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Meal criterion and feeding behaviour in sheep and goats

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Abstract. The present study is aimed to determine meal criterion and other eating behavioural parameters for sheep and goats. Three non-lactating sheep and 3 non-lactating goats were fed with a total mixed ration having 50/50 roughage to concentrate ratio *ad-libitum*. Grounded alfalfa hay having 1.5-2 cm size was used as roughage. Meal pattern of each animal was recorded by electronic feeder scales (30±0.005 kg of capacity) connected to a computer with R-S232 multiplier. The system recorded meal length (beginning date-time and ending date-time for bout) and bout-size (beginning weight and ending weight) for each balance, getting stability after 5 seconds and 30 g feed consumed from the scale feeder for 24 h during 30 days. At the end of study it was obtained that mean value for meal criterion was 13.19 min for goats and 21.84 min for sheep, while inter-meal interval (89.04 min for goat *vs* 105.07 for sheep), meal length (25.41 min for goat *vs* 20.67 min for sheep), meal size (161.20 g/meal for goat *vs* 158.06 g/meal for sheep), eating rates (9.98 g/min for goat *vs* 13.46 g/min for sheep), total feed intake (1.71 kg/day for gout 1.39 kg/day for sheep) and total eating length (269.56 min/day *vs* 185.93 min/day) did not change significantly with respect to species (P>0.05) except meal number (10.75 for goat *vs* 8.94 for sheep). In conclusion, goats have lower meal criterion as a reflection of higher meal number when compared to sheep.

Keywords. Sheep – Goat – Meal criterion – Meal size – Meal number – Meal length.

Critère de repas et comportement d'alimentation chez les moutons et les chèvres

Résumé. *La présente étude est visée pour déterminer le critère de ventrée et d'autres paramètres d'habitudes de consommation des moutons et des chèvres. Trois moutons non allaitants et 3 chèvres ont été alimentés* ad-libitum *avec une ration mélangée totale ayant un rapport fourrages : contentrés de 50:50. Le foin de luzerne ayant la taille de 1,5-2 cm a été employé comme fourrage. Le modèle de ventrée de chaque animal a été enregistré utilisant les balances électroniques (30±0,005 kilogramme de capacité) reliées à un ordinateur avec un multiplicateur RS232. Le système a enregistré la longueur de ventrée (date-heure de début et de terminaison par accès) et la quantité mangé par repas (poids de commencement et poids final) pour chaque balance en obtenant la stabilité après 5 secondes d'alimentation 30 g consommés pour 24 h pendant l'étude de 30 jours. À la fin de l'étude on a obtenu que la valeur moyenne pour le critère de ventrée était 13.19 minutes pour des chèvres et 21,84 min pour des moutons alors que l'intervalle d'inter- ventrée (89,04 min pour la chèvre contre 105,07 min pour des moutons), longueur de ventrée (25,41 min pour la chèvre contre 20,67 min pour des moutons), taille de repas (161,20 g/repas pour la chèvre contre 158,06 g/repas pour des moutons), rythme d'ingestion (9,98 g/min pour la chèvre contre 13,46 g/min pour des moutons), ingestion totale (1,71 kg/jour contre 1,39 kg/jour) et longueur totale de consommation (269,56 minutes/jour contre 185,93 minutes/jour) n'étaient pas changés significativement selon l'espèce (P>0,05) excepté le nombre de repas (10,75 pour la chèvre contre 8,94 pour des moutons). En conclusion les chèvres ont un critère de repas inférieur aux moutons comme réflexion du nombre élevé de repas comparé aux moutons.*

Mots-clés. *Mouton – Chèvre – Critère de repas – Taille de repas – Nombre de repas – Longueur de repas.*

I – Introduction

There are several methods to study the feeding behaviour of animals (Abijaoudé *et al*., 1999). They vary from direct observation (Bourbouze, 1980; Schwartz *et al.,* 1985) to the utilization of sophisticated electronic and computerized equipments. Electronic data recordings appear to be the most adapted methods. Recently, computerized systems were used by the most of the researchers (Tolkamp and Kyriazakis, 1999a,b; DeVries *et al*., 2003; Gorgulu *et al*., 2008; Boga *et al*., 2008). Clusters considered as bout or meal can be separated by proper model obtaining proper statistical techniques (Tolkamp and Kyriazakis, 1999a,b). These systems can separate feeding events from a very short to very long intervals within a bout or meal. Feeding behavior could be defined by obtaining biologically sound meal criteria (minimum interval between meals). Information about diurnal feeding activity is essential for feeding systems and feeding apparatus design, and getting information about composition and physical characteristics of feed consumed in choice fed animals to understand nutritional requirement of animals. Generally these studies have been carried out on dairy cattle in farm conditions (Forbes *et al*., 1986; Tolkamp and Kyriazakis, 1999a,b; De Vries *et al*., 2003, Boga *et al*., 2008) whereas limited studies (Gorgulu *et al*., 2008) are available for small ruminants.

The present study was therefore aimed to design a computerized feeding system to get reliable data for analyzing diurnal feeding activity and to compare sheep and goats for feeding pattern in confined condition.

II – Material and methods

The experiment was carried out at Cukurova University Agricultural Faculty Sheep and Dairy Goat Research Farms under semi-intensive conditions at Adana (36º 59' N, 35º 18'E) in the Eastern Mediterranean region of Turkey. Three yearlings crossbred ewes (25% Awassi+25% Chios+ 50% Rambouillet, 56.6 kg live weight) and three Saanen goats (51.9 kg live weight) were used. Animals were fed *ad-libitum* with a total mixed ration having 50/50 roughage to concentrate ratio. Each animal was housed in an individual 1.5 m x 1.5 m sized pen, having one trough sizing 0.4 m x1.2 m with 15-l bucket for fresh water. The study lasted totally 30 days after one week adaptation period to pen and diet. Meal consuming pattern of each animal was recorded by using electronic feeder scales connected to a computer with RS232 multiplier. The system recorded meal (beginning date-time and ending date-time for bout) and bout size (initial weight and final weight) for each balance with getting stability after 5 seconds and 30 g feed consumed from the scale feeder, for 24 h during 30 trial days.

Meal criteria were calculated as the point at which the probability density functions of the final two populations cross from the parameters of the two and three-population Gaussian models which minimizes the mis-assignment of intervals to the wrong populations (Tolkamp and Kyriazakis, 1999a,b; Yeates *et al*., 2001). The models were fitted using nonlinear curve fitting in GraphPad Prism (2005, Version 4.03) to the pooled and loge-transformed interval lengths (expressed in second) between feeding events.

Obtained data of experiment were analyzed by GLM procedure of SPSS.

III – Results and discussion

Time spent eating and the pattern of meals has important effects on total daily intake of animals. Due to these facts, research based on nutrition and management has focused not only on changes in intake, but also on changes in feeding behavior. The eating patterns results over a 24-hour period are shown in Table 1.

Table 1. Eating patterns of the experimental sheep and goats

Traits	Goat	Sheep	SEM	P-value
Meal criterion (min)	13.19	21.84	–	–
Meal number (number/day)	10.75	8.94	0.45	0.05
Meal size (g/meal)†	161.19	158.06	16.41	0.89
Meal length (min)	25.41	20.67	2.67	0.27
Intermeal interval (min)	89.04	105.07	5.80	0.12
Feed intake (g/day)†	1709.63	1391.76	114.05	0.12
Total meal time (min/day)	269.56	185.93	29.15	0.11
Rate of feed intake (g/min)†	9.98	13.46	1.34	0.14

† As fed.

According to evaluated data, it could be said that goats are more active than sheep, although only the data related to the number of meals were statistically significant ($P<0.05$). The values related to meal size, meal length, feed intake and total meal time were numerically higher in goats than in sheep but the differences were not statistically significant ($P>0.05$). Qinisa and Boomker (1998) revealed that goats consumed more feed than sheep when the protein supplement contained more protein. High variation among animal is common in feeding behavior studies. It is the case in the present study beside limited animal number in the study. Previous studies have suggested that eating behaviour (meal criterion and other eating behaviour parameters) may vary among animal types, depending on the stage of production and physiological state of the animal (e.g.Gorgulu *et al*., 2008).

Gorgulu *et al*. (2008) reported that the meal criterion, meal size, meal length, intermeal interval and meal number of lactating goats fed *ad-libitum* were, respectively, 12.88 min, 203.42 g intake/meal, 33.08 min/meal, 76.91 min and 13.25. Keskin *et al*.(2005) reported that sheep ate higher amount of feed than goats since they were heavier than goats. They also reported that sheep and goats represented similar eating and ruminating behaviour, but goats showed less drinking and standing, and higher playing and resting activities than sheep.

In order to define a meal, a criterion (minimum interval between different meals) is required to separate from both short and long intervals. Determining biologically reliable meal criterion (intermeal interval) is essential for defining whole feeding activities of animals. It is obvious that computerized system is good application to determine such behaviour of animals.

The study indicated that feeding behaviour in sheep and goat are similar except for number of meals in a day that is higher is goats than in sheep. However it is necessary to carry out new studies to learn more about feeding behaviour issues of sheep and goats by increasing the number of animals as there was high variation among individuals for feeding behaviour.

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