. Observations were recorded from 08 to 18 hours. The activities were recorded for grazing, standing, walking and sitting, and the activities were defined as follows: (1) Grazing-grazing or browsing while walking or standing, (2) Walking-moving from one place to another without grazing or browsing, (3) Standing-simply standing, dozing or ruminating, (4) Sitting-simply sitting for rest or for rumination. Observations on the activities during grazing in the field were recorded for eight days in each season. Entries of the activities were made for each observation of about five minutes, so that there were twelve entries during one hour of observation period.

For purpose of study the foraging strategy of goats the vegetation in grazing field broadly categorized into grasses, thorny bushes and miscellaneous. Eight animals were observed for forage categories. Time taken for eating a particular category for 2 hours in the morning, noon and evening each day for seven consecutive days were also observed in the pre-monsoon period. Ten days were given to animals for adjustment before observation started.

Results and discussion

Time spent by goats in the four categories of activities namely; grazing (62.4%), walking (7.8%), standing (10.6%) and sitting (19.2%) was different in different seasons as given in Table 1. Diurnal

Table 1. Time spent (minutes hour⁻¹) by goats for various activities during grazing in different seasons.

Seasons	Grazing		Walking		Standing		Sitting	
Summer	409	7	41	1	55	2	95	7
Monsoon	372	11	36	1	90	5	102	8
Winter	311	9	54	3	48	4	167	13
Average	378	39	43	9	64	22	121	30
(%)	(62.4)		(7.8)		(10.6)		(19.2)	

pattern in the four categories indicates that goats spent little more than half the time in morning hours which declines in noon and thereafter increases and reaches a maximum level of 50 minutes hour^{-1} in the field. The two grazing peaks, one in the morning and another in evening become evident (Fig. 1). The time spent in standing declines progressively throughout the day (Fig. 2). Animals spent about 12 minutes hour^{-1} during the first hour in the field whereas they spent 4 to 5 minutes only during last hour of grazing. The animals spent increasingly more time in sitting as the day advanced from morning to noon, and spent progressively less time from afternoon to evening and during last three hours in the field animals hardly sat (Fig. 1). The time spent in walking was merely constant *i.e.*, 2 to 5 minutes hour^{-1} throughout the day except during last hours in the field where animals spent little more time in walking during the earlier part of the day

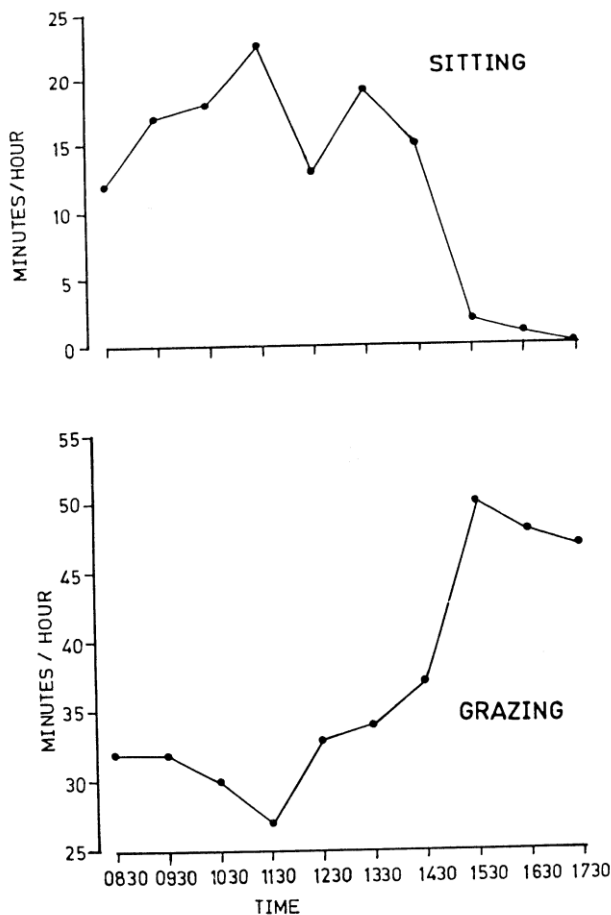


Fig. 1. Pattern of grazing and sitting activities (minutes h^{-1}) of goats in a semi-arid region.

and the walking decreased progressively during the afternoon (Fig. 2).

Table 2 indicates the grazing preference at the different hour of the day. During the first two hours of grazing, goats spent 53.7 and 83.3% of the time for eating grasses, 31.7 and 15.7% eating thorny bushes and 14.6% eating miscellaneous forages. As compared to the other hours of grazing, in the first hour goats spent maximum time for eating miscellaneous forages. Until noon, goats preferred grasses, by evening their preference shifted to thorny bushes. Thus goats showed the diurnal pattern of forage selectivity also. Seasonal changes in time devoted for grazing by the goats in this study are due to the climatic condition of the area. Within two months after the end of monsoon vegetation starts drying up and availability of fodder to the animals become severely limited. This could be attributed for devoting more time for grazing in other season than in the monsoon. Grazing behaviour of goats in terms of time spending varies from habitat to habitat and season to season (Becker & Loharmann 1992; Goniez-Castro *et al.* 1991; Solanki 1994). Pattern of change of the activities has also been reported for other categories of livestock (Pandey 1981; Winter 1980). The grazing behaviour for different activities also va-

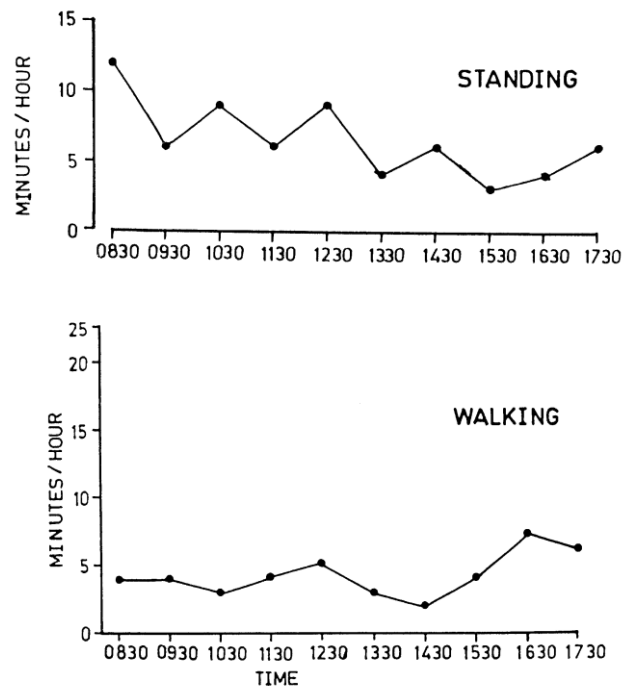


Fig. 2. Pattern of walking and standing activities (minutes h^{-1}) of goats in a semi-arid region.

ries with different age group in goats (Solanki 1994). Standing activity is nearly uniform throughout the period in field (Fig. 2) except in initial hour (8.30 a.m.). This attributes the animal more sense of vigilance and safety from external threats mainly due to predators. More time in beginning of the activity may also be a confidence building measure for safer feeding ground that was maintained later. Walking is the main activity when selection of feeding ground is to be made. However, sitting and walking are the age dependent phenomenon, also confirmed by the author in earlier study (Solanki 1994).

Table 2. Grazing hours and preference (%) of different forage categories.

Period of observation (hours)	Grasses (%)	Thorny bushes (%)	Miscellaneous
0800-0900	53.6	31.7	14.6
1000-1100	83.3	15.6	0.0
1200-1400	81.0	17.5	1.3
1600-1700	30.2	69.7	0.0
1700-1800	30.9	69.0	0.0

The reaction of an individual animal and/or group to micro-climate at given time fluctuate during the day and these fluctuations are more striking than seasonal fluctuations. A marked diurnal periodicity was exhibited in the time spent for grazing and forage preference by goats. When animals started grazing in the first hour of the day, they visited different sites to explore most suitable place for grazing. That may be a reason for preferring more number of plant categories (Table 2). Thereafter goats settled to preferred site for grazing and thereby achieved a first (morning) grazing peak as shown in Fig. 1 (Geoffroy 1974; Milne 1991; Rouaissi & Majdoub 1988; Solanki 1986; Solanki 1994). In noon hours, when grazing activities slow down, the animal sat down to restore the energy and ruminates the ingested feed (Fig. 1). After a gap around noon, the grazing activities increased and the evening peak was more pronounced than morning one (Fig. 1). Along this evening peak of grazing, the peak for preferred plant species also appeared as the goats shifted heavily on to thorny bushes than other forage categories. Thus it becomes evident that grazing activities and feeding preference exhibit diurnal periodicity. Askin & Turner (1972) also observed

similar pattern of feeding. In a wide variety of diurnally active mammals and birds, the peak of foraging activity is higher in the evening than in the morning and this is attributed to assumption that the animal feeds more intensively in the afternoon in anticipation of a long period of food deprivation lying ahead at night (Marler & Hamilton 1968). Walking in free grazing animals and particularly mammals is an exploratory activity for better choice and intensive feeding. Thus walking was more in evening (Fig. 2).

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