

Grazing Behaviour of Saanen and Toggenburg Goats in Sub-Humid Tropical Conditions of Kenya**

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ABSTRACT : The behaviour of 6 Toggenburg and 6 Saanen female goats, grazing on natural vegetation in a modified sub-humid tropical environment of Kenya, was studied during the dry (January and February) and wet (April and May) seasons in 1997. The two exotic breeds grazed for 12 h daily. Observation on feeding, standing, lying and ruminating was done chronometrically at five minute intervals between 0600 and 1800 h. These grazing times were based on the current practice of small holder farmers. During the dry period, the average feeding, standing, lying and ruminating time per 12 h period for Saanens was 5.63, 4.57, 1.80 and 1.50 h respectively while that for Toggenburgs was 7.26, 3.21, 1.53 and 1.96 h, respectively. In the wet (Green) season, the mean feeding, standing, lying and ruminating time for Saanens was found to be 5.08, 4.63, 2.29 and 0.72, respectively. Toggenburgs spent more time feeding ($p < 0.05$) than Saanens in both seasons. It was also observed that standing occurred more often in Saanens than the Toggenburgs in the dry season. During the wet period, Saanens ruminated significantly longer than the Toggenburgs. The health status of the animals was determined by analyzing the respiratory frequency, heart rate, rectal temperature, hemoglobin, erythrocytes and leucocytes of the experimental animals. All the clinical and physiological parameters were within the normal physiological range of healthy goats. It was concluded that differences in the grazing behaviour of Saanens and Toggenburgs in the modified tropical environment of Kenya, do exist. (*Asian-Aust. J. Anim. Sci.* 2001. Vol 14, No. 7 : 951-955)

Key Words : Grazing Behavior, Saanens, Toggenburg, Tropics, Kenya

INTRODUCTION

Goats are important components of mixed and sustainable livestock and agricultural farming systems in the tropics. They produce food items of high biological value and can play a vital role in supplying protein for ever increasing human population due to their good fertility, prolificacy and short generation interval (Raza et al., 1998). In many African countries, goats are regarded as poor man's "dairy" (Peacock, 1987). In Kenya, in the last three decades, there has been influx of exotic breeds of dairy goats from temperate lands. The main breeds brought to Kenya are the Saanens and Toggenburgs. It is not clear if introduction of exotic goats from temperate areas exhibit different behaviour as a means of adaptation. Goats have been almost ignored by ethologists (Arnold and Dudzinski, 1978) despite the important role they play in many parts of the world. The knowledge of the behaviour of exotic goats under local conditions is a vital springboard to embark upon their improvement by applying the modern scientific knowledge gathered through research.

The main activities in goats are feeding, lying, standing and rumination. From literature known to us, no studies have been carried out on the grazing behaviour of free-ranging exotic goats in Kenya. Consequently, there is no information on the duration exotic goats take foraging and

the hours of the day when they are actively feeding and resting.

The aim of the present work is to characterize the feeding and resting behaviours of free-ranging Saanens and Toggenburgs in a modified sub-humid tropical environment of Kenya.

MATERIALS AND METHODS

Study site

The study was carried out on Taton Farm that belongs to Egerton University. Taton farm (0.3° S, 35.9° E) is situated 30 km west of Nakuru in the Rift Valley Region within 40 km from the equator. The elevation of the floor at the study site is approximately 2,250 m above sea level. Although geographically equatorial, the area has a highly modified tropical climate. Lampkin et al. (1958) described the climate of this area as "high altitude temperate".

The terrain has tree vegetation composed primarily of different species of acacia. Grazing was entirely from natural pasture; the predominant grasses were *Cynodon dactylon*, *Pennisetum cladestinum*, *Lasiurus scindicus*, *Senchrus biflorus*, *Dicanthium annulatum*, *Panicum antidotale*, *Aristida funiculata* and *Brachiaria* spp. No supplemental feeding was practiced but a mineral supplement and NaCl were provided *ad libitum*. The area has dry sub-humid modified equatorial climate and is characterized by distinct wet and dry seasons. The two dry seasons usually occur from January to March and August to September while the two wet seasons occur from April to July and October to December. Little or no precipitation

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falls during the dry seasons. Annual rainfall ranges between 760-1,270 mm (mean=950). The maximum temperature is about 25°C while the minimum is around 10°C (Nakuru District Developtment Plan, 1994-1996). During the experimental period the average temperature in the dry and wet seasons were 21.5 ± 0.17 and 18.5 ± 0.20 °C, respectively. Both warmest day and coolest night occur in clear weather. Relative humidity is almost invariably low. Droughts are common, often extending the dry season to 6 or 7 months of the year. During 1997, rainfall patterns were normal.

Animals and management

Six Saanen and six Toggenburg female goats, aged between 14 and 16 months, with an average weight of 46.20 ± 3.5 and 53.8 ± 4.0 kg respectively were randomly selected from a grazing flock of the two breeds. The two breeds were separately kept in two adjacent 10-ha paddocks of uniform natural pasture. All goats had large white numbers painted on their sides with a white gloss paint to aid identification. Two experiments, each lasting two months, were carried out in 1997: January and February (dry season); April and May (wet season). Animals were allowed to graze only during daylight hours and were kept in a shed at night.

Behavioral measurements

During the experiment, the animals were observed once every five minutes and a record made if they were feeding, lying or standing and in the case of standing or lying whether or not they were ruminating. The total time spent per day in each of these activities was calculated by assuming that they had been performing the activity for the remainder of the 5-min period and multiplying the number of recording of each behaviour by the number of 5-min periods in a day (Hull et al., 1960). Animals in each of the two paddocks were observed once per week, between 0600 and 1800 h.

Blood analysis and physiological parameter measurements

At the beginning of each experiment, blood and clinical parameters of each animal were analyzed with the objective of evaluating the health status of the experimental animals. Approximately 10 ml of blood were collected, from the 6 Saanen and 6 Toggenburg goats, with a heparinized 15 ml vacutainers by jugular puncture. From the blood samples, erythrocytes, leucocytes and haemoglobin were analyzed using standard methods (Jain, 1986). Heart rate was measured using a stethoscope, while rectal body temperature and respiratory rate were determined using standard procedures (Kasa, 1998).

Statistical analysis

Statistical annlysis of the data was carried out using the ANOVA and student t-test to compare the means (Steel and Torreid, 1980).

RESULTS AND DISCUSSION

The physiological parameters of the animals are summarized in table 1. The values of the experimental animals were within the normal physiological range of healthy goats (Georgievski, 1990). Thus, they had no clinical or subclinical problems. No significant differences were observed between the breeds and seasons in the physiological parameters measured.

Table 2 showed the mean time spent on various behavioural activities by the animal over a 12 h period in the dry and wet seasons. During the wet season, there was additional forage available due to accumulation of forage biomass. Differences in grazing behaviour of Saamens and Toggenburgs were observed within the seasons and between the seasons. All animals spent more time feeding during the dry season than in the wet season. This is in agreement with Arnold's (1985) observation that animals spend more time feeding when the forage quantity decreases. The results of

Table 1. Physiological parameters of Saanen (n=6) and Toggenburg (n=6) goats in the dry and wet seasons

Parameter	Season			
	Dry		Wet	
	Saanen	Toggenburg	Saanen	Toggenburg
Respiratory frequency (breaths/min)	16.0 ±1.84	15.98 ±1.3	15.80 ±1.54	15.48 ±1.3
Heart rate (beats/min)	77.60 ±4.71	79.50 ±3.56	78.50 ±3.61	77.25 ±2.25
Rectal temperature (°C)	40.00 ±0.92	39.5 ±0.45	38.99 ±0.63	39.24 ±0.45
Haemoglobin (g%)	10.08 ±2.27	10.45 ±1.44	10.50 ±1.57	10.95 ±0.60
Erythrocytes (10 ⁶ /ml)	11.78 ±1.07	11.6 ±0.92	11.55 ±1.62	11.60 ±0.85
Leucocytes (10 ³ /ml)	8.88 ±1.07	7.33 ±0.49	7.87 ±1.02	7.95 ±0.59

±Standard error (SE)

Table 2. Mean time (hrs) spent on various behavioural activities by Saanen (n=6) and Toggenburg (n=6) goats over a 12 h period in the dry and wet seasons

Behaviour	Season			
	Dry		Wet	
	Saanen	Toggenburg	Saanen	Toggenburg
Feeding	5.63±0.45 ^{ab}	7.26±0.48 ^c	5.08±0.38 ^b	6.78±0.45 ^{ac}
Standing	4.57±0.47 ^a	3.21±0.35 ^b	4.63±0.51 ^a	3.34±0.37 ^{ab}
Lying	1.80±0.16 ^{ab}	1.53±0.13 ^a	2.29±0.18 ^{bc}	1.88±0.21 ^{ac}
Ruminating	1.50±0.17 ^{ab}	1.96±0.19 ^a	0.72±0.14 ^c	1.25±0.16 ^b

^{a,b,c} Means with different superscripts in the same row are significantly different ($p < 0.05$).

± SE.

the study indicated that Toggenburgs spent more time feeding ($p < 0.05$) than Saanens in both seasons. The differences may be attributed to body size since the Toggenburgs are larger than the Saanens. It is possible that Toggenburgs had higher nutrients requirement than Saanens and, thus had to spend more time feeding. These findings are thus in accordance with Bail and Mayer (1968), who found that ruminants adjust voluntary food intake in relation to physiological demand for energy. Heat stress may not have caused the differences in feeding behaviour since both breeds were comfortable under the climatic conditions of the area. In the modified temperate climate of the Egerton Tatton Farm, direct effects of heat were minor, and, as elsewhere in similar circumstances (Harker et al., 1961), the major cause of variations in behaviour patterns were likely to be differences between herbage quantity and quality in various pastures. High altitude and low humidity made the climate of the area modified temperate (Larkin, 1972).

The proportion of time spent on various behavioural activities over a 12 h day in the dry and wet seasons was shown in figures 1 and 2 respectively. In both seasons, feeding for Saanens was highest at 1200 h while that for Toggenburgs was at 1000 h. After 1500 h there was a general decline in feeding behaviour of Saanens and Toggenburgs in both seasons. Several peaks in feeding behaviour were observed in both Saanens and Toggenburgs. The general feeding peaks observed in this study may be attributed to a reduction in competition for pasture under tropical range conditions. All the goats had equal chances of getting access to the forage, which was in adequate supply. Single feeding peaks occurred when animals competed for feeds, or when there was a fluctuation in light and ambient temperatures (Young and Lawrence, 1994).

The time available for standing depends upon time used in other activities. Standing may be an indicator of discomfort (Rind and Phillips, 1999). In the dry season, Saanens significantly ($p < 0.05$) spent more time standing compared with Toggenburgs (table 2). All goats tended to

stand more time in the dry season than the wet season. An increase in standing period coincided with a fall in the feeding activity and vice versa (figures 1 and 2). In both seasons, the two breeds of goats spent most of their time standing early in the morning between 0700 and 0900 h and in the evening between 1600 and 1800 h. This kind of time distribution of animals were under heat stress, they could have stood more and fed less between 1200 and 1500 h when the temperature was relatively high. Arnold and Dudzinski (1978) observed that in hot weather, cattle on pastures showed heat stress that was exhibited as excessive standing and crowding in corners. Goats are expected to behave like cattle when they are under heat stress.

Lying and standing fits in between episodes of feeding therefore, the periodicity of the two behavioural activities is the inverse of that for the feeding. Lying represented resting (Arnold and Dudzinski, 1978). During lying, animals were in either of the four states; alert wakefulness, drowsiness, slow wave sleep or paradoxical sleep. In general, both breeds spent more time lying during the wet season (table 2). Saanens significantly ($p < 0.05$) spent more time lying in the wet season compared with Toggenburgs in the dry season. The animals tended to spend more time lying in the wet season, probably, due to the fact they were able to take adequate amount of forages in their rumen could hold and later be rested. During the dry season, the goats walked from one place to another looking for forages and hence rested for a shorter period. This tied in with work by Arnold and Dudzinski (1978) which indicated that when there is shortage of feed, under free-range conditions, animals rested less. Periodicity of lying (figures 1 and 2) indicated that both breeds started lying at 0800 and 0900 h in wet and dry seasons respectively. They started lying early in the wet season because they were able to gather enough forage from the abundant biomass.

Rumination is the major feature of ingestion in goats. It allows the animal to regurgitate, masticate and re-swallow food that had been previously ingested speedily in coarse form. During the dry season, Saanens and Toggenburgs

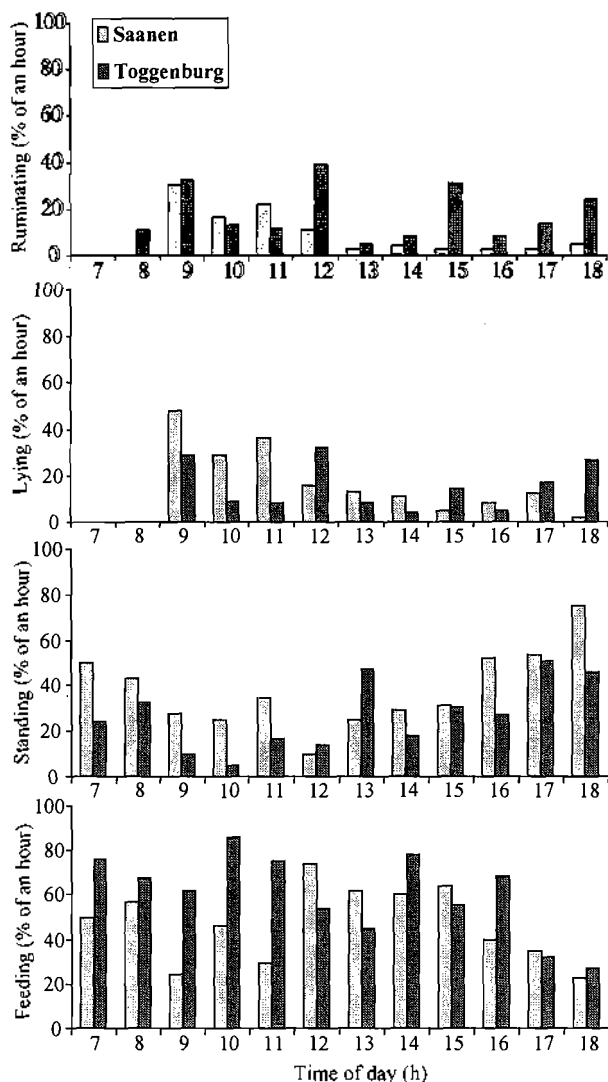


Figure 1. Proportion of time spent by Saanen and Toggenburg goats on various behavioural activities over a 12 h period in the dry season

significantly ($p < 0.05$) spent more time ruminating compared with their counterparts in the wet season (table 2). Rumination time is generally influenced by the amount of feed and physical form of feed (Moon et al., 2000). During the dry period, animals required more time to masticate the fibrous material.

Toggenburgs spent more time ruminating compared with Saanens in the wet season. Toggenburgs spent more time feeding and as a consequence, they required more time to remasticate the large feed material from the reticulo-rumen chamber. In both seasons (figures 1 and 2), Toggenburgs started ruminating at 0800 h with peaks at 0900, 1200, 1500 and 1800 h. On the other hand, Saanens started the same activity at 0900 h in the dry and wet seasons. In both seasons, the highest ruminating bouts were observed between 0900 and 1200 h while the lowest were noted between 1200 and 1500 h.

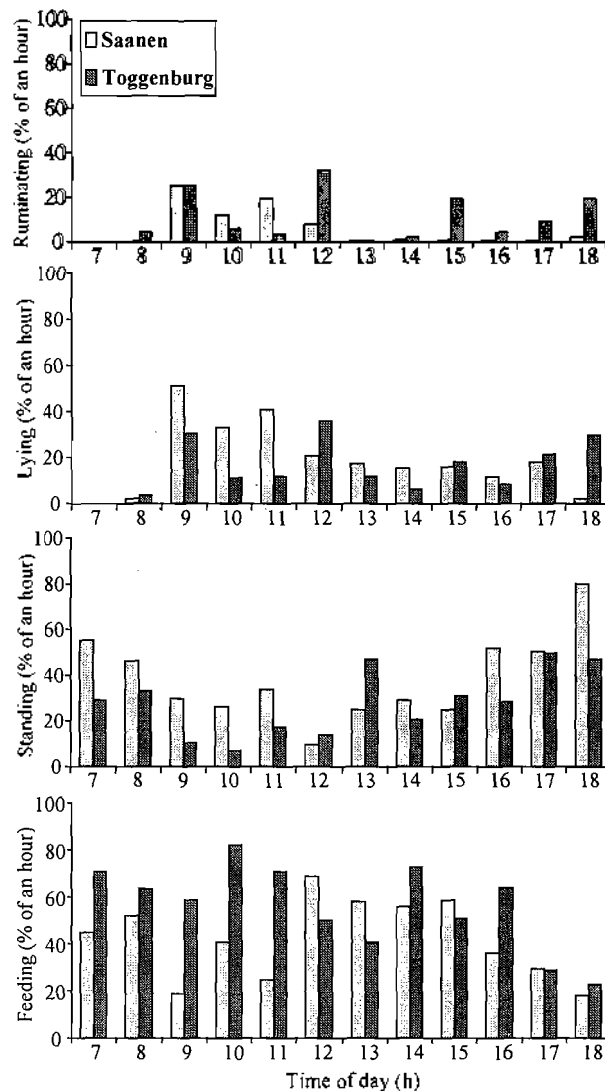


Figure 2. Proportion of time spent by Saanen and Toggenburg goats on various behavioural activities over a 12 h period during the wet season

The results of the present study indicated that the grazing behaviour of Saanens and Toggenburgs within the modified sub-humid tropical conditions of Kenya differed significantly in the dry and wet seasons. The major causes of variations may be differences in body size, physiological requirements, climatic adaptation and susceptibility to stress. This work has raised many further questions, nevertheless, it has illustrated how close examination of behaviour of goats provide clues as to when to feed the animals effectively under free range conditions. Saanens seem to be more adapted to the ambient climatic conditions. For the future, the strategy will be to find out how grazing behaviour affect productivity.

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