

# EFFECT OF CONCENTRATE : VOLUMINOUS RATIO ON THE PERFORMANCE OF SANTA INÊS LAMBS

## Efeitos da relação concentrado:volumoso sobre o desempenho de cordeiros Santa Inês

Rodrigo Palomo de Oliveira<sup>1</sup>, Juan Ramón Olalquiaga Perez<sup>2</sup>, Joel Augusto Muniz<sup>3</sup>, Antonio Ricardo Evangelista<sup>4</sup>, José Camisão de Souza<sup>5</sup>, Aduino Ferreira Barcelos<sup>6</sup>

### ABSTRACT

The experiment was carried out in the sheep division of Universidade Federal de Lavras, aiming to evaluate the effect of different concentrate : voluminous ratio on the performance of Santa Inês lamb after wean. 40 lambs, male uncastrated, were used and fed with four different diets: diet A (100% concentrate), diet B (75:25 concentrate : voluminous) , diet C (50:50 concentrate : voluminous) , diet D (25:75 concentrate : voluminous). The experimental diets were isoproteic, differing only on its levels of concentrate : voluminous and balanced to meet the nutritional demands according to the recommendation of the Agricultural Research Council (1980). The experimental period was not pre-established, because it corresponded to the necessary period for the last lamb to reach the live weight of 35kg. The dry matter consumption (DMC), crude protein consumption (CPC), fiber in neutral detergent consumption (FNDC) and fiber in acid detergent consumption (FADC), were affected by the different concentrate : voluminous ratio, in which, the animals that received diets with higher concentrate inclusion presenting better results for the variables related to the development. The lambs fed with the diet containing higher inclusion of voluminous did not present weight gain, on the contrary, presented weight loss, since none of the animals reached slaughter weight and the mortality rate was extremely high (80%).

**Index terms:** Consumption, Santa Inês, sugar cane, nutrition, sheep.

### RESUMO

O experimento foi conduzido no Setor de Ovinocultura da Universidade Federal de Lavras, com o objetivo de avaliar os efeitos das diferentes relações concentrado:volumoso sobre o desempenho de cordeiros Santa Inês após o desmame. Foram utilizados 40 cordeiros, machos não castrados, que foram alimentados com quatro dietas: dieta A (100% concentrado), dieta B (75:25 concentrado:volumoso), dieta C (50:50 concentrado:volumoso) e dieta D (25:75 concentrado:volumoso). As dietas experimentais foram iso-protéicas, diferenciando apenas em seus níveis de concentrado:volumoso e foram balanceadas para atender às exigências nutricionais segundo as recomendações do Agricultural Research Council (1980). O período experimental não teve duração pré-fixada, pois correspondeu ao período necessário para que o último cordeiro atingisse o peso vivo de 35 Kg. Os consumos de matéria seca (CMS), consumos de proteína bruta (CPB), consumos de fibra em detergente neutro (CFDN) e consumos de fibra em detergente ácido (CFDA), foram afetados pelas diferentes relações de concentrado:volumoso, sendo que, os animais alimentados com dietas com maior inclusão de concentrado apresentaram os melhores resultados para as variáveis relativas ao desenvolvimento. Os cordeiros alimentados com a dieta com maior inclusão de volumoso não apresentaram ganho de peso, pelo contrário, apresentaram perda de peso, sendo que nenhum animal chegou ao peso de abate e a mortalidade foi extremamente alta (80%).

**Termos para indexação:** Consumo, Santa Inês, cana-de-açúcar, nutrição, ovinos.

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### INTRODUCTION

The growing demand for sheep meat, registered over the last years, propelled the increase in the lamb production for slaughter, creating a necessity of improvement in the exploration techniques. The feeding is one of the most important parts in animal production, and, associated with the confinement system, it is possible to maintain the same nutritional level during all the fattening period, different from pastures, which may present

nutritional difference because of oscillations in its quality. The confinement of just weaned lambs with the use of high concentrate level is very common, especially in some regions, where there are meat producing breeds, with great potential. The advantages of these systems include fast and efficient growth, when compared to animals raised in pastures for the same period of time (Notter et al. 1991).

The traditional ingredients such as corn, soya, wheat and cotton, are more convenient to be used in

<sup>1</sup>Doctor, professor of Departamento de Zootecnia – Escola Agrotécnica Federal de Inconfidentes/EAFI – Inconfidentes, MG – rodpalomo@yahoo.com.br

<sup>2</sup>Doctor, full professor at Departamento de Zootecnia – Universidade Federal de Lavras/UFLA – Lavras, MG

<sup>3</sup>Doctor, full professor at Departamento de Ciências Exatas – Universidade Federal de Lavras/UFLA – Lavras, MG

<sup>4</sup>Doctor, full professor at Departamento de Zootecnia – Universidade Federal de Lavras/UFLA – Lavras, MG

<sup>5</sup>Doctor, full professor at Departamento de Zootecnia – Universidade Federal de Lavras/UFLA – Lavras, MG

<sup>6</sup>Doctor, Researcher from EPAMIG – Lavras, MG

confinement diets. Although, an important benefit is the utilization of fibrous sub-product is its low cost, in which, one of the main variables to evaluate the utilization or not, of this food in the diet of production animals. A primary strategy that brings great success in the feeding of production animals is the reduction of feeding cost and production maintenance (Grasser et al., 1995).

When working with confinement or semi confinement systems, one the most important aspects to be studied is the performance of animals in these systems. The evaluation of gain, consumption and alimentary conversion is fundamentally important, because of what the cost of feeding represent to a producer (Furusho – Garcia, 2001).

In this work, the aim was to evaluate the effect of concentrate : voluminous ratio on the performance of Santa Inês lambs after the wean.

#### MATERIAL AND METHODS

The experiment was carried out in the Departamento de Zootecnia, at Universidade Federal de Lavras – UFLA, in the period from March 2003 to June (2004). 40 uncastrated male lambs from Santa Inês breed, originated from the Sheep division – DZO - UFLA own mob.

The animals were distributed into four treatments: treatment A - diet containing 100% of concentrate; treatment B – diet containing 75:25 of concentrate : voluminous; treatment C – diet containing 50:50 of concentrate : voluminous, treatment D - diet containing 25:75 of concentrate : voluminous (proportions based on DM). A completely random delineation was used. Ten animals from each treatment were slaughtered at 35kg of live weight.

After wean, the lambs were separated from their mothers and stored in individual paddocks where they were fed until they reached slaughter body weight. The experimental diets were isoproteic, differing only in its concentrate : voluminous ratio and were balanced to meet nutritional demands according to the recommendations of the Agricultural Research Council (1980). The diets were composed by sugar cane silage and/or citrus pulp, soy bran (*Glicine max* L.), urea and mineral and vitamin supplemented, and supplied twice a day, 40% in the morning and 60% in the afternoon, in quantities that allowed a surplus of 10% of the total supplied. The offered concentrate in all treatments were pelletized. On Tables 1 and 2 are showing the laboratorial analyzed area, conducted at the Animal Research Laboratory at the Animal Husbandry Department of Universidade Federal de Lavras (UFLA).

Table 1 – Rate of dry matter (DM), crude protein (CP), fiber in neutral detergents (FND), fiber in acid detergent (FAD) and calcium (Ca) and phosphorus (P) of the diets' ingredients, expressed in percentage of the dry matter.

Ingredients	DM (%)	CP (%)	FND (%)	FAD(%)	Ca (%)	P (%)
Sugar cane silage	29.4	2.61	71.43	47.0	0.1	0.1
Citrus pulp	89.5	8.70	27.0	25.0	1.5	0.12
Soy Bran	89.3	45.5	14.0	10.0	0.3	0.7
Urea	99.0	281.0	-	-	-	-
Min/Vit supplement. <sup>2</sup>	96.5	-	-	-	23	9

<sup>1</sup>Nutrients/kg of supplement: calcium = 230 g; phosphorus = 90 g; sulfur = 15 g; magnesium = 20 g; sodium = 48 g; cobalt = 100 mg; copper = 700 mg; iron = 2.000 mg; iodine = 80 mg; manganese = 1250 mg; selenium = 200 mg; zinc = 2,700 mg; fluoride = 900 mg; vitamin A = 200,000 UI, vitamin D3 = 60,000 UI; vitamin E = 60 UI.

Table 2 – Chemical composition (%) of supplied diets, expressed in dry matter percentage.

	Diets			
	A	B	C	D
DM %	89.61	59.70	44.76	35.65
FNDf %	-	12.50	25.00	37.75
Total FND %	23.62	34.30	45.05	55.94
FAD %	21.24	26.44	31.70	36.98
CP %	16.3	16.3	16.3	16.3
Ashes	8.78	8.43	8.08	7.74

The consumption control of the diet was done daily. The development evaluation of the animals was done by weekly weight always on the time, before the supply of fodder at 7 in the morning, with the purpose of controlling of growth and obtaining of average daily weight gain. Weight gain (g/day), total gain (kg) alimentary conversion (ratio between consumption and gain), number of days in confinement (days) and slaughter age (days) of the lambs from each treatment were evaluated.

The experimental period did not have a pre-established duration, because it corresponds to the necessary period for the last lamb to reach body weight of 35kg. The experimental delineation was completely random, with 10 repetitions, where each animal represented a repetition. The variable data went through the not structured Proc Mixed, from the statistic program SAS Institute (1996). The variables were analyzed using the following statistic model:

$$Y_{ij} = \mu + a_i + \xi_{(ij)}$$

Where:  $Y_{ij}$  the observed levels on level  $i$  of treatments, on repetition  $j$  ( $j = 1,2,3...10$ ),  $\mu$  the general average,  $a_i$  the effect of level  $i$  of treatments ( $i = 1,2,3,4$ ) and  $\xi_{(ij)}$  the experimental error associated with observation  $Y_{ij}$ , that by hypothesis has normal distribution with average zero and variance of  $\sigma^2$ .

## RESULTS AND DISCUSSION

The average daily consumption of dry matter (DMC), crude protein (CPC), fiber in neutral detergent (FNDC) and fiber in acid detergents (FADC) were influenced ( $P < 0.05$ ) by different diets (Table 3).

The DCM ( $\text{g/kg}^{0.75}/\text{day}$ ) was similar for diets A and B. The diets C and D were different between themselves, with superiority of diet C, although with lower values than the found for diets A and B. The diets A and B used in this experiment contained, respectively, low quantities of FND

and FND from forage, and the consumption was, probably limited by physiological mechanism. With diets C and D, occurred the physical control of ingestion, even when using thinly crushed silage. This physical limitation occurred, because of accumulation of fiber in the rumen, because, the increase in the volumetric capacity of the rumen is dependent on solid diet consumption (Soest, 1994), and in the case of diets C and D this volumetric capacity, although higher because of higher fiber consumption (especially FND from forage) in these diets, caused the stuffing of rumen – reticule and low nutrient recycling.

The crude protein consumption of the animals that received only concentrate (diet A), and the animals that received 75% of concentrate : 25% of voluminous (diet B) were similar between themselves, as the 50 :50 and 25:75 ratios. However diets A and B provided crude protein consumption higher than the diets with smaller percentage of concentrate (diets C and D). Since the diets were isoproteic, this higher crude protein consumption was, in consequence of higher dry matter consumption provided by the diets with lower voluminous inclusion. Bolzan et al. (2002), working with different levels of concentrate for sheep, observed and increase in the dry matter consumption and crude protein consumption, with increase in the concentrate levels in the diet.

The consumption of fiber in neutral detergent ( $\text{g/kg PV}^{0.75}/\text{day}$ ) of the diets increased in proportion to the increase of FND from forage inclusion in the diets up to the inclusion level of 50% of voluminous (diet C). Only the animals fed with higher inclusion of voluminous (diet D) presented decrease in the FND consumption. However, because of the interval of voluminous inclusion between the diets is 25%, based on the DM, it is not possible to affirm where really occurred a decrease in the FDN consumption.

In the diets C and D, there was sufficient quantity of FND from forage to limit the consumption by physical mechanism. Diets with over 30% of voluminous may cause ingestion balance by physical mechanism.

Table 3 – Average of daily consumption of dry matter(DMC), crude protein (CPC), fiber in neutral detergent (FNDC) and fiber in acid detergent (FADC), in  $\text{g/kg}^{0.75}/\text{day}$ , of Santa Inês lamb, fed with different diets.

Variables	Diets (Concentrate : Voluminous)			
	A (100)	B (75:25)	C (50:50)	D (25:75)
DMC	69.59 a	70.14 a	56.98 b	34.59 c
CPC	11.59 a	10.58 a	8.63 b	7.27 b
FNDC	14.26 c	20.93 b	25.01 a	15.83 c
FADC	12.40 b	16.98 a	17.34 a	10.63 b

\* Averages followed by different letters in the lines differ among themselves by the Tukey test ( $P < 0.05$ ).

The consumption of fiber in acid detergent (FADC) (g/kg PV<sup>0.75</sup>/day) increased in proportion to the increase of forage percentage of the diet (Table 3). The diet with higher voluminous inclusion (diet D) presented a similar value to the diet with inclusion of only concentrate (diet A), because of the physical stuffing of the rumen and limitation of higher fodder ingestion. Resende (1999), working with different concentrate : voluminous ratios, found decrease in the FAD consumption, when the concentrate level was increased. The same was verified by Carvalho et al. (1996) and Araújo (1998).

The average daily weight gain (ADG) and total gain (TG) were influenced (P<0.05) by the different diets. On Table 4, are presented the average values for ADG and TG, of Santa Inês lambs, fed with diets containing different concentrate : voluminous ratios.

The lambs supplied with feeding with diets A and B presented a higher average daily weight gain (P<0.05) than the animals fed with diet C, confirming the effectiveness of the treatments imposed on these animals. The lambs fed with a diet containing a higher voluminous inclusion (diet D), presented weight loss. The variable total gain (TG) presented a similar behavior to the average daily gain. Although the slaughter weight was established and all the lambs were slaughtered with similar weight, the was higher mortality rate in diets with higher voluminous inclusion, especially among the animals fed with diet D, a not recommended treatment for practical use, because of the weight loss and high mortality rate (80%). This fact altered the data referring to the average daily gain and total gain of animals supplied with the diet 25:75 (diet D). It was not possible to obtain data from animals supplied with diet D, such as alimentary conversion, number of days in confinement, slaughter age and carcass characteristics, since, none of the animals from this treatment were slaughtered.

Furusho – Garcia (2001) reported and average daily gain for Santa Inês lambs slaughtered at 35kg of 233 g/day and Gerassev (2003) reported and average daily gain of 230 g/day, both authors working with animals originated from the same genetic and, under the same handling and installation conditions, although using diets containing inclusion of voluminous lower than 25% (based on DM). The referred authors used as voluminous in their experiments crushed *coast-cross* hay.

Morais et al. (1999) and Mendes et al. (2000), using Santa Inês lamb, consuming diets with 80 % of concentrate and 20% of sugar cane bagasse, weaned at 21 and 20.6kg, respectively, verified that the sheep reached 45.9 and 43.9kg at the 84<sup>th</sup> day of confinement, with gain averages of 297 and 278 g/day and Susin et al. (200) and Rocha et al. (2002) using Santa Inês lambs consuming the same the same diet quoted before, weaned with 19.7 and 18.3kg respectively, verified that the sheep reached 34.7 and 31 kg at the 56<sup>th</sup> day of confinement, with gain averages of 268 and 230 g/day, values a lot higher than the ones found on this experiment. The lower gains in the present study, in comparison to the ones quoted above, are because of the older slaughter age, since, in proportion to approaching maturity, there is a decrease of weight gain.

The alimentary conversion in kilos of ingested dry matter per kilo of weight gain (kgDM/kgPV) (AC), number of days in confinement (ND) and slaughter age (SA), in days, were not influenced (P>0.05) by the different diets (Table 5). The animals fed with diets A and B presented better (P<0.05) alimentary conversion than the animals fed with diet C. In proportion to the removal of concentrate from the diet, the alimentary conversion increased.

Table 4 – Average of average daily gain (ADG) in g/day, and total gain (TG) in kg of Santa Inês lambs fed with different diets.

Variables	Diets (Concentrate : Voluminous)			
	A (100)	B (75:25)	C (50:50)	D (25:75)
ADG	159.56 a	146.18 a	75.01 b	-17.61 c
TG	21.13 a	20.41 a	10.91 b	0.73 c

\* Averages followed by different letters in the lines differ among themselves by the Tukey test (P<0.05).

Table 5 – Average of alimentary conversion (AC), number of days in confinement (ND), in days, and slaughter age (SA) in days, of Santa Inês lambs, fed with different diets.

Variables	Diets (Concentrate : Voluminous)		
	A (100)	B (75:25)	C (50:50)
AC	5.03 a	5.10 a	8.37 b
ND	127 a	134 a	153 a
AS	187 a	194 a	217 a

\* Averages followed by different letters in the lines differ among themselves by the Tukey test (P<0.05).

Values varying from 5.03 to 8.37 for animal conversions were found, being higher than the reported by Furusho – Garcia (2001) and Gerassev (2003) for Santa Inês lambs (3.87 and 3.71, respectively), uncastrated males originated from the same genetic, kept under the same handling and installation conditions.

The number of days in confinement (ND) is considered the period necessary for the animals to reach 23kg of live weight and the slaughter age (SA) is considered the entire life period of the animal until slaughter, reminding that the lambs from all treatments were weaned with 60 days averagely and average of 12.5kg of live weight. The animals fed with diet C remained longer in confinement (153 days) than the animals fed with diets A and B (127 and 134 days, respectively), with the same behavior being observed for slaughter age. Because of, not all lambs from the treatments reached slaughter weight (35kg) there was no difference found between the number of days in confinement and for slaughter age, however, in proportion to longer remain in confinement, the longer utilization period of the installations and the expenses with labor force, besides other costs, which increases the production cost.

Furusho – Garcia (2001, using Santa Inês lambs and crossed with Texel, Bergamasca and Ile de France, consuming diets with 80% of concentrate and 20% of *coast-cross* hay, weaning averagely with 14kg, verified that the sheep reached 35kg in 107, 83, 119 and 81 days of confinement, with gain averages of 233, 257, 193 and 276 g/day, respectively, better results than the ones obtained on this work, including with animals from Santa Inês breed. Medeiros et al. (2004), comparing the post weaning performance on sheep from the Morada Nova breed fed with diets containing different increasing levels of concentrate (20, 40, 60 and 80%) and Tifton hay, verified that the sheep reached the average of 30kg in 123, 87, 75 and 53 days of confinement, with an average weight gain of 89, 134, 168 and 224 g/day. The authors verified that the concentrate levels are related to the remaining in confinement and with the obtained weight gain, same results found on this experiments.

It is necessary to study more about the studied food supply of this experiment, when supplied together for confined lambs or with other food, with closer voluminous inclusions, to infer with more value over each kind of supplied food, including sugar cane silage for confined lambs, as long as in low inclusions.

### CONCLUSIONS

The consumption of dry matter, crude protein, fiber in neutral detergent and fiber in acid detergent

were affected by the different concentrate : voluminous ratio.

The animals fed with diets containing higher inclusion of concentrate presented the best results for the variables related to development and, consequently, were obtained in younger ages because of bigger higher gain, better alimentary conversion rates and, the lambs fed with diets containing higher voluminous inclusion did not present weight gain, on the contrary, the presented weight loss, since none of the animals reached slaughter weight and the mortality rate was extremely high (80%).

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