

Use of soy massa as a food source in finishing lambs

Uso de massa de soja como fonte de alimento na terminação de cordeiros

Uso de la masa de soya como fuente de alimento en corderos de engorde

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Abstract

The study aimed to evaluate the performance of lambs finished with two diet formulations, one using a commercial feed and the other using a soy co-product called soy mass. Forty-two castrated male lambs, mixed breed and aged between 8 and 10 months, were used. The design used was completely randomized with three replications of each treatment. The treatments were: Control (CON), without addition of co-product and soybean mass (MAS), with addition of co-product. Both diets were in the proportion roughage:concentrate (V:C) of 20-80%, where the roughage used was corn silage. Every 7 days all animals were weighed to follow the ADG and ECC and FAMACHA were measured. When they reached the established weight, they were transported to the slaughterhouse where the slaughter took place, after which the finish of each carcass was evaluated. For statistical analysis, Fisher's test was performed at a significance level of 5% for comparison between termination systems, in the SAS statistical program (v.9.1). The evaluations and average values of each treatment were then: FAMACHA CO 1.29; MS 1.42; ECC CO 2.32; MS 2.19; ADG CO 0.165g; MS 0.171g; CMS CO 67.97kg; MS 53.28kg; WeightQ CO 22.45kg; MS 21.23kg; yield CO 47.36%; MS 48.38% and CO finishing 3.67; MS 3.17. It was concluded that the addition of soy mass in the diet of lambs decreases the dry matter intake, however, it does not influence the finishing of the carcasses.

Keywords: Feed alternative; Finishing; Confinement; Dry matter intake; Carcass yield.

Resumo

O estudo visou avaliar o desempenho de cordeiros terminados com duas formulações de dieta, sendo utilizado em um tratamento uma ração comercial e outro com o coproduto da soja denominado massa de soja. Foram utilizados 42 cordeiros machos castrados, sem raça definida e com idades de 8 a 10 meses. O delineamento utilizado foi inteiramente casualizados com três repetições de cada tratamento. Os tratamentos foram: Controle (CON), sem adição de coproduto e massa de soja (MAS), com adição do coproduto. Ambas as dietas eram na proporção volumoso:concentrado (V:C) de 20-80%, onde o volumoso utilizado foi silagem de milho. A cada 7 dias todos os animais foram pesados para acompanhar o GMD e aferido ECC e FAMACHA. Ao alcançarem o peso estabelecido foram transportados até o frigorífico onde ocorreu o abate, após o qual foi avaliado o acabamento de cada carcaça. Para análise estatística foi realizado o teste de Fisher ao nível de 5% de significância para comparação entre os

sistemas de terminação, no programa estatístico SAS (v.9,1). As avaliações e os valores médios de cada tratamento foram então: FAMACHA CO 1,29; MS 1,42; ECC CO 2,32; MS 2,19; GMD CO 0,165g; MS 0,171g; CMS CO 67,97kg; MS 53,28kg; PesoQ CO 22,45kg; MS 21,23kg; rendimento CO 47,36%; MS 48,38% e acabamento CO 3,67; MS 3,17. Concluiu-se que a adição da massa de soja na dieta de cordeiros diminui o consumo de matéria seca, porém, não influencia o acabamento das carcaças.

Palavras-chave: Alternativa alimentar; Acabamento; Confinamento; Consumo de matéria seca; Rendimento de carcaça.

Resumen

El estudio tuvo como objetivo evaluar el desempeño de corderos terminados con dos formulaciones de dieta, una con un alimento comercial y la otra con un subproducto de soya llamado masa de soya. Se utilizaron 42 corderos machos castrados, mestizos y con edades comprendidas entre 8 y 10 meses. El diseño utilizado fue completamente al azar con tres repeticiones de cada tratamiento. Los tratamientos fueron: Testigo (CON), sin adición de coproducto y masa de soya (MAS), con adición de coproducto. Ambas dietas fueron en la proporción forraje:concentrado (V:C) de 20-80%, donde el forraje utilizado fue ensilado de maíz. Cada 7 días se pesaron todos los animales para seguir la ADG y se midió ECC y FAMACHA. Cuando alcanzaron el peso establecido, fueron transportados al matadero donde se realizó el sacrificio, luego de lo cual se evaluó el acabado de cada canal. Para el análisis estadístico se realizó la prueba de Fisher a un nivel de significancia del 5% para comparación entre sistemas de terminación, en el programa estadístico SAS (v.9.1). Las valoraciones y valores medios de cada tratamiento fueron entonces: FAMACHA CO 1,29; EM 1,42; ECC CO 2,32; EM 2.19; GMD CO 0,165 g; EM 0,171 g; CMS CO 67,97 kg; EM 53,28 kg; Peso Q CO 22,45 kg; EM 21,23 kg; rendimiento CO 47,36%; MS 48,38% y acabado CO 3,67; EM 3.17. Se concluyó que la adición de masa de soya en la dieta de los corderos disminuye el consumo de materia seca, sin embargo, no influye en el acabado de las canales.

Palabras clave: Alimentación alternativa; Engorde; Confinamiento; Consumo de materia seca; Rendimento de la canal.

1. Introduction

The sheep species (*Ovis aries*) is one of the earliest recorded human species, which is found all over the world and is adapted to different types of ecosystems with its own characteristics for each continent (Lopes, 2017). According to Embrapa (2021), China is the country with the largest number of sheep in the world, with approximately 149 million head, followed by India and Australia. With regard to Brazil, it has shown an increase in its herd, where the last census showed a total of 20.6 million head, in which the main producing regions are the Northeast and South, where Rio Grande do Sul represents around 14.3% of the total Brazilian herd.

Brazilian consumption of sheep meat is considered low when compared to other species. Estimates by Alves et al. (2017) indicate per capita consumption of 0.700 kg to 1 kg/year, yet Brazil is an importer of sheep protein because its production does not meet existing demand. In addition, Santos & Borges (2019) stated that the sheep meat chain is unstructured and poorly coordinated, due to the lack of communication between the sector's bases, making it difficult to achieve standardization and consistency in marketing. However, the country has great potential to increase production, given the vast territorial extension and the technological improvement to be explored in production (Alves et al., 2017).

The lamb category is the most acceptable to consumers in terms of meat, due to its carcass characteristics. They are also more efficient to produce due to their high growth rate. As a result, the market is demanding meat from lambs slaughtered at a body weight of around 40 kg, which is leading to an increase in the number of animals sent to feedlots, as pasture production systems still need to be optimized.

The search for new nutritional techniques is therefore becoming relevant. The feedlot finishing system has advantages such as accelerated growth, a constant supply of animals for slaughter, reduced slaughter age, standardized carcasses and the release of pastures for other animal categories (Lanna & Almeida, 2005; Gomes et al., 2015). However, such intensification is synonymous with greater management demands, the most important of which is nutritional strategy, since feed accounts for two thirds of production costs in this system (Gomes et al., 2015).

In this context, the search for alternative foods to traditional diets to boost weight gain is fundamental for the economic viability of confined animal production, as well as for environmental reasons (Costa et al., 2019). Alternative feeds include the use of by-products from the food and bioenergy industry as a food source.

Soy is a raw material that is widely used for human and animal food all over the world. Through its processing, thousands of tons of products and by-products are generated every day. In view of the high production, the use of by-products derived from soy has become a lower-cost alternative for finishing lambs (Souza, 2021). One example is soybean paste, but at the time of writing, there have been no studies to intensify its use and prove its quality, especially in sheep diets.

In view of the above, we decided to carry out this study with the aim of evaluating the performance of lambs finished on two diet formulations, with one treatment using a commercial formulation and the other using a soya co-product called soya paste.

2. Methodology

The experiment was conducted on a rural property in the municipality of Capão do Leão/RS, from May to June 2021. We used lambs with an average age of 9 months (n=42), castrated males, without a defined breed, with an average initial body weight (BW) of 38.64kg. The experimental period was 55 days (26 days of adaptation + 29 days of experiment).

On arriving at the property, the animals were individually identified, dewormed with the active ingredient monepantel 2.5%, vaccinated for clostridiosis and had their hooves analyzed for possible foot diseases. The animals' health status was also checked using the FAMACHA[®] and OPG (eggs per gram of feces) methods, and their nutritional status was assessed using the body condition score (BCS).

Afterwards, the animals were randomly assigned to each finishing system, where they were subjected to the following techniques once a week: FAMACHA[®], OPG and ECC, the first method being a tool aimed at the identification and selective treatment of sheep parasitized by *Haemonchus contortus* (Molento, 2004). With regard to the OPG technique, the aim was to check the number of parasites the animals may be suffering from, using the technique described by Gordon and Whitlock, 1939. And the third technique used, the ECC, is a tool of fundamental importance and widely used in sheep farming (Trucolo, 2015), the purpose of which is to subjectively assess muscle filling and fat cover in the lumbar region, assigning scores from 1 (very lean) to 5 (very fat), at intervals of 0.5 (Bouchinas et al., 2006). The animals were weighed using a mechanical platform scale every 7 days, after a solid fast of 14 hours. The average daily weight gain (ADWG) was calculated from the weighings.

The treatments were divided according to the type of feed applied for finishing: Control treatment (CON), where the animals had access to a diet formulated with 24% supra nucleus and 56% corn; Soybean paste treatment (MAS), where the animals were offered a soybean co-product called soybean paste in the proportion of 65% of the total diet and 15% more corn. Both diets had a volume:concentrate ratio (V:C) of 20-80%. The volume used was corn silage, which was purchased for the experiment and dried to check the DM and adjust the amount in the diet.

The feed used for the control group (corn and supra nucleus) was collected and sent to the animal nutrition laboratory at UFPeL for bromatological analysis at the start of adaptation (tables 1 and 2), as was the soybean paste co-product. Because pasta is a product that could be more affected by the weather, as it contains a large amount of water, it was collected weekly for study, so that an average of its analyses could be obtained (table 3), where the final results were obtained from LABNUTRIS Laboratório de Análise Físico-Chímica LTDA.

The dry food was stored in a slatted shed with good ventilation, including the silage, which was stored in bags. Soybean paste, on the other hand, as it is a moist food, was stored outside, which was duly checked to make sure there was no damage to the structure.

Table 1 - Chemical composition of the experimental ingredients, expressed as % of DM.

Description	Corn	Supra core	Soybean paste
Moisture and volatiles	93,79	93,93	8,54
Crude Protein	8,54	39,66	21,21
Mineral Matter	1,23	21,04	4,79
FDA*	-	-	27,35
NDT*	-	-	59,16

*FDA - Acid Detergent Fiber; NDT - Total Digestible Nutrients. Source: Authors.

The animals were confined in collective stalls with concrete floors and rice husk bedding, with a stocking rate of approximately 1.5m²/head, equipped with drinking fountains and feeders with the capacity to meet the stocking rate per stall. The animals were adapted for a period of 26 days, where for the first seven they received 1% of their CP, in the second week 2% and from the third week onwards 3% of their CP. However, the group that was offered soybean paste took longer to adapt and their dry matter consumption fluctuated a lot, so we waited for consumption to stabilize in both treatments before starting the experiment (26 days of adaptation + 29 days of experiment). In both systems, the animals were given mineral salt and water *ad libitum*.

The animals were rationed twice a day, and silage was offered along with the concentrate at 8am and 5pm. Before the first treatment, all the leftovers from the previous day were collected to be weighed so that the necessary adjustments could be made and to check that the amount offered was within what was proposed and with leftovers of up to 10%, where the DM values were measured for each batch of each treatment and each week.

When the animals reached the established slaughter weight (an average of 45 kg), they were transported to the slaughterhouse, where they were humanely slaughtered. Afterwards, and before the carcasses entered the cold room, the finish of each carcass was visually assessed by a specialized employee of the slaughterhouse.

The response variables were: Body Condition Score (BCS), Body Weight (BW), Average Daily Gain (ADG), Dry Matter Intake (DMI), Hot Carcass Weight (WCW), Hot Carcass Yield (%) and Carcass Finishing Degree.

The experimental design was entirely randomized, with two feeding systems, where the stall was the experimental unit. For statistical analysis, Fisher's test was used at a 5% significance level to compare the finishing systems, using the statistical program SAS (v.9.1).

3. Results and Discussion

The average values for the variables studied are shown in Table 2.

Table 2 - Means and standard error of the mean for the response variables studied, according to treatments.

Parameters	Control		Soybean paste	
	Average	Strandard Error	Average	Strandard Error
FAMACHA	1,29	0,063	1,42	0,066
ECC	2,32	0,064	2,19	0,068
GMD (g)	0,165	0,037	0,171	0,038
CMS** (kg)	67,9	1,55	53,3	1,63
WEIGHT(kg)	22,4	0,741	21,2	0,741
Carcass yield(%)	47,4	0,577	48,4	0,577
FINISHING*	3,67	0,135	3,17	0,135

Significance of *p<0.05, **p<0.01. ECC= Body condition score; GMD= Average daily gain; CMS= Dry matter intake; PESOQ= Hot carcass weight. Source: Authors.

When evaluating the performance of the two diets, it can be seen that the SBM of the MAS group was lower than the SBM of the CON group. This difference in DM may be linked to the fact that soybean paste is a feed with more moisture, as shown in the bromatological evaluation table (Tables 1), making it more difficult for the animals to eat.

When comparing the performance of the lambs, in addition to the difference in body mass content, there was also a difference in the total volume of consumption, since the animals came from the same system and the separation was totally random for each group. It can be said that the difference in intake and finishing is totally linked to the quality and characteristics of the food offered, Santos and Borges (2019) show that a large number of co-products have been used in ruminant feed recently as an alternative to reduce production costs and optimize the use of waste products from traditional grain production, but many chemical-bromatological analyses and their effects on consumption, digestion and performance are lacking. However, it should be noted that even with all these considerations, both groups achieved a finish of between 3 and 3.5. The GMD recorded in this study was lower than that found by Carvalho et al, 2007 working with confined animals on different volume-concentrate ratios, where they found average gains of around 0.200 kg. However, the GMD values found here were higher than those found by Yadollah et al. (2010) apud Maciel (2012) who observed an increase in performance up to 10% with the use of another co-product, dehydrated grape pomace, reaching 236.77g/day and a subsequent decrease to 140.17g with the inclusion of 20%. These results show that the use of by-products compared to conventional feed still requires a lot of study, as their performance varies greatly. However, with the right proportions, they can be good alternatives for reducing feedlot costs, as according to Piccoli et al. (2013), who compared different treatments and indicated that the costs of feeding confined lambs, in the farming conditions of southern Rio Grande do Sul, represent 56% to 65% of the total cost of production.

The low GMD results can be explained by a number of factors, such as the high weight of the animals at the start of the experiment, since the deposition of 1 kg of fat requires between 10 and 20 kilos of calories more than the deposition of 1 kg of muscle tissue (Osorio, et al, 2012), which can limit the potential for weight gain during this period, as well as the delay in adapting the animals to the new diet that was offered, especially the inclusion of soybean paste in the feed.

Carcass finish is an important parameter in meat production, as it is directly related to the quality and value of the end product. Finishing is determined by the amount of fat present on the carcass and is assessed using subjective methods. According to Esteves et al. (2010). ECC is an excellent indicator for determining carcass fat finish, as they are directly related to each other. Fat finish and final SCC were similar, as shown in Table 2, demonstrating that both batches were slaughtered at the ideal time, even though the slaughterhouse's starting point was the weight in live kilos (45 kg average). It should be emphasized that the evaluation of finishing and the score are subjective evaluations and can vary according to the individuality of each evaluator, and in this case they were not the same as described in the methodology.

In a study by Gois et al. (2018), carcass yields ranged from 43.88% to 49.20%, with an average of 46.88%. The values verified in this work are within the expected margin, thus demonstrating the efficiency and profitability of this system.

Even though CMS and Finishing differed statistically in this work, the results and discussions presented show us that the use of MAS, soybean paste + corn compared to a more conventional diet is a good alternative for confinement lambs, since both batches reached the minimum ECC and Finishing required by the market.

4. Conclusion

Soybean paste can be used as an alternative source for finishing lambs, where even with the influence of the treatment on the indicators of dry matter consumption and carcass finish, it did not change performance.

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