Behavioural patterns of free-ranging Angora goats under different stocking rates

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SUMMARY – Behavioural rhythms analysis can be considered as valid only if supported by long-term uninterrupted data collection, required to evaluate the animal-environment relationships. A storage telemetry system (Ethosys) which allows for the automatic registration of main behavioural patterns was tested with 34 Angora goats and 5 mouflons under free-ranging conditions. The experiment was conducted on a 20 ha area covered by woodland vegetation and divided into 3 plots according to the following experimental design: (i) goats at low density (1.7 head/ha); (ii) goats at high density; and (iii) goats at high density and mouflons (*Ovis ammon musimon*). Animals were under continuous set-stocking grazing management. Comparison of visual observation (scan sampling methods) and registration by automatic recording system was carried out, the latter to assess behavioural patterns (grazing, ruminating and general activity) on individual animal basis. Collared and uncollared animals showed the same spatial and feeding behaviour. Movements and searching for food by goats was concentrated at dawn and dusk and was more evenly spread throughout the day for mouflons. The discriminating capacity of the automatic system between browsing and ruminating needs to be validated.

Key words: Grazing behaviour, automatic recording, goats, stocking rate, rangelands.

RESUME – *"Profils comportementaux des chèvres Angora sous différentes densités de chargement". L'évaluation du comportement ne peut être considérée comme valable que si l'on collectionne des données continues ; cela permet d'analyser correctement la relation entre l'animal et l'environnement. Un système de télémétrie (Ethosys) permettant de détecter et analyser automatiquement les données concernant le comportement, a été testé sur 34 chèvres Angora en pâturage libre sur un parcours en milieu méditerranéen. L'essai a été conduit sur une zone marginale de 20 ha divisée en 3 parcelles: (i) taux faible de chargement (1,7chèvres/ha) ; (ii) taux élévé de chargement (deux fois le chargement faible) ; et (iii) chargement élevé avec présence de mouflons (Ovis ammon musimon). Le nombre d'animaux a été maintenu fixe pendant toute la période expérimentale. L'enregistrement du comportement des animaux (ingestion, rumination et activité générale) a été effectué individuellement, aussi bien par observation directe "scan sampling" que de façon automatique à travers Ethosys . Les animaux avec les colliers ont montré le même comportement spatial et alimentaire que les autres animaux témoins. L'activité de mouvement ainsi que celle liée à la recherche de l'aliment a été concentrée à l'aube et au crépuscule aussi bien pour les chèvres que pour les mouflons, mais les comportements des chèvres ont été répartis d'une manière plus homogène pendant la journée. La capacité du système à discriminer entre rumination et broutement des feuilles doit être vérifiée d'une façon plus approfondie.*

***Mots-clés :** Comportement en pâturage, enregistrement automatique, chèvres, densité de chargement, parcours.*

Introduction

Few investigations have been devoted to the analysis of grazing behaviour of free ranging animals. Most grazing research has concentrated on short-term direct observation and sampling. The importance of assessing grazing behaviour by using automatic recording systems have been recently proposed (Penning, 1983; Scheibe *et al*., 1991; Langbein *et al*., 1996; Rutter *et al*., 1997). Behavioural rhythms analysis is only valid when based on long-term uninterrupted data collection which facilitates the evaluation of animal-environment relationships. In this paper the effects of different stocking rates and different ratios of goats: mouflons on feeding beaviour when grazing on native herbaceous and woodland vegetation were assessed.

Materials and methods

The trial was conducted on a 20 ha of hilly marginal area covered by deciduos trees and shrubs and located in Lazio, Central Italy. The area was characterized by the occurrence of two plant communities: grassland, dominated by *Trifolium* spp., *Avena* spp., *Bromus* spp., *Lolium* spp., and *Dactilis glomerata*, and woody species, where *Ulmus* spp., *Quercus* spp., *Acer campestre*, *Fraxinus ornus*, and *Prunus spinosa* were the dominant woody species. After assessing forage availability, thirty-four Angora goats and 5 mouflons were allocated as follows to three treatments: (i) goats at a low stocking density of 1.7 head/ha (51 kg liveweight/ha); (ii) goats at a high stocking density of 3.4 heads/ha (102 kg liveweight/ha); and (iii) goats + 5 mouflons at a high stocking density (102 kg liveweight/ha). In the third area, mouflons (*Ovis ammon musimon*) were introduced in order to assess any possible interaction between the two species. Groups of animals were homogeneous for age and proportion of the two sexes and were under continuous set-stocking grazing management. The measurement of behavioual patterns was carried out by visual observation (scan sampling method at 10-min intervals, according to Altmann, 1974) and by means of a storage telemetry system (Ethosys) which allows automatic recording. The system (Scheibe *et al.*, 1996) consists of three components: (i) the collar, Ethorec, which has two sensors (i.e., head position and animal movement), and four channel of activities such as grazing (GR), ruminating (R), activity with head down [(HD), i.e., searching for food] and general activity (GA); (ii) the central station, Etholink; and (iii) the software package, Ethodat. Three animals per area were collared: in the third treatment three goats and two mouflons were collared. Comparison of visual observation and behaviour registration by automatic recording system was carried out in order to assess feeding patterns on individual animal basis throughout seasons. Measurements of ingestive behaviour, i.e., chews per ruminating bolus, duration of ruminating cycle and bite rate, were also performed according to a stratified random procedure. Bite rate was measured over a 2-min period every 10 min of pasture. All data were analyzed using the statistical package SAS (1989).

Results and discussion

Collared and uncollared animals showed the same spatial and feeding behaviour. Goats moving and searching for food was mainly concentrated at dawn (6:00 h) and dusk (18:00 h), but it showed a more homogeneous distribution throughout the day than mouflons. Hourly distribution observed in areas 2 and 3 followed the same pattern. Differences among individuals were reported as far as the intensity of single activities are concerned. Stocking rate as well as of species to species ratio treatments did not influence the behavioural patterns (Fig. 1): no significant differences were found between the feeding behaviour of the three groups of animals, in terms of time spent per activity. On the contrary, bite rate resulted affected by the area: bite rate per minute on herbaceous and woody plants was significantly ($p < 0.01$) lower (27.5) for treatment 1 compared with treatments 2 and 3 (30.6). With an increase in stocking rate, over certain limits, a decrease in selectivity and an increase in bite rate may occur. In Fig. 2 the effect of season on behavioural patterns of Angora goats in the two areas with same grazing pressure is shown: season had no effect on behavioural pattern between groups stocked at the same grazing density (Fig. 2) except for moving and standing ($p < 0.05$). Although the diet of goats was almost based on grass, a slight increase in browsing activity occurred during summer. Comparison of behavioural data recorded by visual observation and automatic device (Fig. 3) showed that there were not significant differences between the two methods concerning grazing (grazing vs HD) and ruminating, but significant differences were observed with regard to general activity (activity vs GA). This was probably due to biases linked to visual observation such as disturbance caused by the observer, limited period of observation (10 hours of daylight) as well as limited sampling interval if compared to the automatic system. Nevertheless the discriminating capacity of the automatic recording system between browsing and ruminating needs to be validated.

Preliminary results related to the ingestive and ruminating activity showed a high variability for all parameters: the rumination period for each bolus was of 48.7 ± 14.5 seconds, the pause between two ruminating cycles averaged 6.9 ± 3.1 seconds, and the chews per bolus were 67.4 ± 13.9. Bite rate did not differ between vegetation categories (herbaceous/woody). This was probably related to the fact that sward composition is not homogeneous and bite rate is decreased by the presence of particular species (e.g., *Picris echioides*). When recorded for single species, bite rate was shown to vary according to the morphological characteristics of the plant (e.g., Graminaceae: 62.4; *Rubus fruticosus*: 40.3; *Picris echioides*: 11.3).
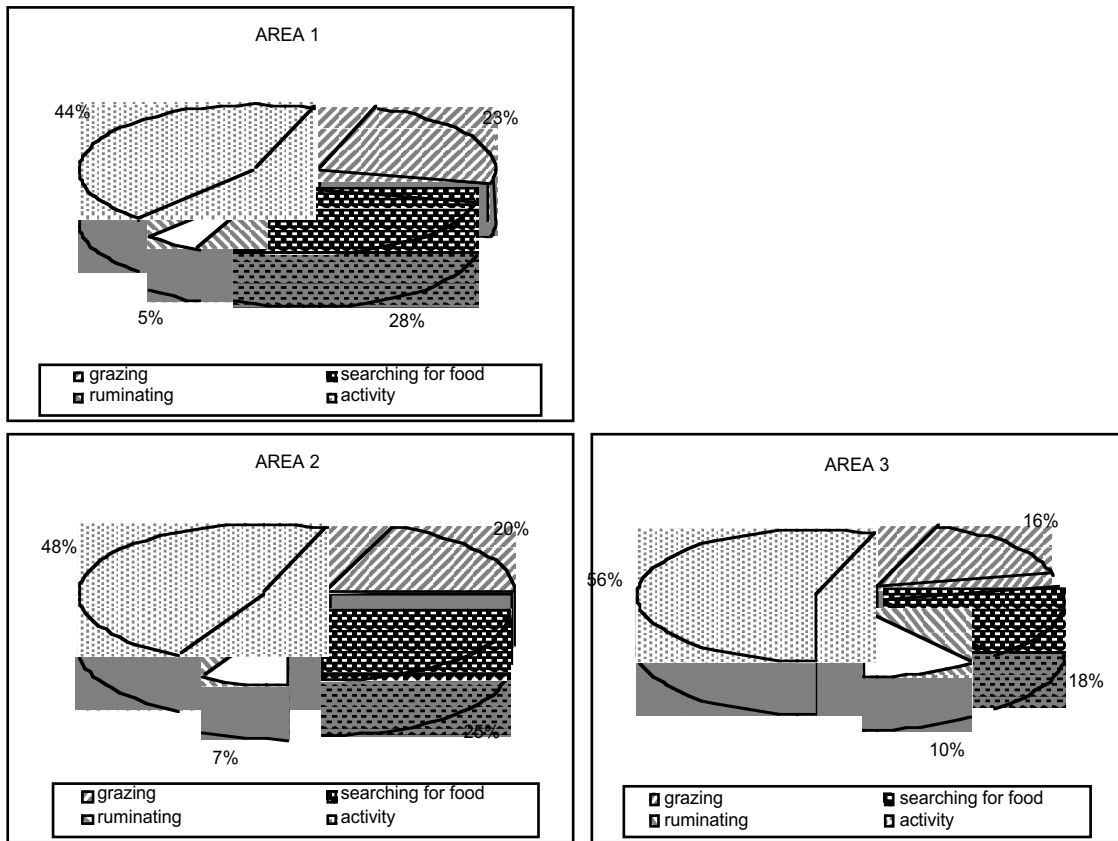
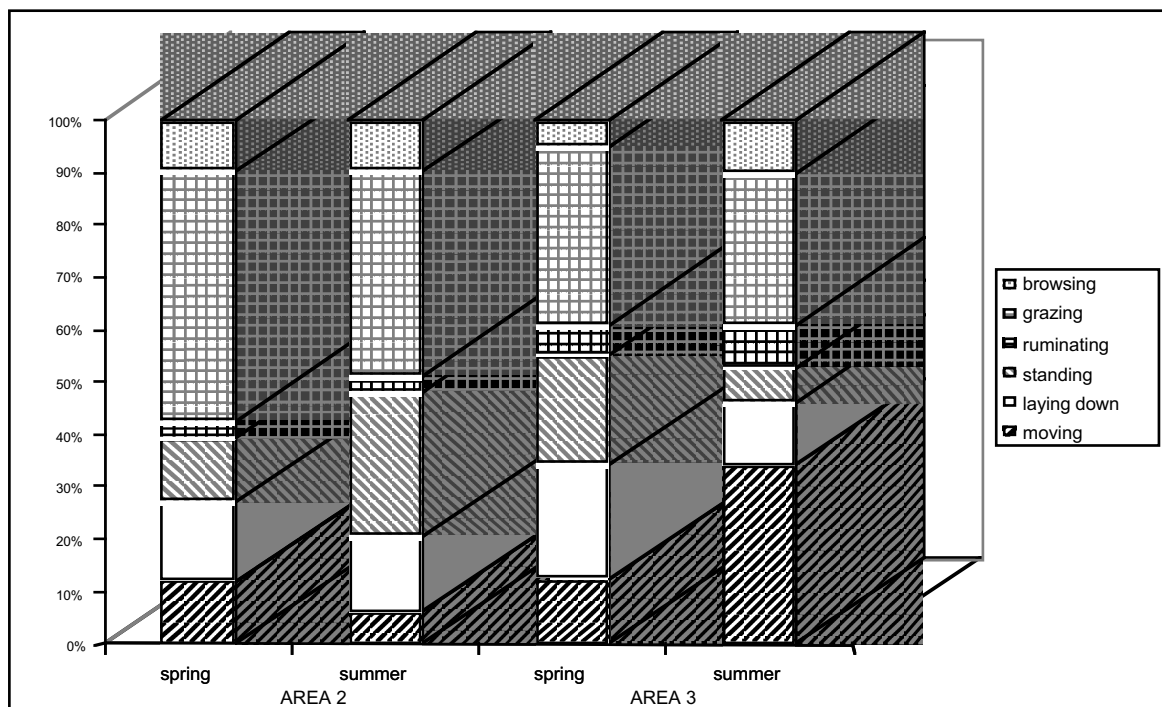Fig. 1. Activity pattern of Angora goats as affected by stocking rate (automatic recording).

Fig. 2. Effect of season on behavioural patterns of Angora goats (visual observation).
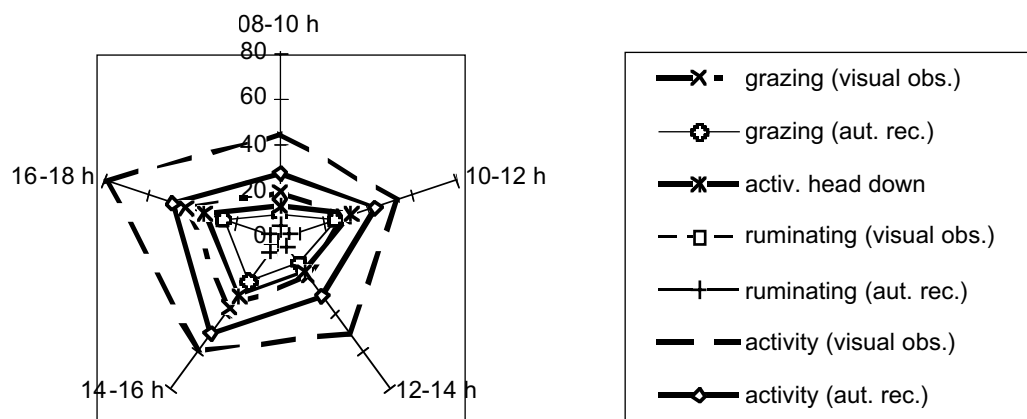
153

Fig. 3. Hourly distribution of behavioural patterns of Angora goats according to automatic recording and visual observation.

Conclusions

Automatic recording of feeding behaviour was able to implement data from visual observation, allowing the continuous registration of main behavioural activities. Caution is needed when evaluating browsing activities through the adopted automatic system, because both browsing and ruminating rely upon "head up" jaw activity. Preliminary results suggest that stocking rates did not influenced behavioural patterns. Further analysis is needed in order to better evaluate the applied treatments.

References

Altmann, J. (1974). Observational study of behaviour: Sampling methods. *Behaviour*, 49: 227-267.

Langbein, J., Scheibe, K.M., Eichhorn, K., Lindner, U. and Streich, J. (1996). Application of a new activity data logger for monitoring free ranging animals. *Applied Anim. Behav. Sci.*, 48: 115-124.

Penning, P.D. (1983). A technique to record automatically some aspects of grazing and ruminating behaviour in sheep. *Grass Forage Sci.*, 38: 89-96.

Rutter, S.M., Champion, R.A. and Penning, P.D. (1997). An automatic system to record foraging behaviour in free-ranging ruminants. *Applied Anim. Behav. Sci.*, 54(2-3): 185.

SAS (1989). *SAS User's Guide: Statistics*. SAS Institute Inc., Cary, NC.

Scheibe, K.M., Eichhorn, K., Schleusener, Th., Berger, A. and Langbein, J. (1996). Biorhythmic analysis of behaviour of free ranging domestic and wild animals by means of a new storage telemetry system. In: *Proc. of the Thirteenth Int. Symp. on Biotelemetry*, Cristalli, C., Amlaner, C.J. and Newmann, M.R. (eds). Williamsburgh (USA), pp. 271-276.

Scheibe, K.M., Ziller, S., Eichhorn, K. and Scheibe, A. (1991). Circadian and infradian rhytms of behaviour in alpacas. *Ungulates*, 91: 461-465.