

Grazing Behaviour of Jersey and Guernsey Heifers in Sub-Humid Tropical Conditions of Kenya**

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ABSTRACT : The behaviour of 5 Jersey and 5 Guernsey heifers, grazing on natural vegetation in a sub-humid tropical environment in Kenya, was studied during the dry (January and February) and wet (April and May) seasons in 1999. The heifers grazed for 12 hours daily in both seasons. Observations on feeding, standing, lying and ruminating were done chronometrically, at five-minute intervals, between 0600 and 1800 h. During the dry season, the average feeding, standing, lying and ruminating times per 12 h period for Jerseys was 8.0, 3.13, 0.87, and 1.40 respectively, while those for Guernseys were 8.6, 3.26, 0.4, and 1.35 respectively. In the wet (green) season, the mean feeding, standing, lying and ruminating times for Jerseys were found to be 7.54, 3.07, 1.39, and 1.27 respectively, and for Guernseys were 8.42, 3.10, 0.48, and 0.44 respectively. In both seasons Guernseys spent more time feeding ($p < 0.05$) in comparison with the Jerseys. It was also observed that lying occurred more often in Jerseys than the Guernseys ($p < 0.05$) in both seasons. During the wet season, Jerseys ruminated longer ($p < 0.05$) than the Guernseys. The health status of the animals was determined by examining the respiratory frequency, heart rate, rectal temperature, haemoglobin erythrocytes and leucocytes of the experimental animals. All the clinical and physiological parameters were within the normal physiological range of healthy cattle. It was concluded that there are differences in grazing behaviour between Jerseys and Guernseys in the sub-humid tropical environment of Kenya and Jerseys seem to be more adapted to the tropical climatic conditions. (*Asian-Aust. J. Anim. Sci.* 2001. Vol. 14, No. 4 : 491-495)

Key Words : Grazing Behavior, Jersey, Guernsey, Tropics, Kenya

INTRODUCTION

In recent years, there has been an influx of exotic dairy cattle breeds (*Bos taurus*) into developing countries in an attempt to increase milk production in order to achieve self sufficiency in food production. In Kenya, commercial dairy production with exotic breeds has developed into an important industry. The dairy herds mainly consist of four breeds- Ayrshire, Friesian, Jersey and Guernsey (Stortz, 1980) with the latter two breeds being very popular, particularly among the small-scale farmers. These breeds are now an important part of the agricultural economy of Kenya (Stortz, 1980).

Livestock production is affected by environmental conditions through a direct influence of heat stress, or indirectly by affecting forage supplies, and domestic animals are known to change their behaviour in order to adapt to changes in environmental conditions. The major behavioural activities of cattle are feeding, resting and ruminating (Njoka-Njiru, 1999) and the time allotted to each of the activities depends on age of the animal, husbandry system (Nicks et al., 1991)

and possibly environmental conditions. It is not clear if different breeds of cattle, from temperate areas express different behaviours as a means of adaptation. There are few studies on the behaviour of exotic breeds of cattle in the tropics, especially in the hot sub-humid regions (Arnold and Dudzinski, 1978) and to our knowledge, no studies have been conducted to examine the grazing behaviour of exotic breeds of cattle in Kenya. Therefore, the present study was conducted to determine the feeding, standing, lying and rumination behaviours of Jersey and Guernsey heifers, receiving no supplementary feeding, under sub-humid tropical conditions of Kenya.

MATERIALS AND METHODS

Study site

The study was conducted on a demonstration farm belonging to Egerton University. The farm is in Nakuru District located in the Great Rift Valley region of Kenya. The altitude of the farm is approximately 2,250 m above sea level. The terrain is hilly with a vegetation cover mainly composed of different species of acacia, and shrubs. Grasses that provide natural pasture are dominated by *Cynodon dactylon*, *Pennisetum cladezinum*, *Lasiurus scindicus*, *Senchrus biflorus*, *Dicanthium annulatum*, *Panicum antidotale*, *Aristida funiculata* and *Brachiaria* species.

The area has a sub-humid modified tropical climate (Larkin, 1972) and is characterized by distinct wet and dry seasons. The dry seasons usually occur from

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January to March and August to September, while the wet seasons occur from April to June and October to December. Little or no precipitation falls during the dry seasons. Annual rainfall ranges between 760-1270 mm (mean=950 mm) and moisture index of 10-30. The maximum temperature is about 25°C while the minimum is around 10°C (Nakuru District Development Plan, 1994-1996). Information on average daily temperatures was collected, for both dry and wet seasons, during the experimental period. Relative humidity was invariably low.

Droughts are common, often extending the dry season to 6 or 7 months of the year. However, during the year of study (1999), there was no drought and the rainfall patterns were normal.

Animals and their management

Five Jersey and five Guernsey heifers, aged between 14 and 16 months, with an average weight of 250 kg were randomly selected from a herd. The two breeds were separately grazed in two adjacent 10 ha paddocks of natural pasture. There was no supplementary feed provided except for mineral and salt supplements. All the animals were earmarked for easy identification during the experimental period.

Behavioural measurements

Two observation experiments, each lasting two months, January to February (dry season) and April to May (wet season), were carried out in 1999. Animals were allowed to graze only during daylight hours (0600 to 1800 hours) and kept in a shed at night. During the experiment, the animals were observed using the scan observation technique (Altman, 1974). Feeding, lying, standing and ruminating bouts of all the five animals in each of the two paddocks were observed once per week, chronometrically at five-minute intervals, from 0600 to 1800 hours. The total of times the animals spent eating, lying standing and ruminating were calculated from the observation sheets, by multiplying the number of times the behaviour was observed by the interval between

observations (5 min).

Blood analysis and physiological parameter measurements

At the beginning of each experiment, blood and clinical parameters of each animal were analysed with the objective of evaluating the health status of the experimental animals. Approximately 10 ml of blood were collected from each heifer, into heparinized 15 ml vacutainers by jugular puncture. From the blood samples, erythrocytes, leucocytes and haemoglobin were determined using standard methods (Jain, 1986). Body temperature, heart rate and respiratory frequency were also determined, at the beginning of each experiment, using the standard procedures (Boddie, 1969).

Statistical analysis

Statistical analysis of the data was carried out using the student t-test and ANOVA described by Steel and Torrie (1980).

RESULTS

The average temperatures during the dry and wet seasons were $21.5 \pm 0.17^\circ\text{C}$ and $18.5 \pm 0.20^\circ\text{C}$ respectively. Temperature in the dry season was significantly higher ($p < 0.001$) than in the wet period. There was additional forage available during the wet season due to accumulation of forage biomass.

The physiological parameters of the animals are summarized in table 1. The values reported were within the normal physiological range of healthy cattle (Georgievsky, 1990) and there were no significant differences between the two breeds in the physiological parameters measured in the dry and wet seasons.

Table 2 shows the mean time spent on behavioural activities by the animals over a 12 h period. Animals ruminated while standing or lying. All animals spent more time feeding during the dry season than in the wet season. In both seasons, Guernseys spent

Table 1. Physiological parameters of Jersey (n=5) and Guernsey (n=5) heifers in the dry and wet seasons

Parameter	Season			
	Dry		Wet	
	Jersey	Guernsey	Jersey	Guernsey
Respiratory frequency (breaths/min)	27.00 ± 1.45	27.4 ± 0.87	27.20 ± 1.56	27.3 ± 0.77
Heart rate (beats/min)	71.60 ± 3.87	68.02 ± 2.15	71.20 ± 3.77	67.95 ± 2.25
Rectal temperature (°C)	39.09 ± 0.01	39.34 ± 0.14	38.99 ± 0.03	39.24 ± 0.15
Haemoglobin (g %)	12.52 ± 0.37	12.95 ± 0.58	12.72 ± 0.47	12.95 ± 0.60
Erythrocytes (10 ⁶ /ml)	7.24 ± 0.53	8.91 ± 0.65	7.15 ± 0.62	8.79 ± 0.85
Leucocytes (10 ³ /ml)	7.78 ± 1.06	8.05 ± 0.49	7.87 ± 1.02	7.95 ± 0.59

± Standard error (SE).

Table 2. Mean time (hrs) spent on various behavioural activities by Jersey (n=5) and Guernsey (n=5) heifers over a 12 h period in the dry and wet seasons

Behaviour	Season			
	Dry		Wet	
	Jersey	Guernsey	Jersey	Guernsey
Feeding	8.00 ± 0.21 ^b	8.60 ± 0.12 ^c	7.54 ± 0.22 ^a	8.42 ± 0.14 ^c
Standing	3.13 ± 0.09	3.26 ± 0.31	3.07 ± 0.02	3.10 ± 0.33
Lying	0.87 ± 0.11 ^b	0.14 ± 0.04 ^c	1.39 ± 0.23 ^a	0.48 ± 0.19 ^b
Ruminating	1.40 ± 0.40 ^{ab}	1.35 ± 0.32 ^a	1.27 ± 0.29 ^a	0.44 ± 0.15 ^b

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

± SE.

significantly ($p < 0.05$) more time feeding than Jerseys. There was significant difference ($p < 0.05$) observed in feeding time for Jerseys in the dry and wet seasons with the lowest mean feeding time (7.54 hours) observed during the wet season. The highest (8.60 hours) grazing time was found in Guernseys during the dry season. Jerseys and Guernseys spent more time feeding ($p < 0.05$ and $p < 0.001$ respectively) during the dry season compared with Jerseys in the wet season.

The proportion of time spent on various behavioural activities over a 12-hour day in the dry and wet seasons is shown in figures 1 and 2 respectively. In both seasons, feeding for Jerseys was highest during the morning hours and tended to decline towards noon. Between 1200 and 1300 h, the feeding bouts for Jerseys rose sharply followed by a fall between 1300 and 1400 h. From 1400 to 1600 h, it was observed that Jerseys had a rise in their feeding bouts. Guernsey heifers didn't have a sharp decline from morning to noon as observed in Jerseys during the two seasons. The lowest feeding time for Guernseys was observed at 1300 h and was followed by a sharp rise up to 1600 h in both seasons. After 1600 h there was a general decline in feeding behaviour of Jersey and Guernsey heifers in both seasons.

The time available for standing depends upon time used in other activities. The animals spent more time standing in the dry season than in the wet season, but the differences were neither significant between the breeds nor between the seasons (table 2). In general, an increase in standing period coincided with a fall in the feeding activity and vice versa (figures 1 and 2). In both seasons the lowest standing time was recorded between sunrise (0600 h) and 0800 h. From 0800 to 1100 h, there was a gradual rise in the standing behaviour of Jerseys in the two seasons which coincided with gradual decline in feeding bouts. Within the same period (0900-1100 h), in both seasons, it was also observed that the proportion of time spent by Guernseys on standing was almost uniform. The longest standing period for Jerseys and

Guernseys was observed at 1400 and 1300 h respectively in both seasons. It was observed that during the dry season, standing bouts of Jersey and Guernsey heifers declined from 1400 to 1600 h and started rising from 1600 to 1700 h. This corresponded with rising and falling of the feeding bouts within the same period. During the wet season, a different pattern appeared in standing bouts of Guernseys. At 1400 and 1500 the standing bouts for Guernseys tended to be lower than those observed in the dry season. There was a gradual increase in standing time of Guernseys from 1400 to 1800 h in the wet season.

During lying (resting) periods, animals were in 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). The mean lying time for Jerseys and Guernseys in the wet season was 1.39 and 0.48 h respectively while during the dry season it was 0.87 and 0.14 h respectively. In both dry and wet seasons, Jerseys significantly ($p < 0.05$) spent more time lying as compared with the Guernseys. During the dry season, Jerseys and Guernseys spent less time lying ($p < 0.05$ and $p < 0.001$ respectively) as compared with the Jerseys in the wet season. The distribution of lying bouts (figures 1 and 2) indicates that Jersey heifers started lying much earlier (9.00 h) than the Guernseys in the wet season. However during the dry season both breeds started lying at 12.00 h. In both seasons Guernsey heifers started lying at 12.00 h. No lying behaviour was observed before 0900 h.

It was observed that animals ruminated more during the dry season than the wet season (table 2). During the wet season, Jersey heifers significantly spent more time ruminating than Guernseys ($p < 0.05$), while during the dry season the difference was not significant between the two breeds. It was observed that during the dry season, Guernsey heifers ruminated for a longer period ($p < 0.05$) than in the wet season. Jerseys started ruminating before the Guernseys (figures 1 and 2). In both seasons, Jerseys started chewing cud at 1000 h with peaks at 1200 and 1400

h. On the other hand, Guernsey heifers started the same activity at 1100 in the dry and wet seasons. There was only one peak ruminating period for the Guernseys that was observed at 1700 h in both seasons.

DISCUSSION

The physiological parameters (table 1) indicate that the animals had no clinical or sub-clinical problems, and that they were all healthy. In a related study, Georgievsky (1990) found respiratory frequency (breath/min), heart rate (beats/min), body temperatures

(°C), haemoglobin (g %), erythrocytes ($10^6/ml$) and leukocytes ($10^3/ml$) of healthy cattle ranging from 15 to 40, 50 to 75, 38.0 to 39.5, 9 to 12, 5 to 7.5 and 6 to 10 respectively. The findings were comparable to present results. However, the level of haemoglobin and the number of erythrocytes in both breeds, reported in this study, were on the higher limit, probably due to the altitude of the area. Animals in higher altitudes will require more red blood cells for efficient transportation of oxygen.

Mean daily feeding time for the two breeds accounted for more than 60% of time spent in the dry and wet seasons. Arnold (1985) indicated that feeding period may reflect the richness of the foraging environment, with animals taking a long period feeding

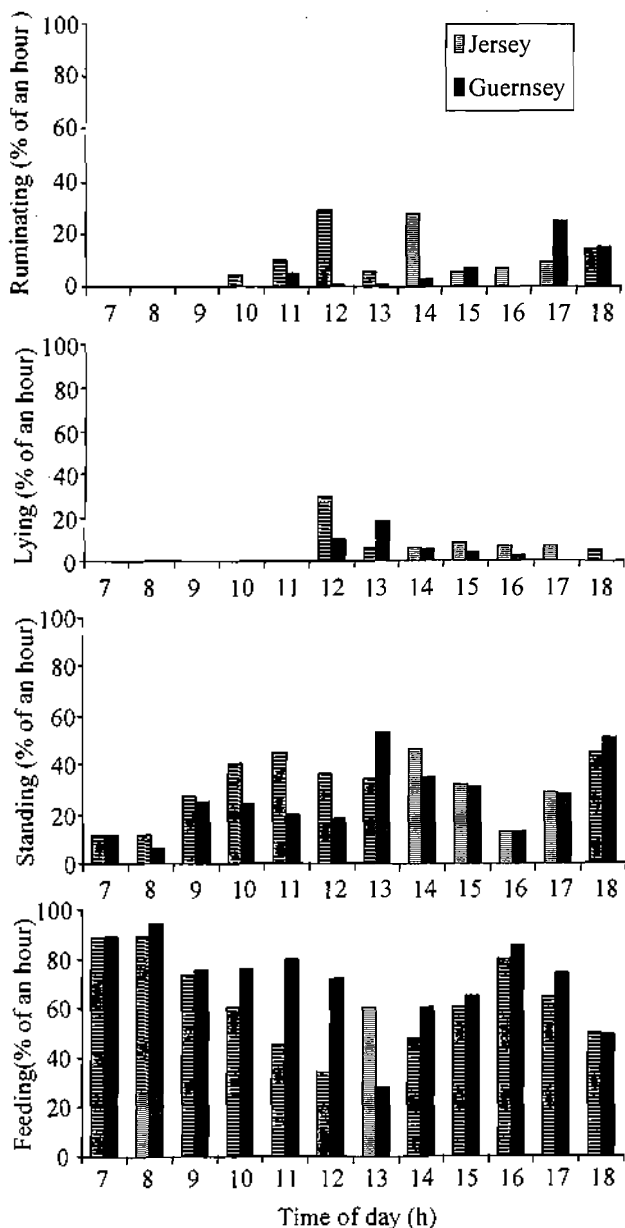


Figure 1. Proportion of time spent by Jersey and Guernsey heifers on various behavioural activities over a 12 h period in the dry season

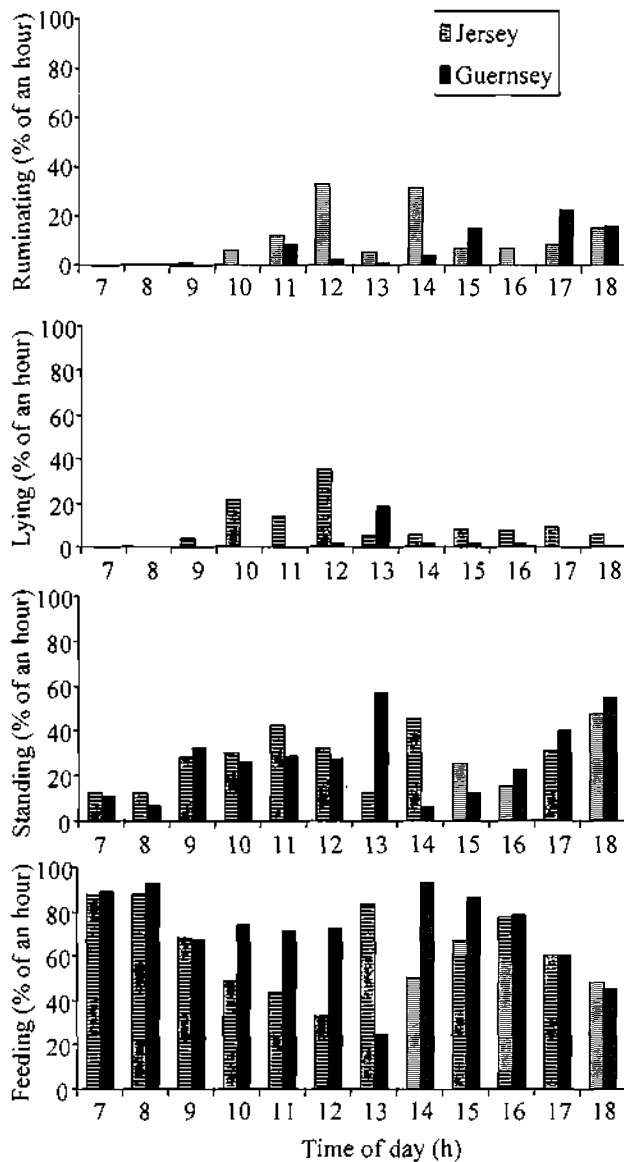


Figure 2. Proportion of time spent by Jersey and Guernsey heifers on various behavioural activities over a 12 h period during the wet season

as forage quantity decreases. This study supported such a view since animals took less time feeding during the wet season when there was accumulation of biomass. The results of the study indicated that Guernseys took more time feeding ($p < 0.05$) than Jerseys during the dry and wet seasons. It is possible that Guernseys had a higher nutrient requirement than Jerseys and, thus, had to take more time feeding. Hodgson (1985) argued that the herbage intake of grazing animals can be considered in terms of the balance between the effects of metabolic, physical and behavioural controls all of which depend on the animal and the sward characteristics.

Several peaks in feeding behaviour were observed in Jerseys and Guernseys, whereas previous work has reported peaks early in the morning and late evening (Hancock, 1952). The general feeding peaks observed in this study may be attributed to a reduction in competition for pastures under tropical range conditions. All animals had equal chances of getting access to the forages, which was in adequate supply. Single feeding peaks occur when animals compete for the feeds, or when there is a fluctuation in light and ambient temperatures.

Standing and lying fit in between episodes of feeding and therefore, the periodicity of the two behavioural activities is the inverse of that for feeding. Differences in the standing activities between the two breeds were not significant in all the seasons. High temperatures at 1300 h resulted in increased standing time in Guernseys while Jerseys were less affected (figures 1 and 2) in both seasons. Within the same hour of the day, Jerseys had high feeding activity while the feeding activity of Guernseys was less in both seasons. The most probable biological reason for this observation may be the fact that Jerseys are less susceptible to heat stress (Goldson, 1963).

Periodicity of lying in Jerseys and Guernseys indicates that Jerseys started lying earlier than Guernseys in the wet season, while during the dry season both breeds started lying at noon (figures 1 and 2). Lying represented resting. During the wet season, Jerseys significantly ($p < 0.05$) spent more time lying as compared with the Guernseys (table 2). This may have been due to the fact that Jerseys took the required amount of forages their rumen could hold and later rested. Since Jerseys lay down to rest for a longer period ($p < 0.05$) than Guernseys, they stood for a shorter time.

In rumination the animal regurgitates, masticates and then re-swallows food that had been previously ingested speedily in coarse form. During the wet season, Jerseys spent more time ruminating ($p < 0.05$) compared with Guernseys (table 2). It is suggested that because Jerseys have a small stomach capacity

they spend more time ruminating in order to create more space for more feeding (Njoka-Njiru, 1999). The decreased rumination behaviour observed in Guernseys in the wet season may be due to the high fermentation rate of green forages that leads to the formation of volatile fatty acids (VFAs) within a short period. Oshiro et al. (1998) observed that increased blood acetic acid, butyric acid and glucose during and after feeding caused a depression in rumination behaviour.

The results of the present study indicate that there are differences in the grazing behaviour of Jerseys and Guernseys in this sub-humid tropical area. This may be due to differences in stomach size, physiological nutrient requirements, climatic adaptations and susceptibility to heat stress. Jerseys, in comparison with the Guernseys, seem to be more adapted to the tropical conditions of Kenya.

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