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Feeding behaviour of grazing and zero-grazing goats fed with the same herbage

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SUMMARY - The aim of this experiment was to investigate the influence of the different modalities of herbage utilization on goat feeding behaviour. The experiment was carried out at the beginning of spring. Two groups of six dry goats were used. The first group (Grazing) grazed for eight hours/day a native pasture, the second one (zero-grazing), allocated in metabolic cages, was fed with the same herbage of the first group offered *ad libitum*. The percentage of grasses and forbs species was not influenced by herbage utilization modalities, on the contrary, that of the legumes was influenced. The diet was poorer in legumes in the grazing group than in the zero-grazing one. Despite the lower percentage of legumes in the grazing goats, crude protein (CP) content was about 6% higher in the grazing group. On the other hand neutral detergent fibre (NDF) and crude fibre (CF) were 5 and 7 points higher in the zero-grazing group. The result of this research show that the selective ability of zero-grazing goats was much lower than that of grazing goats.

Key words: Herbage utilization, feeding behaviour, grazing, zero grazing, goats.

RESUME - "Comportement alimentaire de chèvres en pâturage et zéro-pâturage alimentées avec le même herbage". L'objectif de cette expérience était d'étudier l'influence des différentes modalités d'utilisation de l'herbage sur le comportement alimentaire des chèvres. L'expérience a été menée au début du printemps. On a utilisé deux groupes de six chèvres taries. Le premier groupe (pâturage) a pâture pendant huit heures/jour sur une prairie naturelle, le deuxième groupe (zéro-pâturage), placé dans des cages métaboliques, recevait *ad libitum* le même herbage que le premier groupe. Le pourcentage d'espèces herbacées et à feuille large n'était pas influencé par les modalités d'utilisation de l'herbage, tandis qu'au contraire les légumineuses subissaient cette influence. Le régime était plus pauvre en légumineuses dans le groupe en pâturage que dans le groupe de zéro-pâturage. Malgré le pourcentage plus faible de légumineuses chez les chèvres en pâturage, la teneur en protéine brute (CP) était d'environ 6% de plus chez le groupe en pâturage. D'autre part, la fibre neutro-détergente (NDF) et la fibre brute (CF) étaient de 5 et 7 points plus élevées chez le groupe de zéro-pâturage. Le résultat de cette étude montre que l'aptitude sélective des chèvres en zéro-pâturage était bien moindre que celle des chèvres en pâturage.

Mots-clés : Utilisation de l'herbage, comportement alimentaire, pâturage, zéro-pâturage, chèvres.

Introduction

Animal feeding behaviour has been the object of numerous studies and there are a number of explanatory theories regarding the principles of herbage selection by grazing animals, (Arnold and Hill, 1972; Arnold, 1985; Dumont, 1995). Studies conducted in recent years on feeding behaviour of grazing goats by Masson *et al.* (1991), Fedele *et al.* (1993a,b), Meissner and Paulsmeier (1995), showed that this behaviour is influenced by a number of frequently interacting factors: herbage availability, nutritive and floristic composition of the herbage, plant morphology and vegetation development. Feeding behaviour knowledge is of fundamental importance in grazing management, especially with regard to the determination of opportune feeding strategies and the type and quantity of concentrates to distribute. The aim of this experiment was to investigate the influence of the different modalities of herbage utilization, grazing and zero-grazing, on feeding behaviour.

Materials and methods

The study was carried out at the beginning of spring at the Istituto Sperimentale per la Zootecnia, Bella, Italy, 360 m above sea level. The Mediterranean vegetation is exclusively herbaceous. Annual

rainfall varies from 600 mm to 1100 mm. About 70% of the rainfall occurs during the winter, while during the summer the rainfall is practically zero.

Two groups of six dry goats were used, the first group (*Grazing*) grazed a native pasture for eight hours/day, the second one (*Zero-grazing*), allocated in metabolic cages, was fed with the same herbage offered *ad libitum*.

In the grazing group, four esophageal-fistulated goats were used to collect samples of select diet, and six goats, harnessed with faecal collection bags, were used to collect faecal samples. Herbage intake of zero-grazing goats was calculated by taking into account the faeces output and the *in vitro* digestibility of freeze-dried bolus, using the procedure of Tilley and Terry (1963).

Bolus samples were collected for 8 consecutive days, at 8:30 a.m. and 4:30 p.m. The animals grazed for 40-60 min prior the collection of the samples. Faecal output of each goat was collected daily, weighed and dried at 64°C.

In the zero-grazing group, botanical and chemical composition of herbage intake was determined by differences between herbage offered/herbage refused.

Herbage samples were analysed for dry matter (DM) (AOAC, 1990), crude protein (CP), crude fibre (CF) and neutral detergent fibre (NDF) (Goering and van Soest, 1970).

Analysis of variance procedures were used to test for differences between groups (SAS, 1987).

Results

Results shown in Table 1 reveal no significant differences between botanical composition of the pasture and that of herbage offered to the zero-grazing goats. As regard the diet, there was an effect of the feeding system only on the legumes which were higher ($P<0.05$) on zero-grazing group than in grazing one (15.2% vs 9.9%).

Table 1. Herbage and diet botanical composition (means \pm s.d.)

	Grazing		Zero-grazing		Feeding system effect
	x	s.d.	x	s.d.	
	Pasture		Offered herbage		
Grasses	56.4	2.8	58.1	5.4	NS
Legumes	14.4	0.7	13.2	4.7	NS
Forbs	29.2	2.5	28.7	9.3	NS
	Diet		Diet		
Grasses	65.4	2.9	60.5	8.3	NS
Legumes	9.9	4.0	15.2	6.8	*
Forbs	24.7	2.8	24.3	10.5	NS

NS: non-significant; * $P<0.05$

Diet CP content was about 6 points higher in the grazing goats, 17.3% vs 11.6% ($P<0.001$). On the other hand, NDF and CF were 5 and 7 points higher in the zero grazing group, 46.6% vs 39.1% and 24.5% vs 18.9% respectively ($P<0.01$) (Table 2).

Table 2. Dry matter intake (DMI) (g/head/day) and chemical diet composition (means \pm s.d.)

	Grazing		Zero-grazing		Feeding system effect
	x	s.d.	x	s.d.	
DMI	847	140.0	1131	359.8	*
Crude protein	17.3	2.4	11.6	1.1	***
Crude fibre	18.9	2.2	24.5	1.3	***
Neutral detergent fibre	39.1	3.8	46.6	1.7	***

*P<0.05; ***P<0.001

Discussion

The feeding system influences the goat selective capacities. Zero-grazing goats cannot explore all the plants distributed and they are unable to choose either the type or the part of the plants they prefer, as they normally do in grazing situations. For this reason, the herbage intake composition of zero-grazing goats does not differ greatly from that of pasture.

In the grazing situation, the goats selective capacity is fully operative. They can examine, explore and take the agreeable plants and refuse disagreeable one. Legumes, rich in simple and polymerized phenols, saponins and therpens, have low levels of palatability and digestibility (Narjissee, 1991) and tend to be refused (Clark *et al.*, 1982; Mitchel, 1986; Fedele *et al.*, 1993b).

Despite the lower percentage of legumes in the grazing goats diet, the CP content is significantly higher. This result could seem contradictory but it reflects the type of selection carried out by the goat. Zero-grazing goats eat almost the entire plant while grazing goats choose the most morphologically apical parts of the plant (leaf extremities, sprouts, flowers) (Fedele, 1996), which normally have a 30% higher proteic value than the rest of the plant (Lyttleton, 1973). Then the diet is richer in protein and less rich in CF and NDF.

These parameters indicate that the nutritive value of the diet of grazing goats is higher than that of the zero grazing goats. The lesser intake of the former is compensated by the greater nutritive value of the herbage. This does not exclude, however, that environmental conditions, temperature, humidity could have limited grazing time and thus herbage intake.

Conclusion

Although goats are generally recognized as having highly developed selective capacities both in housed and grazing environments (Morand-Fehr, 1981), the results of this research show that this capacity is not manifest in the zero-grazing goats or at least not to any significant extent.

In the grazing situation this capacity is surprisingly high especially with regard to the improvement in the nutritive parameters of the diet.

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