Acta Agraria Kaposváriensis (2006) Vol 10 No 2, 159-167
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Behaviour of sheep in three different types of paddock in karst region of Slovenia

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ABSTRACT

Forty sheep and ten goats were reared on three different types of paddock (grass paddock, woody, and partly woody paddock). Behaviour of the ten marked sheep was observed during the time of day light (between 5 a.m. and 9 p.m.). Frequency of the following activities was monitored: grazing, drinking, salt consumption, aggressive behaviour, comfort behaviour and resting (in lying position, in standing position and resting in the flock). On average, the animals were grazing 10.5 hours per day. Circadian rhythm of grazing was different, depending on the type of paddock and on average daily temperature. Drinking frequency was very low. On average, each animal drank 0.99 times per day. Salt consumption, frequency of aggressive behaviour and comfort behaviour were most frequent in woody paddock. Two types of resting (in lying position and resting in the flock) had almost the same percent of the total resting time (46–47%), while the third type of resting (in standing position) had the lowest percent in all three types of paddock (about 7%).
(Keywords: small ruminants, sheep, animal behaviour, pasture)

INTRODUCTION

Due to the climate, geological and morphological conditions over 70% of agricultural land in Slovenia is classified as less favoured for agricultural production and karst occupies almost half of the territory (SURS, 2002). According to the *Cunder* (1998) between 120.000 and 150.000 ha of agriculture land was abandoned in last few years and they are already overgrown with shrub, trees and brushwood. The process is especially distinctive in the lower karst and high alpine region (*Cunder*, 1999), where use of mechanisation is difficult and a result is the land which is not adequately cultivated. Those areas are therefore appropriate for small ruminants, because maintains grasslands and prevents land from bush encroachment and fires.

For the better management of the sheep flocks and choice of the appropriate production methods conditions in the breeding environment has to be well-known. Even more important is to know the behaviour of animals in such conditions. In Slovenia it was tradition that a few goats in a flock of sheep were added. The aim of our study was therefore to observe the behaviour of sheep in a mixed flock with goats in three different paddocks in the karst region of Slovenia, to gain a firm knowledge on ethological traits of sheep.

MATERIALS AND METHODS

The experiment was undertaken during the August and September, on the hilly karst region (900–1000 m a.s.l.). Forty sheep and ten goats grazed together in three different types of paddock: grass paddock, woody, and partly woody paddock.

The total observation time was 12 days. Animals were observed for two days in each paddock with one rotation. Daily observation time was between 5 a.m. and 9 p.m. The animals were in the same paddock six days. During the experiment they were moved from one type of paddock to another due to lack of the feed. To assure that animals were adapted to new paddock, observation started third day after they were moved. For the purpose the ten sheep, approximately the same age, were marked. Every 5 min during 16-h observation time, grazing and resting (in lying position, in standing position, and resting in the flock) of the sheep was recorded. Drinking, salt consumption, aggressive behaviour, withdrawal and comfort behaviour were counted at appearance.

The average daily temperature of 12 recording days was 14.1 °C, with maximum air temperature 18.5 °C and minimum air temperature 9.2 °C. Observations were carried out directly from the observation point; a distance approximately 100–200 m away from the paddock using the binoculars. In woody and partly woody paddock the observer was inside the paddock. The animals were accustomed with the observer; therefore their attendance did not disturb them.

During observation data were written down and later on entered into the computer. They were analysed with the statistical package SAS/STAT. The general linear model (GLM) was used to determine the effects of normally distributed data. The daily values of data were tested for normality. Differences between the types of paddock were analysed using the estimate phrase of GLM procedure.

Activities like resting (in standing position and resting in the flock), salt consumption, drinking, aggression, withdrawal and comfort behaviour were not normally distributed. Those activities are presented and described briefly. Normally distributed data: grazing, resting (total) and resting in lying position were analysed with the GLM procedure, using a model which included the effects of paddock, day and animal. The average daily temperature was included as independent variable.

The following model was used to test various effects on grazing and resting:

$$y_{ijk} = \mu + C_i + D_j + Z_k + b_i \cdot (t_{ijkl} - \bar{t}) + e_{ijkl}$$

y_{ijk} : duration and frequency for i-paddock, j-day and k- average daily temperature,
μ : mean value,
C_i : effect of the type of paddock,
D_j : effect of the day,
Z_k : effect of the animal,
b : regression coefficient,
t_{ijkl} : average daily temperature mean value $\bar{t}$,
e_{ijkl} : difference.

RESULTS AND DISCUSSION

Grazing

Grazing is defined as the time spent each day in grazing activity, that is, the prehension and the mastification (*Woodward*, 1997). Animals were in the paddocks 24 hours per day. As shown in *Figure 1*, total grazing time between 5 a.m. and 9 p.m. was on the average 10.5 hours per day. *Lynch et al*. (1992) reported that the sheep grazed 8-9 hours per day and *Hecker* (1983) reported that the average grazing time per day was 9 hours with the maximum grazing time about 13 hours when feed supply was limited.

Usually grazing can occur at any time of the day or night but is most intensive in the morning and late afternoon until dusk.

As shown in *Figure 2*, we found differences in daily rhythm between different types of paddock. Furthermore, sheep grazed at the sunrise and just before the sunset. Similar findings were reported by *Lynch et al.* (1992) who explained that in continental areas grazing activity is concentrated to 4 hours after dawn and in the last 4 hours around sunset, but can easily start before dawn and extend long into the dark. The average daily temperature did not have any significant effect on grazing time. It only affected the circadian rhythm of grazing (*Figure 3*).

Sheep are typically classified as social animals. *Rook* and *Penning* (1991, cited by *Champion et al*., 1994) concluded that sheep tend to be synchronous in their start of the grazing bouts. The first day of our observation, grazing time was lower compared with grazing time in the second day of observation. *Hodgson* (1985, cited by *Woodward*, 1997) explained that the major factor affecting grazing time is the herbage availability. When the herbage availability is extremely low, it is common that grazing time increases.

Statistical analysis showed that the type of paddock significantly effected the duration of grazing ($P<0.01$). As shown in *Figure 1*, grazing was longer in grass paddock and shorter in woody and partly woody paddock. According to *Vidrih et al.* (1996) there are differences in herbage composition between types of paddock resulting in different duration of grazing time.

Figure 1

Grazing and resting time per animal per paddock

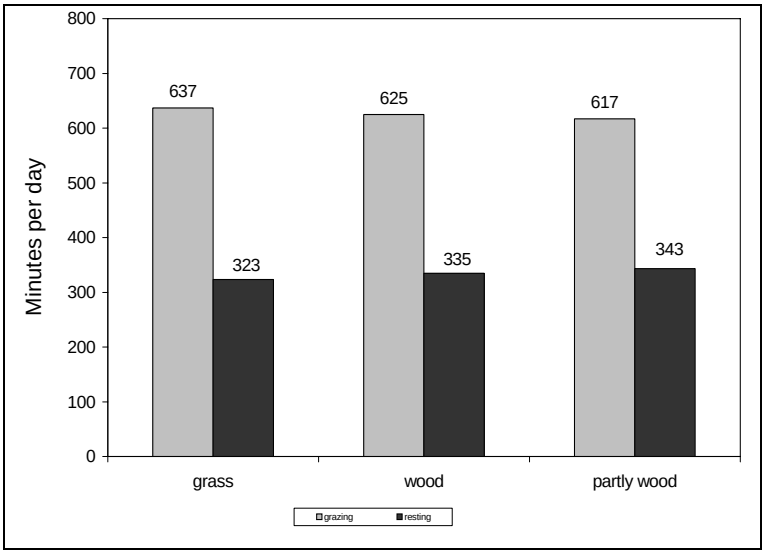


Figure 2

Daily grazing rhythm in grass, woody, and partly woody paddock

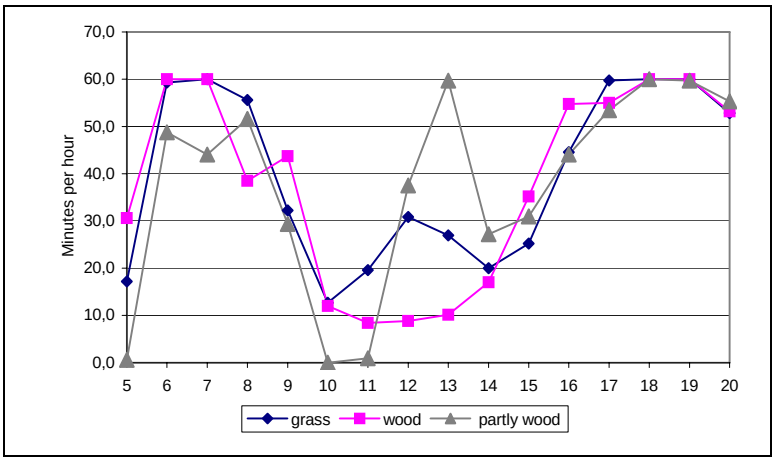
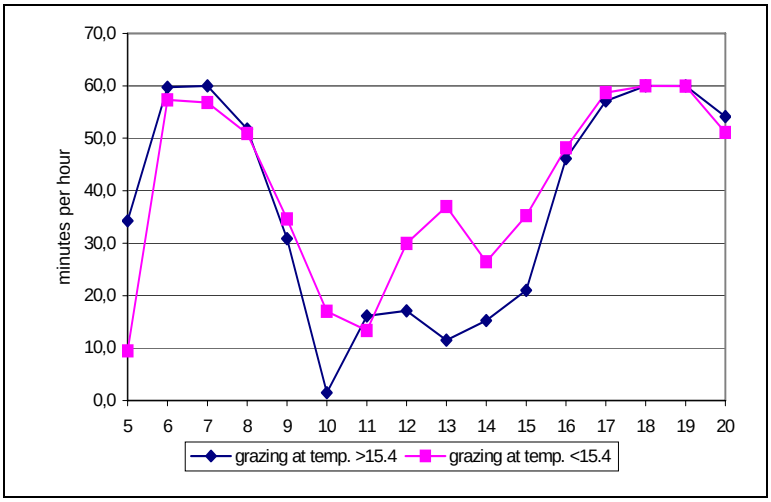


Figure 3

Grazing rhythm at temperatures above and below the average daily temperature



Resting

Resting in lying position and resting in the flock had almost the same percentage as total resting time (46–47%). As shown in *Figure 4*, the third type of resting in standing position had the lowest percent, only about 7% of the total resting time. Statistical analysis showed significant effect of the type of paddock on the resting time ($P<0.01$). The effect of the consecutive day after moving into another paddock on the resting time was also significant ($P<0.001$). During hot weather sheep were resting in the shade under

the trees, except in grass paddock which was without a shade. Resting in the flock appeared to be most frequent. Sheep formed subgroups of different sizes.

In a sunny weather, sheep usually stretched their necks or even pushed their heads under the other animal's belly. *Lynch et al.* (1992) reported that during the summer period sheep preferred resting in the shade under the trees, and if no shade was available sheep spent many hours resting at the highest site of the paddock. As shown in *Figure 1*, total resting time was on average 6 hours per observation period of the day. *Lynch et al.* (1992) also reported that the total resting time was 10 hours per day. As shown in *Figure 5*, the daily rhythm of resting periods was converse to the daily rhythm of grazing (*Figure 2*).

Figure 4

The rate of different type of resting in total resting time per paddock

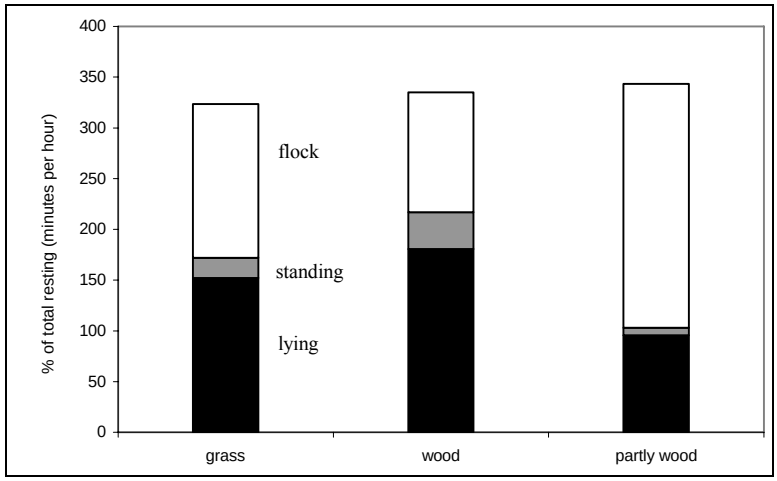
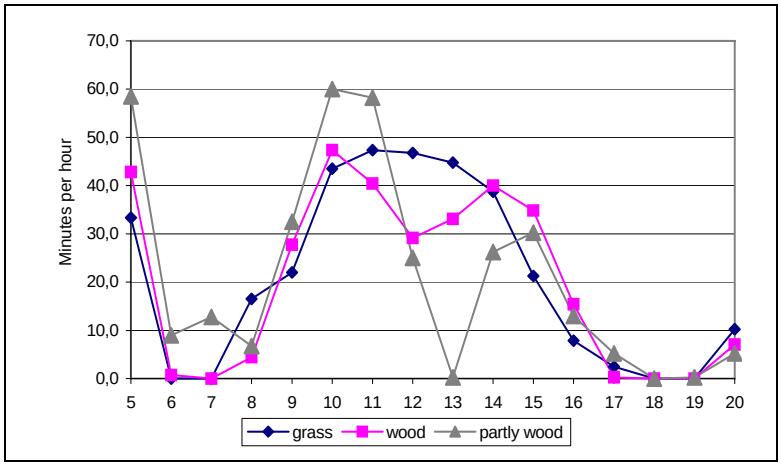


Figure 5

Daily resting rhythm in grass, woody, and partly woody paddock



Drinking

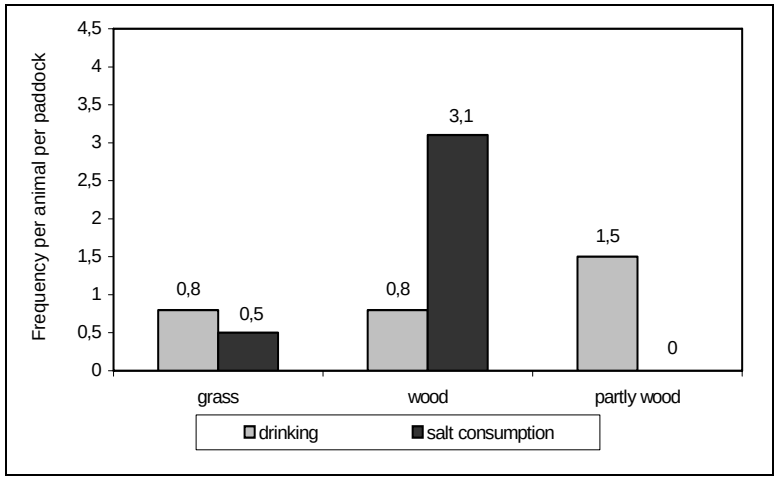
All animals had free access to water. We noticed that the animals tended to be synchronous in their going to the water supply. When one or two animals started to approach the water supply the other animals followed. Similar findings were reported for sheep by *Vidrih et al*. (1996) and explained that drinking is a group activity (alelomimetic behaviour). As shown in *Figure 6*, drinking frequency was low during the observation time. We noticed that during observation, between 5 a.m. and 9 p.m., some sheep did not drink water at all. *Hecker* (1983) and *Kermauner* (1996) reported that sheep may graze without having the access to water for a long period. *Lynch et al.* (1992) reported that during summer sheep should drink at least once a day. Otherwise, they tend to reduce the grazing time in the heat and increase grazing at night and early in the morning, when dew is on the grass. Due to our calculation the average drinking frequency was 0.99 per animal during our observation time. Drinking frequency was higher in the morning between 8 a.m. and 9 a.m., and in the afternoon between 3 p.m. and 7 p.m. Drinking frequency was also higher in partly woody paddock and lower in grass and in woody paddock.

Salt consumption

Animals had free access to the salt-lick. Frequency of the salt intake was higher in woody and lower in grass paddock. As shown in *Figure 6*, animals did not consume salt in partly woody paddock during our observation time. The salt intake frequency was higher in the morning between 6 a.m. and 8 a.m. and in the afternoon between 5 p.m. and 9 p.m. *Vidrih* (1996) analysed the leaves of the hazel and beech tree and found out that leaves contained 0.15–1.17 g sodium/kg of dry matter. Sheep under 50 kg of body weight need 1.5 g of sodium in dry matter for normal life. In woody paddock animals were chewing the bark of a tree or wood itself. *Kermauner* (1996) reported that chewing was a consequence of the lack of sodium.

Figure 6

Frequency of drinking and salt consumption per animal per paddock

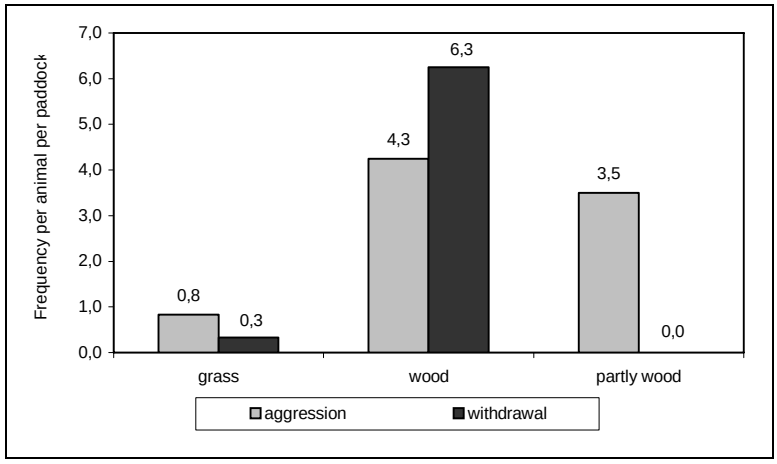


Aggressive behaviour and withdrawal

The frequencies of aggressive behaviour and withdrawal were very low. More frequent was the aggressive behaviour around salt and drinking trough. In woody paddock aggressive behaviour was higher probably because of the bushes (*Figure 7*). When animals (mostly goats) reached branches and pulled them down, all animals wanted to eat. Such situations were in most cases the reason for aggressive behaviour. Animals butted with the head into the side or rump of the other animal. In such situations the goats were more active, therefore increased withdrawals were noticed in sheep (*Figure 7*). Similar findings were reported by *Lynch et al*. (1992).

Figure 7

Frequency of aggressive behaviour and withdrawal per animal per paddock

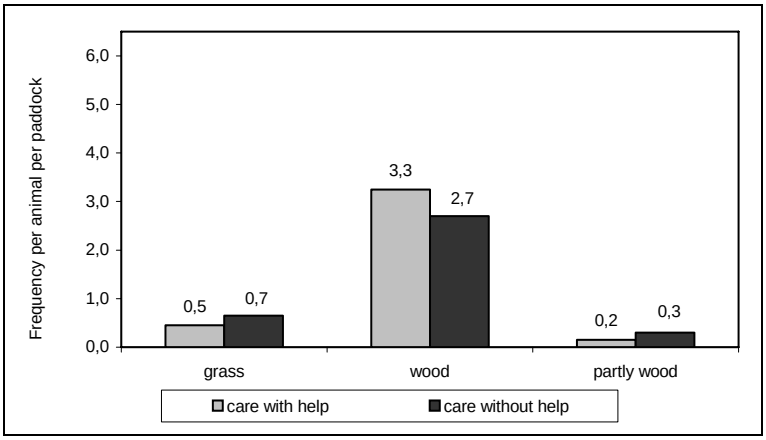


Comfort behaviour

Fraser and *Broom* (1990) explained comfort behaviour as: licking of the body, biting, skin care, rubbing of the horns, neck, muzzle, face and scratching with a leg. In partly woody and woody paddock they used trees and bushes as a help in comfort behaviour. For this purpose we placed a woody timber into grass paddock. As shown in *Figure 8*, frequency of selfcare with or without help was higher in woody paddock than in partly woody and in grass paddock. Animals took care of the neck, lateral and back side of the body with the help of trees and bushes. Similar findings were reported by *Fraser* and *Broom* (1990) who maintained, that animals took care of their bodies with the help when they could not reach the definite part of the body. These parts are often head, neck and hips which they care for with the help of rubbing them at a pillar, a tree, a door or a fence. Biting definite part of the body or scratching with a leg is considered as a care without any outside help, similar as was explained by *Fraser* and *Broom* (1990). Frequency of the care with help was 1.33 per day, and frequency of the care without help was 1.27 times per day in our case.

Figure 8

Frequency of comfort behaviour per animal per paddock



CONCLUSIONS

During the observation time between 5 a.m. and 9 p.m., sheep were grazing on average 10.5 hours per day. The type of paddock influenced the duration of grazing time and daily rhythm of the sheep. During the afternoon heat animals moved to the shade, if available. Shade should be provided if not available in the paddock. Drinking frequency was very low, only 0.99 per animal per day. Salt consumption frequency was the highest in woody paddock, which can be explained by the lack of sodium in the leaves and branches that are also often eaten. The aggression frequency was very low. The highest number of aggression and withdrawal was during the hustling for branches in woody and partly woody paddock. In the other paddock the aggression and the hustling appeared only around the salt lick. The frequency of comfort behaviour was the highest in woody paddock, despite the fact that the animals had wooden timber for this purpose in grass paddock.

ACKNOWLEDGEMENTS

The authors of this paper would like to thank to Andreja Komprej and Spela Malovrh for the statistical assistance.

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