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Effect of time and period of occupation on the feeding behavior of Boer goats, Mafikeng, North West Province, South Africa

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Abstract

The study aimed at determining the feeding behavior, effects of time of feeding as well as the effect of period of occupation in a grazing camp by Boer goats. The study utilizes experimental design of 10ha plot in which the goats were confined in order to control the environment and collect data for analysis twice a week for four weeks. The Data was analyzed using Generalized Linear Model (GLM) with time of the day and period of occupation and their interactions as the main factors in the model. The study reveals that, time of the day and period of occupation did not significantly influence the relative time goats devoted to browsing. However, there was a significant difference between time of the day and period of occupation. The time of the day and period of occupation also had significant influence on the time goats spent on non-feeding activities (NFA).

Keywords: Boer goats, effects of time, feeding behavior, period of occupation

1. Introduction

Animal feeding behavior has been an object of numerous studies [4, 12, 13] and there are a number of exploratory theories regarding the principles of herbage selection of grazing animals. Feeding behavior is any activity of an animal that is aimed at the procurement of nutrients including modes of feeding, rhythm patterns of feeding and time intervals. Grazing behavior of goats can be classified according to search time; time, bite rates within feeding stations, and the duration of biting while at the feeding station as this determines the productivity of livestock. Knowledge of feeding behavior is of fundamental importance in management of pastures, especially with regard to the determination of opportune feeding strategies, the type and quantity of supplements to distribute [2, 13]. Several perspectives have been postulated regarding the feeding behavior of goats with the argument whether the goat genotypes can be classified as either grazers or browsers. [15], argued that goats cannot be clearly defined as either browsers or grazers but are opportunistic feeders.

Goats are mainly raised in rangelands in semi-deserts and sub-tropic conditions. Conditions in the rangelands, such as heterogeneity, as well as the seasonal change of potential feeds and nutritional restrictions, induce range ruminants to exhibit strong food selectivity in order to meet the demands for growth, maintenance, production and reproduction. Goats, like all animals, express a degree of nutritional wisdom since they select plants or part of plants higher in nutrients than the average in pasture [1, 16, 14, 17, 14] have demonstrated that even during spring when herbaceous species are very palatable, goats ingest high proportions of shrubs. [8, 12] stated that goats prefer areas dominated by shrubs due to their different grazing habits and spend more time eating grass than thorny bushes. Furthermore [13] stated that goats exhibit a versatile feeding behavior, an advantage which comes mainly from their physical body structure (bipedal stance, mobility of upper lip, and vigorous grazing) as well as the variable rumen micro-flora allows them to cope with harsh environments. In the tropics they exploit even the meager shrubby resources, selecting the more nutritive parts and converting them to a useful product.

Understanding feeding behavior and diet selection of ruminants is imperative for efficient rangeland management as well as profitable goat production from rangelands because these parameters affect goats performance and hence production. Feeding behavior influences the quantity and quality of nutrients selected by the free-ranging goats and thus, has a direct effect on the productivity of these goats. This study aims at determining the feeding behavior, effect

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of time of feeding as well as the effect of period of occupation in a grazing camp on the feeding behavior of Boer goats. The study hypothesized that feeding behavior, effect of time of feeding and effect of period of occupation in a grazing camp has an effect on the feeding behavior and productivity of Boer goats. The study utilizes an experimental design in which the goats were confined in a grazing camp in order to control the environment and collect data for analysis.

2. Materials and Methods

2.1 Description of the experimental area

The study was conducted in Mafikeng which is in the North West province of South Africa. The farm is 1260m above sea level and is located at 25° 51' 0" S and 25° 38' 0" E. The average annual rainfall is 559 mm and most of it is received in hot-wet season (summer). The mean annual temperature of the farm is 22°C–30°C. The vegetation type is Mafikeng Bushveld.

2.2 Experimental design and procedure

The experimental 10ha plot was stocked with 36 Boer goats for a period of four weeks. At the start of the trial, there was an adaptation period of 14 days on the veld immediately adjacent to the experimental plot. For goats to be easily identified from a distance, the thirty six observed animals were painted on both flanks with a unique identification number. During the four week experimental period, goats had daily access to the experimental plot only, but kraaled at night. Twice a week (Tuesdays and Thursdays), feeding behavior of the thirty six Boer goats (experimental animals) was observed. Their feeding behavior observations were recorded from 08h10 – 10h10 (to represent morning), 10h30 – 12h30 (to represent midday), and 14h10 – 16h10 (to represent afternoon). All goats were observed at the same time. During observations, these activities of goats were recorded: browsing, grazing, and non-feeding activities (walking, standing, lying and drinking). Browsing activity included bipedal stance and browsing of all woody species. Grazing activity represented the grazing of grasses without identification of grass species. Non-feeding activities included recordings of walking, lying, standing and drinking. The goats were observed for 2 hours in the morning, midday, and afternoon observation periods. During a 120 minute observation time, the time spent on different activities of feeding behavior by goats was recorded every five minutes and then converted into percentages.

2.3 Data analysis and Generalized Linear Model (GLM)

Data was analyzed using Generalized Linear Model (GLM) of [18] with time of the day and period of occupation and the interactions as the main factors in the model. In order to determine the effect of time of occupation on the breeding behaviour of boar goats, the mean comparison was done using the probability of difference method (PDIFF) procedure [18]. Differences which were detected at the statistical significance of 0.05 levels were considered statistically significant. Thus, the following statistical model was used:

$$Y_{ijkl} = \mu + T_i + D_j + (TD)_{ij} + e_{ijk}$$

Where

Y is the observation on any of the feeding activities; μ is the overall mean; T_i is the time of the day effect: morning

(08h10 – 10h10), midday (10h30 – 12h30), and afternoon (14h10 – 16h10); D_j is period of occupation effect (1st day – 8th day); $(TD)_{ij}$ is the two way interaction of effects among factors included in the model; e_{ijk} is random error term, assumed to be distributed normally with mean of 0 and variance, σ^2_e .

3. Results and discussion

On average, the Boer goats were observed to spend 17%, 59%, and 24% of their day on browsing, grazing, and non-feeding activities (walking, standing, lying, and drinking) respectively. Goats thus spent 22.22% and 77.78% of their active feeding time on browsing and grazing respectively. The time of the day and period of occupation did not significantly ($P > 0.05$) influence the relative time goats devoted to browsing as shown in table 1 below.

Table 1: Mean percentage on browsing as influenced by time of the day and period of occupation.

Factors	Browsing Time (%)	Standard Error (Se)
Time of the day		
(08h10 – 10h10h)	30	0.47
(10h30 – 12h30)	38	0.47
(14h10 – 16h10)	32	0.47
Period of occupation		
Day 1	13	0.77
Day 2	19	0.77
Day 3	12	0.77
Day 4	12	0.77
Day 5	16	0.77
Day 6	10	0.77
Day 7	9	0.77
Day 8	9	0.77

On average, goats spent more time browsing during midday than in the morning and afternoon. The average percent time spent on browsing was not significant. There was a significant difference between time of the day ($P > 0.008$) and period of occupation ($P > 0.002$) as shown in table 2 below.

Table 2: Mean percentage on grazing as influenced by time of the day and period of occupation.

FACTORS	GRAZING TIME (%)	SE
Time of the day		
(08h10 – 10h10h)	35.60	0.53
(10h30 – 12h30)	34.82	0.53
(14h10 – 16h10)	29.58	0.53
Period of occupation		
Day 1	11.72	0.86
Day 2	8.82	0.86
Day 3	12.72	0.86
Day 4	13.50	0.86
Day 5	12.61	0.86
Day 6	12.61	0.86
Day 7	14.17	0.86
Day 8	13.84	0.86

On average, goats spent more time grazing in the morning. The time of the day ($P < 0.0001$) and period of occupation ($P = 0.007$) significantly influenced the time goats spent on NFA as shown in table 3 below.

Table 3: Mean percentage on NFA as influenced by time of the day and period of occupation.

Factors	Nfa Time (%)	SE
Time of the day		
(08h10 – 10h10h)	30	0.34
(10h30 – 12h30)	26	0.34
(14h10 – 16h10)	44	0.34
Period of occupation		
Day 1	14	0.55
Day 2	17	0.55
Day 3	13	0.55
Day 4	11	0.55
Day 5	9	0.55
Day 6	14	0.55
Day 7	11	0.55
Day 8	11	0.55

On average, goats spent more time on NFA during the afternoon than morning and midday. The study found that, the proportion of time spent browsing was lower (22.22%) compared to the time spent grazing (77.78%). This finding was not supported by results from a similar study conducted by Raats (1998, J. G. Raats, Department of Livestock and Pasture Science, University of Fort Hare, Private Bag X1314, Alice, 5700, South Africa). However, the finding from the study was supported in recent studies by ^[11, 12] which reveals that, goats spent 33% and 67% of their feeding time browsing and grazing respectively. Although the results by Raats (1998, J. G. Raats, Department of Livestock and Pasture Science, University of Fort Hare, Private Bag X1314, Alice, 5700, South Africa) were opposite to the results of the current study, both reveal that there is a shift between browsing and grazing depending on several factors such as forage availability, temperature, rainfall and others. More time was spent grazing as the grass was more abundant than browse.

Browsing showed a decline as period of occupation in a camp advanced. On the other hand, grazing increased at a decreasing rate as a period of occupation in a camp advanced. This may be as a result of the limited availability of browsing and grazing species within the camp as the period of occupation increases. Grasses were the preferred feed for goats in this present study. Goats were observed to switch to grazing during the later days of period of the occupation of a camp due to depletion of browse. The study also found that, diurnal (morning vs. afternoon) variation was a major factor affecting the feeding behavior of goats and has a significant influence on both browsing and grazing. In general, midday feeding periods were dominated by browsing while grazing was the dominated activity during the morning than averages found by Raats (1998, J. G. Raats, Department of Livestock and Pasture Science, University of Fort Hare, Private Bag X1314, Alice, 5700, South Africa). The finding is supported by ^[11, 13], which observed a distinct diurnal pattern for selectivity of forages, with grasses being preferred more in the morning (80%) followed by bushes (18%) while in the evening bushes were more preferred (69%) than grasses (30%). These workers found that on average, goats spent almost twice (1.8:1) as much time on browsing than for grazing during the morning whilst the ratio is reserved during the afternoon. This indicates that browsing and grazing behavior of goats is affected by time of the day.

Browsing was low in the morning (30%) due to goats feeding (grazing) unselectively and becoming selective as the day progresses. This is because goats wandered more in

the afternoon than the morning and midday. In this study, non-feeding activities (walking, standing, lying and drinking) were higher in the afternoon as compared to morning and midday. Goats avoid feeding when the temperature is high during the day. Higher ambient temperatures associated with the hot and wet season, resulting in decreased feed intake, an increase in the respiratory rate and the animal will always be drinking water at all times ^[3,18]. There is a direct effect of temperature, rainfall and forage availability on the feeding behavior of goats.

4. Conclusion

The study has shown that, goats are faced with opportunities of choice; the tropic diversities of goats are high. The study have concluded that goats spent more time grazing during the morning as opposed to browsing while in the evening, they spent more time browsing than grazing in the Mahikeng Bushveld of the North West Province. More time devoted to grazing might be attributed to the abundance of grass than browse; access of plant species, herbaceous plant species are easily accessible than browse species; body size of goats, they were not able to reach browse leaves at higher levels; and shoots from trees were starting to emerge at the onset of this study. This left goats with no option but to feed more on the herbaceous material closer to the ground during the study.

The research further concluded that time spent by goats browsing and grazing decreased in the afternoon. The reduced intake, could be explained as a strategy employed by goats when the rumen were full, hence non-feeding activities (NFA) were high in the afternoon. A diurnal pattern of foraging observed in this study indicates that goats were more selective in the afternoon than in the morning and midday. Instead of lying down, goats spent more of their time searching for palatable for a feed to compensate for a decrease in availability ^[5,12]. This could account for less time spent NFA in the camp during the period of stay. There was no comparison of season and/or breeds in this study and this warrants further investigation.

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