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Ingestive behavior of lambs or hoggets fed on high-concentrate diets of maize or sorghum[1]

Comportamento ingestivo de cordeiros ou borregos alimentados com dietas de alto concentrado de milho ou sorgo

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ABSTRACT - The aim of this study was to evaluate the ingestive behaviour of lambs or hoggets, finished in confinement on high-concentrate diets based on maize or sorghum grain. A total of 32 animals were used, 16 lambs (milk teeth) and 16 hoggets (2 teeth), which were distributed in a completely randomised experimental design and a 2 x 2 factorial scheme (two categories x two types of grain). In the categories under evaluation (lambs and hoggets), a significant difference ($P \leq 0.05$) was found for total chewing time, idle time and other activities (expressed in min/day and as a percentage), number of meals per day, time spent per meal and for the weight of dry matter or NDF ingested per meal (g/DM per REF and g/NDF per REF respectively). For the grain under test (maize or sorghum), significant differences ($P \leq 0.05$) were seen in feeding time, total chewing time and idle time (expressed in min/day and as a percentage) and for feed efficiency (g DM/h and NDF/h). Differences in the nutritional demands of lambs and hoggets, and in the composition of high-concentrate diets of maize or sorghum, cause changes in some characteristics of the ingestive behaviour of the animals.

Key words: Animal category. Confinement. Sheep.

RESUMO - Objetivou-se avaliar o comportamento ingestivo de cordeiros ou borregos terminados em confinamento com dietas de alto concentrado à base de grão de milho ou de sorgo. Foram utilizados 32 animais, sendo 16 cordeiros (dente de leite) e 16 borregos (2 dentes)**,** os quais foram distribuídos em um delineamento experimental inteiramente casualizado, em esquema fatorial 2 x 2 (duas categorias x dois grãos). Nas categorias avaliadas (cordeiros e borregos), verificou-se diferença significativa ($P \leq 0,05$) para tempo de mastigação total, tempo em ócio e outras atividades (expressos em min/day e percentagem), número de refeições por dia, tempo despendido por refeição e para peso de matéria seca ou de FDN ingeridos por refeição (g/MS por REF e g/FDN por REF, respectivamente). Já para os grãos testados (milho ou sorgo) foram observadas diferenças significativas ($P \leq 0,05$) no tempo de alimentação, tempo de mastigação total e tempo em ócio (expressos em min/day e percentagem) e para eficiência de alimentação (g MS/h e g FDN/h). Diferenças existentes nas exigências nutricionais de cordeiros e borregos e na composição bromatológica de dietas de alto concentrado de milho ou de sorgo fazem com que ocorram alterações em algumas características do comportamento ingestivo dos animais.

Palavras-chave: Categoria animal. Confinamento. Ovinos.

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INTRODUCTION

Throughout history, the traditional aim of sheep farming was to profit from the production of the wool industry. It also typically presented large-scale systems of sheep-breeding in natural pasture. However, the present situation is of breeding animals for meat production as the product is highly valued, with the activity consequently becoming very profitable.

As a result, production systems have also undergone changes in recent years, with an increase in the use of confinement. Carvalho *et al.* (2014) note that finishing sheep under a confinement system is of interest, as it supplies feed that meets the nutritional demands of the animals when forage production is scarce, in addition to providing quality mutton or lamb in the off-season, thereby increasing the commercial value of the product.

With the confinement system, the use of high-concentrate diets has been gaining ground in the area of sheep farming due to being easier to manage and, as a result, requiring less manpower, a limiting factor in current livestock production. To this effect, the use of high-energy ingredients such as maize and sorghum may influence the ingestive behaviour of the animals.

However, in diets of high energy density in relation to the animal's requirements, and which are low in neutral detergent fibre (NDF), intake may be limited by energy demand (MAIA *et al*., 2014). For Mendes *et al.* (2010), it is important to use a minimum of fibre content in high-concentrate diets, as this stimulates chewing and promotes an appropriate rumen environment, thus not compromising performance.

The characteristics of ingestive behaviour among categories of animals may differ, due to differences in their physiology, size, weight, and nutritional demands, among others. According to Cirne *et al.* (2014), the study of ingestive behaviour is therefore a great tool for adjusting feed management in animals. However, there are few studies on the differences related to ingestive behaviour among sheep categories in a confinement system.

The aim of the present study therefore, was to evaluate the ingestive behaviour of lambs and hoggets finished in confinement on high-concentrate diets based on maize or sorghum grain.

MATERIAL AND METHODS

The work was carried out at the Sheep Breeding Laboratory of the Department of Animal Science at the Federal University of Santa Maria, in Santa Maria, in the State of Rio Grande do Sul, from November 2013 to January 2014. The region, known physiographically as the Central Depression, is located at 29º43' S and 53º42' W, at an altitude of 95m. The climate according to the Köppen classification is type Cfa (subtropical moist) (MORENO, 1961). The experiment was conducted following the ethical standards of, and approved by the Internal Committee for Ethics in Animal Experimentation of the above institution (Protocol 059/2014).

Thirty-two Corriedale sheep were used, comprising 16 lambs (milk teeth, with an initial live weight of 22.11 ± 1.83 kg, at 60 days of age) and 16 hoggets (2 teeth, with an initial live weight of 33.76 ± 2.52 kg, at 360 days of age). All were castrated males from the same herd, and therefore of similar genotype. The animals were confined in individual, fully covered stalls, each 2 m^2 in size with a slatted floor, and equipped with an individual feeder and drinking fountain.

The diet for each category was of isoprotein, consisting of white oat hay (*Avena sativa*) with maize (*Zea mays*) or sorghum (*Sorghum bicolor* (L.) Moench) grain, and offered whole to the animals. To meet the demands of each category for crude protein and minerals, soybean meal (*Glycine Max*) and calcitic limestone were added respectively, as per the NRC (2007) to achieve a weight gain of 200 g/day. Sodium bicarbonate ($NaHCO_3$) was also used in the proportion of 1% of the total DM offered, monensin sodium (Rumensin) was used according to the manufacturer's recommendations, and common salt was provided at will in individual containers. The diet was offered in the form of a complete mixture, at a forage to concentrate ratio of 10:90, based on the dry matter content.

Table 1 shows the chemical and bromatological composition of the feed used, and Table 2, the proportion of ingredients and the bromatological composition of the experimental diets.

The feed was offered to the animals *ad libitum*, once a day at 0800. The quantity offered was adjusted according to the daily-observed surplus, which should be 10% of the amount offered the previous day, so as to guarantee maximum voluntary intake by the animals.

During the period of confinement (a total of 51 days), two observations were made of the animals' ingestive behaviour for a period of twenty-four hours, which began at eight o'clock in the morning and went on until eight o'clock the following morning. The evaluations were made by 2 trained observers who were replaced every 4 hours. The first period of observation took place five days after the beginning of the experimental period of confinement, and the second, fourteen days after the first experimental period. During these periods of evaluation, the time spent on feeding, rumination, leisure and other

Table 1 - Average levels of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fibre (NDF), acid detergent fibre (ADF), total carbohydrates (TC), non-structural carbohydrates (NSC), ashes (ASH), total digestible nutrients (TDN), calcium (Ca) and phosphorus (P), of the ingredients used in formulating the experimental diets

Item (%)	Oat Hay	Maize, grain	Sorghum, grain	Soybean Meal	Sodium Bicarbonate	Calcitic Limestone	Monensin Sodium
DM	89.99	90.98	90.70	92.50	99.00	99.27	98.00
OM	92.84	98.95	98.67	93.39	-	-	-
CP	5.94	8.96	8.42	52.30	-	-	-
EE	1.87	5.36	4.30	3.89	-	-	-
NDF	64.36	9.84	11.60	16.16	-	-	-
ADF	36.80	1.53	5.51	5.88	-	-	-
TC	85.02	84.64	85.96	37.20	-	-	-
NSC	20.67	74.79	74.35	21.04	-	-	-
ASH	7.16	1.05	1.33	6.61	-	-	-
TDN	55.58	86.03	78.80	80.73	-	-	-
Ca	0.44	0.03	0.04	0.33	-	37.70	-
P	0.24	0.25	0.28	0.88	-	0.02	-

Table 2 - Proportion of ingredients (%DM) and bromatological composition of the experimental diets

	Treatment			
	Lamb		Hogget	
	Maize	Sorghum	Maize	Sorghum
	Proportion of ingredients (%DM)			
Oat Hay	10.00	10.00	10.00	10.00
Maize, grain	60.82	-	77.81	-
Sorghum, grain	-	59.92	-	76.67
Soybean Meal	26.04	26.81	9.48	10.47
Sodium Bicarbonate	1.00	1.00	1.00	1.00
Calcitic Limestone	2.11	2.24	1.67	1.83
Monensin Sodium	0.034	0.034	0.034	0.034
	Bromatological composition (%DM)			
DM	91.53	91.39	91.24	91.06
OM	96.90	96.68	97.82	97.55
CP	19.66	19.66	12.52	12.52
EE	4.46	3.81	4.72	3.89
NDF	16.63	17.72	15.63	17.02
ADF	6.14	8.56	5.43	8.52
TC	69.66	69.98	77.89	78.30
NSC	53.03	52.26	62.26	61.28
ASH	3.07	3.28	2.16	2.43
TDN	78.93	74.45	80.18	74.46
Ca/P	2.50	2.50	2.50	2.50

(DM) dry matter; (OM) organic matter; (CP) crude protein; (EE) ether extract; (NDF) neutral detergent fibre; (ADF) acid detergent fibre; (TC) total carbohydrates; (NSC) non-structural carbohydrates; (ASH) ashes; (TDN) total digestible nutrients; (Ca) calcium; (P) phosphorus

activities, as well as the time spent standing or lying down, were observed at 10-minute intervals. The number of meals and ruminations per animal, and the amount of feed and insoluble neutral detergent fibre consumed or ruminated per activity, were also determined. Nocturnal observation of the animals was carried out using artificial lighting by incandescent lamps, which was kept on throughout the period of confinement.

Results referring to the characteristics of ingestive behaviour were obtained as per Carvalho *et al*. (2006), using the following equations:

EFD_{DM} = DMI/TFD

EFD_{NDF} = NDFI/TFD

where: EFD_{DM} (g DM consumed/h) and EFD_{NDF} (g NDF consumed/h) = feed efficiency; DMI (g) = daily dry matter intake; NDFI (g) = daily NDF intake; TFD = daily time spent on feeding.

ERU_{DM} = DMI/TRU

ERU_{NDF} = NDFI/TRU

where: ERU_{DM} (g DM consumed/h) and ERU_{NDF} (g NDF consumed/h) = rumination efficiency; TRU (h/day) = rumination time.

TCT = TFD + TRU

where: TCT (min/day) = total chewing time.

In the analysis of the data, the effect of sheep category, of the grain, and the category x grain interaction were tested by analysis of variance and F-test, adopting a 5% level of significance. The mean values were compared by Student's t-test, using the SAS (2014) statistical software package. The same program was used in the correlational study between the dependent variables, through calculation of the Pearson correlation coefficients. The mathematical model employed was:

$$Y_{ijk} = \mu + \alpha_i + ßj + (\alpha_* ß)_{ij} + \varepsilon_{ijk}$$

where: Y_{ijk} = Observation for animal k, of animal category i and high-concentrate diet j; μ = General mean for the observations; α_i = Effect of the animal category (i = lamb or hogget); ßj = Effect of the high-concentrate diet (j = maize or sorghum); $\alpha_*ß$ = Effect of the interaction; ε_{ijk} = Random error associated with each observation.

RESULTS AND DISCUSSION

For each of the variables analysed in this study, no interaction was found (P>0.05) between the animal category (lamb or hogget) and the high-concentrate diet (maize or sorghum), and therefore the results are presented separately.

The total chewing time (TCT), expressed in min/day and as a percentage, was greater (P≤0.05) for lambs than for hoggets (Table 3). Since the values obtained for rumination time (min/day and percentage), which also make up the equation for obtaining the TCT, are fairly close, this result can be explained by the feeding time. Carvalho *et al*. (2014) working with Texel and Ideal lambs fed on soybean hulls in confinement, found values similar to those of this study, with a value for TCT of 494.21 min/day.

In relation to the time for which the animals remained idle (min/day and percentage), the lamb category was superior to the hoggets. The nutritional demand of older animals (hoggets) is relatively smaller compared to growing animals (lambs), since young animals have a faster metabolism and thus require a greater proportion of nutrients. The hoggets therefore, due to a lower nutritional demand, spend less time on feeding in comparison to the lambs when similar diets are used, and consequently remain idle for a longer period during the day. In high-concentrate diets, this idle period varies from 840 to 1020 min/day under a confinement system (BÜRGER *et al*., 2000, CARVALHO *et al*., 2014, CARVALHO *et al*., MISSIO *et al*., 2010); whereas in this study, mean values of 905.66 and 969.37 min/day were found for lambs and hoggets respectively, results which agree with those obtained by the aforementioned authors.

For the other activities variable (OTH), in min/day and as a percentage, the lamb category was superior (P≤0.05) to the hoggets. Zanin, Fregonesi and Mangilli (2016) note that when any abnormality occurs in the animals' behaviour, it is due to the deficiency of an important element in their environment. The same authors report that young animals exhibit such behaviour as licking, nibbling, and sucking on objects. It should be emphasised that, lambs, possibly due to the recent stress of weaning, feel a greater need for recognition of the area and other animals, due to the absence of their mothers. They therefore spend more time on other activities, in a search for social interaction and a housing environment.

With the grains under test (maize or sorghum), significant differences (P≤0.05) were seen for the variables of feeding, total chewing time (TCT) and idle time (IDLE), expressed in min/day and as a percentage (Table 3).

The animals fed on maize spent more time on FEED (min/day and percentage) than the animals fed on sorghum. According to Rooney and Pflugfelder (1986), sorghum grain has lower digestibility than maize, due mainly to the presence of a peripheral endosperm in

the sorghum, which is extremely dense and resistant to digestion. Thus, sorghum grain takes longer to be degraded by rumen bacteria, and consequently, due to physiological impulses, the animal has the sensation of being satiated, unlike diets of maize grain, which has greater digestibility. Another aspect that may have had an influence, is that maize grain shows greater acceptability in comparison to sorghum grain. Barcellos *et al*. (2006) report that the tannin present in sorghum grain may affect the acceptability and digestibility of nutrients in the animals, which may also influence the time the animals spend on feeding.

The TCT (min/day and percentage) was found to be greater (P≤0.05) in animals fed on maize than on sorghum, this result being a direct consequence of the difference in the time spent on feeding.

It was found that the time the animals remained idle was greater (P≤0.05) in animals fed on sorghum grain than those fed on maize grain. This result was influenced by the TCT, which is calculated from the equation (TCT = FEED + RUM), since the shorter this period, the greater the period the animals remain idle. This assumption is based on the high Pearson correlation coefficient between IDLE and TCT (r = -0.97; P≤0.0001) (Table 6).

There was a significant difference (P≤0.05) in the grain under test (maize or sorghum) for feed efficiency (EFD), when expressed in g DM/h and g NDF/h (Table 4). For the other variables evaluated in relation to the grain under test and the animal categories, no significant differences were found (P>0.05).

The EFD (g DM/h) was greater in the animals fed on sorghum grain than in the animals fed on maize grain, which can be explained by the similarity in dry matter intake (DMI), and by the shorter feeding time of the animals that consumed sorghum in relation to those that consumed maize. The animals fed on sorghum grain ingested a greater amount of dry matter for a shorter feeding time, which increases the animals' EFD. This assertion is corroborated by Van Soest (1994), who stated that the feed efficiency at which the animal captures the feed correlates with the time spent on feed intake. The Pearson correlation coefficient in this study, between FEED and EFD (g DM/h) (r = -0.78; P≤0.001) (Table 6), confirms this assertion. The same behaviour for this variable was described by Missio *et al*. (2010) when working with bulls finished in confinement and fed on diets with different levels of concentrate, who demonstrated that shorter feeding times displayed greater values for food efficiency, and also that these variables had a high Pearson correlation coefficient (r = -0.86; P≤0,0001) (Table 6).

The animals fed on sorghum grain were also superior for EFD, expressed in g NDF/h, compared to those fed on maize grain. This result is due to the

Table 3 - Mean values for the characteristics of ingestive behaviour, in minutes and as a percentage, in lambs and hoggets fed on high-concentrate diets

	Category		Grain		Probability*			CV† (%)
	Lamb	Hogget	Maize	Sorghum	Category	Grain	Category x Grain	
FEED (min/day)	208.12	180.62	221.25	167.50	0.1437	0.0045	0.5560	13.43
RUM (min/day)	271.56	267.50	279.68	259.37	0.8497	0.3470	0.0568	22.28
TCT (min/day)	490.66	448.12	513.33	426.87	0.0343	0.0003	0.0719	6.28
IDLE (min/day)	905.66	969.37	893.00	981.25	0.0072	0.0004	0.1207	3.27
OTH (min/day)	43.66	24.00	32.18	35.71	0.0104	0.2998	0.6413	19.01
STAND (min/day)	381.87	390.62	366.56	405.93	0.9873	0.2162	0.2644	3.29
LIE (min/day)	1056.56	1048.75	1072.81	1032.5	0.7783	0.1536	0.2174	7.38
FEED (%)	14.60	12.53	15.54	11.62	0.1437	0.0046	0.5551	13.43
RUM (%)	19.05	18.56	19.64	18.00	0.8501	0.3476	0.0569	22.28
TCT (%)	34.07	31.11	35.64	29.64	0.0342	0.0003	0.0719	6.28
IDLE (%)	63.55	67.26	62.72	68.09	0.0072	0.0004	0.1209	3.27
OTH (%)	2.80	1.66	2.10	2.29	0.0192	0.4068	0.6137	28.58
STAND (%)	26.55	27.13	25.46	28.22	0.9871	0.2161	0.2642	5.98
LIE (%)	73.45	72.87	74.54	71.78	0.7790	0.1536	0.2174	7.38

(FEED) feeding; (RUM) rumination; (TCT) total chewing time; (IDLE) idle time; (OTH) other activities and (STAND) standing or (LIE) lying down; †CV: Coefficient of variation; *(P≤0.05)

bromatological composition of the diet (Table 2), since the presence of NDF in the sorghum diet is greater than in the maize diet. It is important to emphasise that feed efficiency, expressed in g NDF/h, shows increasing linear behaviour due to the NDF in the diet and also the amount of food consumed, agreeing with the results of studies by Cardoso *et al*. (2006) and Hübner *et al*. (2008).

Significant differences (P≤0.05) were found between the categories under evaluation (lambs or hoggets) for number of meals (NREF), time spent per meal (min/REF), weight of dry matter ingested per meal (g/DM per REF) and weight of NDF ingested per meal (g/NDF per REF). For the remaining variables shown in Table 5, there were no significant differences (P>0.05) between animal category nor between the tested grains.

The superiority of the lamb category in relation to the hogget category for number of meals (NREF) is explained by the nutrient demand of each category to meet the requirements for maintenance and gain. To this effect, it is important to emphasise that the lambs were superior (P≤0.05) in relation to dry matter intake, when this was expressed as a percentage of live weight (%LW), with an intake of 3.71% LW, and the hoggets with an intake of 3.01% LW. Barros *et al*. (2014) stated that the nutrient levels required by the animals influence the number of meals.

It can be seen that hoggets spent more time per feeding activity (min/REF) and had a lower number of meals per day (NREF) compared to the lambs (Table 5).

It was therefore found that the lambs ingested feed more quickly and more times per day, this being a direct result of the greater nutritional requirement of the category, where the animals feed faster, possibly due to having a greater appetite, and more times per day, to

Table 4 - Mean values for dry matter intake (DMI) and neutral detergent fibre intake (NDFI), and for feed efficiency (EFD) and rumination efficiency (ERU) in lambs and hoggets fed on high-concentrate diets

	Category		Grain		Probability*			CV† (%)
	Lamb	Hogget	Maize	Sorghum	Category	Grain	Category x Grain	
DMI (kg/day)	0.978	1.070	0.992	1.055	0.2648	0.4320	0.2020	10.81
NDFI (kg/day)	0.167	0.173	0.160	0.180	0.5783	0.1363	0.3763	10.08
EFD (g DM/h)	311.84	347.28	281.10	380.07	0.2583	0.0304	0.3703	6.00
EFD (g NDF/h)	53.54	56.73	45.03	65.80	0.3551	0.0082	0.5878	8.34
ERU (g DM/h)	222.55	237.84	219.34	241.25	0.4389	0.3018	0.7433	4.55
ERU (g NDF/h)	38.01	38.84	35.88	41.12	0.7597	0.1344	0.4637	6.87

† CV: Coefficient of variation; *(P≤0.05)

Table 5 - Mean values for the number of meals (NREF) and ruminations (NRUM) in 24 hours, time spent per meal (min/REF) and rumination (min/RUM), weight of dry matter or NDF ingested per meal (G/DM PER REF and g/NDF per REF respectively) and weight of dry matter or NDF ruminated per rumination activity (g/DM per RUM and g/NDF per RUM respectively), in lambs and hoggets fed on high-concentrate diets

	Category		Grain		Probability			CV† (%)
	Lamb	Hogget	Maize	Sorghum	Category	Grain	Category x Grain	
NREF	13.53	10.03	12.78	10.78	0.0020	0.0602	0.9460	13.00
NRUM	16.90	17.78	17.50	17.21	0.4452	0.8452	0.0806	9.05
min/REF	15.28	18.37	17.92	15.73	0.0077	0.0517	0.4095	18.09
min/RUM	15.53	15.03	15.32	15.23	0.4460	0.8863	0.1055	6.20
g/DM per REF	76.42	105.71	84.21	97.40	0.0102	0.1731	0.1585	7.39
g/NDF per REF	13.09	17.23	13.45	16.85	0.0143	0.0608	0.2825	11.80
g/DM per RUM	57.24	61.77	55.80	63.22	0.4284	0.2302	0.8768	6.18
g/NDF por RUM	9.78	10.12	9.11	10.78	0.7393	0.0963	0.7870	11.19

†CV: Coeficiente de variação; (P≤0,05)

meet their nutritional needs. Carvalho *et al*. (2015), when working with confined lambs using high-density diets with an NDF content of 14.34%, found a mean value of 16.93 min/REF, agreeing with the present study. Carvalho et al. (2014) note that the shorter time spent per meal (min/REF) in high-concentrate diets compared to a diet with a large percentage of forage, is explained by the smaller size of each particle, since the smaller the particle of food, the greater amount of food the animal ingests per mouthful. Also, diets with a high percentage of grain, compared to those with a greater percentage of forage, have a higher energy density, making the animals feel satiated sooner, which leads to a reduction in the time spent on each meal.

For both the weight of dry matter ingested per meal (g/DM per REF), and the weight of NDF ingested per meal (g/NDF per REF), the hogget category was superior ($P \leq 0.05$) to the lamb category (Table 5), this being a result of the lower number of meals per day of the hogget category. Cirne *et al*. (2014) state that the number of meals is capable of influencing this variable. This is confirmed by the high Pearson correlation coefficient found in the present study between NREF and the weight of dry matter ingested per meal (g/DM per REF), where the correlation value was r = -0.80; $P \leq 0.001$, and also by the high correlation between the variables NREF and weight of NDF ingested per meal (g/NDF per REF), whose value was r = -0.75; $P \leq 0.001$ (Table 6).

In relation to the distribution of feeding and rumination activities over 24 hours, no differences were found between the animal categories nor between the grain types under test (Figure 1).

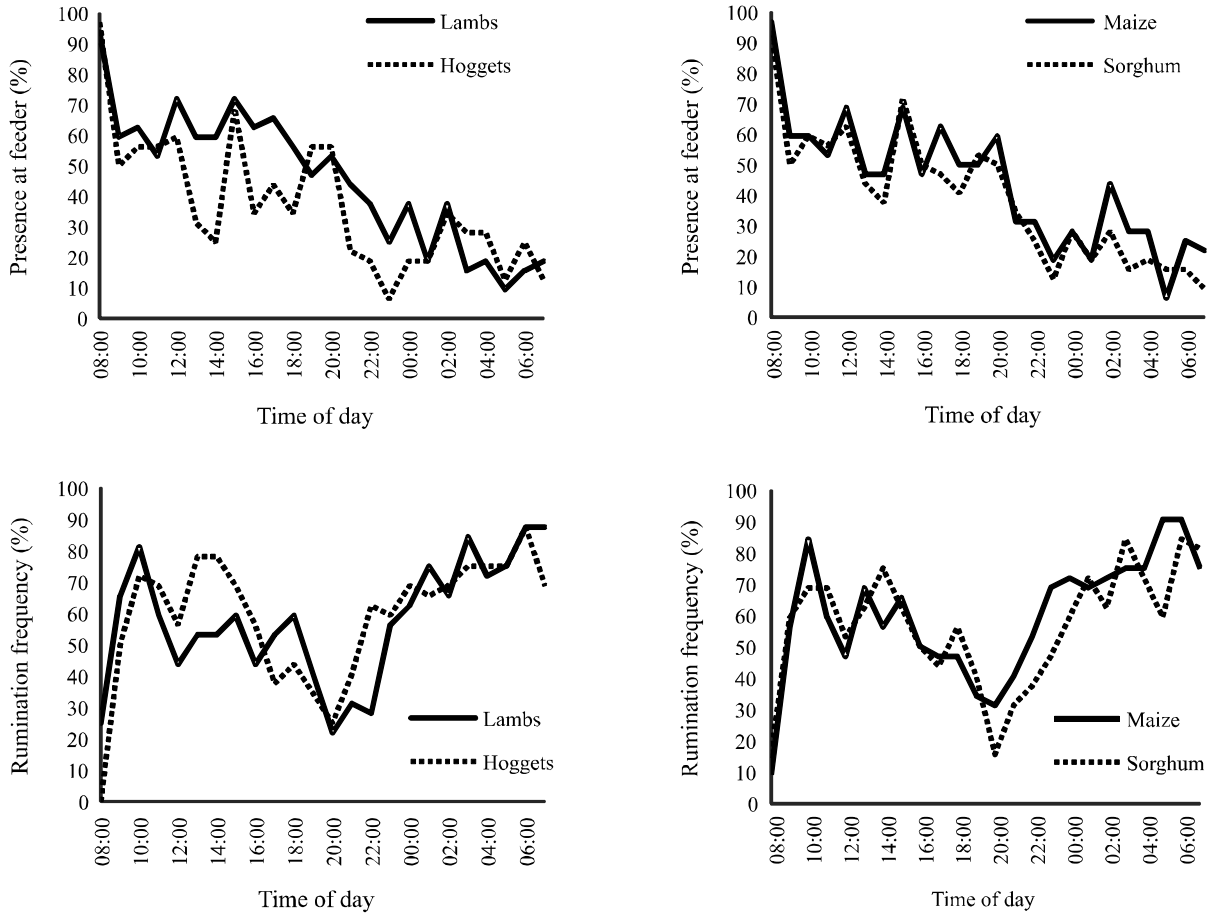
It can be seen that there is a peak in feeding concentrated around the time of the daily food supply, feeding time being at 0800. Freitas *et al*. (2010), evaluating the presence of animals at the feeder, found a greater presence close to the time of the food supply, showing the animals are conditioned to the routine of food-management. However, some peaks can be seen during the afternoon, a fact that can be explained by the movement of handlers in the installations during this period.

Rumination is more frequent at night, followed by the early hours of the morning. This result is similar to that found by Cardoso *et al.* (2006), who evaluated the ingestive behaviour of lambs fed on diets containing different levels of neutral detergent fibre under a confinement system. It was also found that during the period following feeding there is a higher frequency of rumination; Hübner *et al*. (2008) note that such behaviour is caused by rumen fill, and the subsequent need to process food through rumination.

Table 6 - Pearson correlation coefficients between characteristics of ingestive behaviour

Variable		FEED min/day	TCT min/day	IDLE min/day	FEED (%)	TCT (%)	IDLE (%)	EFD (g DM/h)	NREF	g/DM per REF	g/NDF per REF
FEED min/day	r	1.00	0.64	-0.66	1.00	0.64	-0.66	-0.78	0.79	-0.56	-0.67
	P		0.0001	<.0001	<.0001	0.0001	<.0001	<.0001	<.0001	0.0011	<.0001
TCT min/day	r		1.00	-0.97	0.64	1.00	-0.97	-0.38	0.49	-0.24	-0.47
	P			<.0001	0.0001	<.0001	<.0001	0.0383	0.049	0.1988	0.0077
IDLE min/day	r			1.00	-0.66	-0.97	1.00	0.40	-0.56	0.30	0.53
	P				<.0001	<.0001	<.0001	0.0293	0.011	0.1033	0.0021
FEED (%)	r				1.00	0.64	-0.66	-0.78	0.79	-0.56	-0.67
	P					0.0001	<.0001	<.0001	<.0001	0.0011	<.0001
TCT (%)	r					1.00	-0.97	-0.38	0.49	-0.24	-0.47
	P						<.0001	0.0383	0.0049	0.1986	0.0076
IDLE (%)	r						1.00	0.40	-0.56	0.30	0.53
	P							0.0293	0.0011	0.1032	0.0021
EFD (g DM/h)	r							1.00	-0.60	0.81	0.80
	P								0.0004	<.0001	<.0001
NREF	r								1.00	-0.80	-0.75
	r									<.0001	<.0001
g/DM per REF	P									1.00	0.95
	r										<.0001

Figure 1 - Distribution of feeding and rumination as a percentage during 24 hours of behavioural evaluation, in lambs and hoggets fed on high-concentrate diets



CONCLUSIONS

1. Lambs spend more time daily in total chewing and other activities, and remain idle for less time, when compared to hoggets. In addition, the lambs have more meals per day, and spend less time on each meal activity compared to the hogget category;
2. The use of high-concentrate maize diets allows the animals to spend more time on feeding and chewing, and less time idle, as well as having a lower feed efficiency than animals fed on high-concentrate sorghum diets.

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