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Primal and sub primal lamb carcass cuts from three different genetic groups finished in feedlot

[*Cortes primários e secundários da carcaça de cordeiros de três diferentes grupos genéticos terminados em confinamento*]

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ABSTRACT

The objective of this study was to evaluate the yield, morphometric traits, and the primal and sub primal cuts of Santa Inês lamb carcasses and their crossbreds with Dorper rams finished in feedlot. Thirty uncastrated lambs of the following genetic groups were used: 10 Santa Inês, 10 ½Dorper + ½Santa Inês and 10 ¾Dorper + ¼Santa Inês at 115 days of age averaging 20kg of live body weight. The experiment period was 53 days, preceded by seven days for adaptation. The carcasses of the Dorper crossbred lambs had higher carcass weight and yield, as well as larger thorax and rump width, and larger thorax, rump, and leg perimeter. The carcasses of the Dorper crossbred lambs also showed greater weight for all primal and sub primal carcass cuts, except for the neck. The lamb carcasses of Santa Inês had higher yields of shoulder and neck primal cuts and the carcasses of Dorper crossbred lambs showed higher loin yield. The carcasses of the crossbred lambs had higher yield of sirloin, rump steak, and frenched rack cap. The genetic group influences the linear and circular measures of the lamb carcasses and the weight of primal and sub primal cuts.

Keywords: crossing, finishing, genotype, morphometry, sheep, yield

RESUMO

Objetivou-se avaliar o rendimento, as características morfométricas e os cortes primários e secundários da carcaça de cordeiros Santa Inês e de suas cruzas com reprodutores Dorper terminados em confinamento. Trinta cordeiros foram utilizados dos seguintes grupos: 10 Santa Inês, 10 ½ Dorper + ½ Santa Inês e 10 ¾ Dorper + ¼ Santa Inês, que apresentaram, no início do experimento, 115 dias de idade média e 20kg de peso vivo médio. O período experimental foi de 53 dias, precedidos de sete dias para adaptação. As carcaças dos cordeiros mestiços Dorper tiveram maiores pesos e rendimentos, bem como maiores larguras do tórax e da garupa e maiores perímetros do tórax, da garupa e da perna. As carcaças dos cordeiros mestiços Dorper também apresentaram maiores pesos para os cortes primários e secundários da carcaça, exceto para o corte do pescoço. As carcaças dos cordeiros Santa Inês apresentaram maiores rendimentos de cortes primários de paleta e pescoço, e as carcaças dos cordeiros mestiços apresentaram maior rendimento do lombo. As carcaças dos cordeiros mestiços obtiveram maiores rendimentos de picanha, lombo e carré francês. O grupo genético influencia medidas lineares e circulares da carcaça de cordeiros e o peso dos cortes primários e secundários.

Palavras-chave: cruzamento, genótipo, morfometria, ovinos, rendimento, terminação

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INTRODUCTION

In the Northeast region of Brazil, most sheep flocks lack early finishing and carcass quality, despite being adapted to the local climatic conditions. In this manner, the production efficiency of sheep meat in this region can be intensified through planned breeding systems, using early meat-type genetic groups fit for finishing in feedlot (Landim *et al*., 2017).

The genetic group used for finishing in feedlot can influence the zootechnical (Menezes Junior *et al*., 2014) and economic indicators of sheep. In this manner, it is necessary to perform an evaluation of the genetic groups used in semiarid regions, originated from different breeding (Fernandes Junior *et al*., 2013).

Currently, there is an increase in demand from consumers of sheep meat from young animals, for better sensory traits. Therefore, the lamb production system with later weaning provides the slaughter of lambs with advanced age, compromising carcass and meat quality, as well as increasing the interval between deliveries by the ewes, affecting the productivity of the flocks. In this perspective, the reduction in the weaning age of lambs, followed by finishing in feedlot, can provide the market with both carcass and meat with superior quality.

The ideal carcass should present a higher proportion of tender cuts and muscle, a minimum number of bones, and adequate fat content for each consumer market. Carcass quality is related to the weight at slaughter, fat covering, conformation, tissue composition (muscle, bone, and fat) and primal cuts (Gomes *et al*., 2013), and in this sense, the genetic group and the food management influence these characteristics.

According to Cezar and Sousa (2018), the marketing of sheep meat in Brazil is still made though whole and half carcasses, or at most in primal and basic cuts, making it difficult for consumers to purchase this product. For Moreno and Boaventura Neto (2016), the marketing of sheep meat by primal and sub primal cuts promotes the fair valuation of the best parts of the carcass.

In this perspective, the objective was to evaluate the weight and yield traits of primal and sub primal cuts of Santa Inês lambs and their crossbreds with Dorper sheep finished in feedlot.

MATERIAL AND METHODS

The project was sent to the Ethics Committee on Animal Use of the Federal University of Paraíba under protocol nº. 2598200218.

The research was conducted at the Benjamim Maranhão Experimental Station, belonging to the State Company of Agricultural Research of Paraíba (EMEPA-PB), currently named State Company of Research, Rural Extension, and Land Regularization of Paraíba (EMPAER), located in the municipality of Tacima-PB, Brazil, at an elevation of 188 m, and mean temperature of 24ºC.

One hundred and twenty sheep were selected to produce the research-destined lambs, divided into 80 Santa Inês ewes and 40 ½Dorper + ½Santa Inês ewes. The Santa Inês sheep were divided into two groups: 40 ewes were bred with two pure Santa Inês rams, and 40 sheep were bred with two pure Dorper rams. In their turn, the 40 ½Dorper + ½Santa Inês ewes were bred with two pure Dorper rams.

All females were subjected to flushing 14 days prior to the breeding season and during the entire coverage period. In the growing phase, the lambs had access to creep feeding (23.3% crude protein (CP), 20.9% neutral detergent fiber (NDF), 4.80% ethereal extract (EE), 6.15% mineral matter (MM), and 2.95 Mcal of metabolizable energy (ME)/kg of DM) from 10 days of life until weaning, which occurred at 60 days of age. Afterward, the lambs remained in a stalled sheep barn, receiving sorghum silage *ad libitum* and 200g/day of roughage for 55 days, until the beginning of the experiment.

For the following phase of finishing in feedlot, the heaviest lambs from each genetic group were selected to compose the three experimental treatments. Thus, 30 lambs, uncastrated 10 Santa Inês, 10 ½Dorper + ½Santa Inês, and 10 ¾Dorper + ¼Santa Inês were selected, which remained stored in three collective stalls per genetic group, with one stall containing four lambs and two containing three lambs, with free access to feed and water troughs. The average age of 115 days and live weight of 20.0±3.32 kg

at the onset of the experiment were used, being slaughtered at 175 days of age.

The experiment lasted 53 days, consisting of seven days used as a period of adaptation to diet and facilities. The diet was calculated and to meet the requirements for lamb with an average initial weight of 20.0 kg to gain 300 g/animal/day, in accordance with the NRC (Nutrient…, 2007) (Table 1). Feed was available *ad libitum*. The diet was supplied twice daily, at 08:00 and 16:00, then readjust the amount offered to ensure 10% orts.

Table 1. Nutritional and chemical composition of the experimental diet based on dry matter

Nutritional composition (g/kg)	
Shoot cassava hay	300.0
Ground maize	548.0
Soybean meal	120.0
Soybean oil	20.0
Mineral salt	5.0
Calcitic limestone	7.0
Total	1000
Chemical composition (g/kg of DM)	
Dry matter[a]	889.2
Crude protein	143.4
Metabolizable energy (Mcal/kg DM)	2.78
Neutral detergent fiber	255.5
Total digestible nutrients	768.0
Etheral extract	52.5
Mineral matter[b]	54.7

[a]g/kg of fresh matter

[b]Represents the mineral composition per kilogram, as follows: 147g of sodium; 120g of calcium; 87g of phosphorus; 18g of sulphur; 3.8mg of zinc; 3500 mg of iron; 1.3mg of manganese; 870mg of flerovium; 590mg of copper; 300mg of molybdenum; 80mg of iodine; 40mg of cobalt; 20mg of chromium; 15mg of selenium.

An average dry matter intake was established at 5% of the live weight, and it was readjusted and weighed daily so that there were 10% of leftovers. The animals were weighed to obtaining the live weight at slaughter (LWS) and for the slaughter procedures, the animals were subjected to 16 h fast of solids. After bleeding and skinning, the gastrointestinal content, skin, viscera, head, hoofs, and genital organs were removed. The obtained carcass was then washed and weighed to determine the hot carcass weight (HCW) and the hot carcass yield (HCY) was calculated by the following equation: HCY = (HCW/LWS) × 100.

Afterward, the carcasses were transported to a cold storage at 4 °C, where they remained for 24 h. After cold storage the cold carcasses were weighed to determine the cold carcass weight and were subjected to the following morphometric evaluations, using a measuring tape: thorax width, rump width, thorax depth, thorax perimeter, rump perimeter, leg perimeter, leg length, internal carcass length, and carcass length.

The right half carcasses were sectioned into six primal cuts, determining the weight and yield of the primal cuts, as follows:

- Neck (separated from the head at its lower extremity, between the last cervical vertebra and the first thoracic vertebra);

- Shoulder (obtained by the section of the axillary region, by the cut of the tissues that bind the scapula and the humerus to the thoracic region of the carcass);

- Loin (obtained by two cuts, one between the last thoracic vertebra and the first lumbar, and another between the last lumbar and the first sacral);

- Rack (resulted from two cuts, the first between the last cervical vertebra and the first thoracic

vertebra, and the second between the last thoracic vertebra and the first lumbar);

- Hindquarter (the primal hindquarter was sectioned between the twelfth and thirteenth rib);

- Leg (separated from the carcass at its upper extremity, between the last lumbar and the first sacral). As the primal cuts were removed from the carcasses, they were immediately weighed.

The sub primal cuts were obtained from the primal cuts (boneless leg, sirloin, tenderloin, sliced hindquarter, sliced shoulder, and frenched rack cap on) and secondary cuts (frenched cap off rack) of the right half carcass, according to the following description:

- Boneless leg (obtained by the total dissection of the leg through the removal of all bones);

- Sirloin (the primal loin was divided into a ventral, boneless portion (flank steak) and a dorsal portion with bone, from which the lumbar vertebrae were extracted, and from the resulting muscle portion, its largest muscle was removed (*longissimus dorsi*), which after trimming originated the sirloin);

- Tenderloin (followed the same procedure as before, although the *psoas major* muscle was removed, which originated the tenderloin);

- Sliced hindquarter (the primal hindquarter was entirely sliced aiming at separating all ribs and costal cartilages, giving origin to 13 hindquarter slices);

- Frenched rack cap on (the primal rack was sectioned, and the last 8 ribs were sawed so that the extremities had a straight-line shape, with later trimming);

- Frenched cap off rack (a cut was made between all thoracic vertebrae and their corresponding ribs, followed by the extraction of the vertebrae; all ribs were kept connected to the *longissimus dorsi* muscle and the remaining costal muscles of the cut. In the ventral/distal third of the ribs, trimming was performed by allowing bone tissue only);

- Sliced shoulder (the shoulder was subjected to transversal cuts at every 3 cm throughout the entire cut, discarding the distal extremity of the primal shoulder).

The yields of primal and sub primal cuts were determined by the following equation: (cut weight/cold carcass weight) × 100.

The data of the studied variables were subjected to analysis of variance, observing a completely randomized design with 10 replications per genetic group, using the F-test for the comparison of the average of the tested factors. The weight of the lambs at the beginning of the finishing in feedlot was added to the model as a covariable.

The statistical model employed was the following: $Y_{ij} = \mu + G_i + P_i + \varepsilon_{ij}$, in which Y_{ij} = observed value of the dependent variable studied, μ = general mean; G_i = effect of the genetic group i; P_i = effect of the weight covariable at the beginning of the finishing in feedlot; and ε_{ij} = random error associated to each observation. The averages were compared by Tukey's test at 5% of probability.

RESULTS AND DISCUSSION

The Dorper crossbred lambs, regardless of their genetic composition (½Dorper + ½Santa Inês and ¾Dorper + ¼Santa Inês), had higher live ($P < 0.05$) weight at the beginning and at the end of finishing in the feedlot, as well as higher hot carcass weight and yield when compared to Santa Inês lambs (Table 2).These results indicate that the breeding of Dorper rams with Santa Inês and ½Dorper + ½Santa Inês ewes provided better biological a performance of the lambs finishing in feedlot.

The ½Dorper + ½Santa Inês and ¾Dorper + ¼Santa Inês lambs had higher hot carcass yields ($P < 0.05$) compared to Santa Inês lambs (51.14 vs. 49.63%), respectively. This demonstrates that the lambs whose paternal breed was the meat-type bred Dorper, and whose maternal genetic group was the Santa Inês breed or ½Dorper + ½Santa Inês crossbreds showed higher carcass yield and, consequently, featured a larger edible portion per kilogram of live weight produced compared to the Santa Inês lambs, which constitutes an important characteristic for the producer when the marketing of the carcass is performed within a fridge.

Table 2. Initial, final, and hot carcass weight (HCW) and hot carcass yield (HCY) of the lambs as a function of the genetic group

Parameters	Genetic group			CV (%)	P
	SI	½DP + ½SI	¾DP + ¼SI		
Initial weight (kg)	17.46b	20.68a	22.08a	13.83	0.0030
Final weight (kg)	30.62b	37.74a	39.32a	6.21	0.0029
HCW (kg)	15.22b	19.23a	20.13a	6.72	0.0001
HCY (%)	49.63b	50.93a	51.14a	2.26	0.0034

SI = Santa Inês; ½DP + ½SI = ½Dorper + ½Santa Inês; ¾DP + ¼SI = ¾Dorper + ¼Santa Inês. Means followed by distinct letters differ ($p < 0.05$) from each other by Tukey's test; CV= coefficient of variation, P = probability.

The average hot carcass yield was equivalent to 50.57%, and it must be attributed to the average lamb weight at slaughter, which was 35.89kg. There is a high and significant correlation between the live weight at slaughter and the carcass yield, which may have probably influenced this good hot carcass yield.

The closest hot carcass yield to that observed in the Santa Inês lambs was reported by Queiroz *et al*. (2015) in Santa Inês lambs slaughtered with 32.83kg, which showed 50.14%.

There was no effect of the genetic group ($P > 0.05$) for the internal and external length of the carcass, and for the depth of the thorax (Table 3). However, the carcasses of the ½Dorper + ½Santa Inês and ¾Dorper + ¼Santa Inês lambs had higher ($P<0.05$) morphometric values for thorax and rump width, as well as for thorax, rump, and leg perimeter. This suggests that the breeding of Dorper rams with Santa Inês and ½Dorper + ½Santa Inês ewes improved the relationships between the linear, circular, and depth measures of lamb carcasses, resulting in increments in the yield of some sub primal cuts, consequently improving the quality and value of the carcass to be marketed, according to the discussion of the data of Table 5.

The results corroborate those obtained by Cartaxo *et al*. (2017), who worked with crossbred Dorper lambs with the same genetic composition as in the present study, observing a larger rump width in the carcass of crossbred Dorper lambs when compared to Santa Inês lambs. The authors suggested that there is a greater deposition of muscular and fat tissue plans in the posterior part of the animal, considering that the leg constitutes the most sub primal cut of the sheep carcass (Moreno and Boaventura Neto, 2016).

Table 3. Morphometric characteristics of the lamb carcasses as a function of the genetic group

Variable	Genetic group			CV (%)	P
	SI	½ DP + ½ SI	¾DP + ¼SI		
Thorax width	14.10b	16.10a	17.20a	6.84	0.0001
Rump width	17.80b	20.30a	20.50a	7.18	0.0007
Thorax depth	25.10	25.50	25.60	9.09	0.5122
Thorax perimeter	66.70b	70.80a	71.60a	2.80	0.0001
Rump perimeter	55.00b	61.20a	62.00a	4.01	0.0001
Leg perimeter	35.80b	39.00a	40.00a	4.76	0.0001
Leg length	38.80a	38.20ab	37.10b	4.29	0.0147
Internal carcass length	63.50	65.10	64.30	2.29	0.2072
Carcass length	58.20	58.60	57.50	3.22	0.0653

SI = Santa Inês; ½DP + ½SI = ½Dorper + ½Santa Inês; ¾DP + ¼SI = ¾Dorper + ¼Santa Inês. Means followed by distinct letters differ ($P<0,05$) from each other by Tukey's test; CV= coefficient of variation, P= probability.

Landin *et al*. (2017), when evaluating the carcass morphometry of Santa Inês x Rabo Largo and Rabo Largo pure lambs slaughtered with 26.0kg observed an influence of the Santa Inês breed on carcass and leg length, although no effect was verified on internal carcass length, rump width, leg perimeter, and thorax perimeter. The authors associated the higher morphometric values to the anatomy of the breed since the Santa Inês

animals are characterized for being longilineous and tall-legged.

In the present study, the carcasses of Santa Inês lambs also obtained a greater leg length (P < 0.05) when compared to the carcasses of ¾Dorper + ¼Santa Inês lambs (38.80 vs. 37.10 kg), an increase of 4.4% (Table 3). This is an inherent trait of the Santa Inês breed, whose individuals are more tall-legged, which reverberated on a longer leg length; however, when the genetic composition of the Dorper breed reached 75%, this trait was reduced due to the more compact body conformation of this exotic breed.

Furusho-Garcia *et al*. (2010), when studying the performance and carcass trait of Santa Inês pure lambs and their crossings with Dorper in different management systems, observed that the genetic group affected (P < 0.05) the leg length, the internal carcass length, and the circumference of the rump, so that the Santa Inês pure lambs obtained higher measures for these parameters. Fernandes Junior *et al*. (2013) reported a significant effect of the genetic group (P < 0.05) on the internal carcass length, thorax depth, and leg length of Santa Inês, Somalis, Morada Nova and ½Dorper + ½Santa Inês sheep. It was observed that the Santa Inês and the ½Dorper + ½Santa Inês animals showed similar means for internal carcass length, thorax depth, and leg circumference, although a superiority was verified in the leg length of the Santa Inês animals, as also described by Costa *et al*. (2014).

The weights and yields of the primal cuts were influenced (P < 0.05) by the genetic group (Table 4), in which the carcasses of the ¾Dorper + ¼Santa Inês and ½Dorper + ½Santa Inês lambs showed greater weight of leg, loin, shoulder, rack, and hindquarter when compared to Santa Inês lamb carcasses. These greater weights are related to the better performance of the crossbred Dorper lambs during finishing in feedlot. It is worth noting that the lambs in this research were selected as the heaviest ones from an improved production system that employed feeding management strategies, such as creep feeding, which may have favored the crossbred Dorper lambs to have entered the finishing in feedlot with heavier weight, however, this effect was adjusted in the analysis with the use of weight as a covariable at the beginning in feedlot. Another important point for the obtainment of greater weights of primal cuts in Dorper crossbreds was the diet, which was formulated for high weight gain (300 g/day) and may have favored the lambs with meat-type breed genetic composition. Specific meat-type breeds present better carcass conformation, favoring the amount and distribution of muscle and fat tissues in strategic spots of the carcass and, consequently, improving the edible portion of primal and sub primal cuts in the sheep carcass.

Table 4. Weights and yield of the primal cuts of sheep carcasses as a function of the genetic group

Variable	Genetic group			CV (%)	P
	SI	½DP + ½SI	¾DP + ¼SI		
Leg (kg)	2.27b	2.86a	3.03a	6.97	0.0001
Leg (%)	30.32	30.05	30.52	3.95	0.4193
Loin (kg)	1.09b	1.53a	1.62a	10.51	0.0001
Loin (%)	14.62b	16.05a	16.18a	9.56	0.0315
Shoulder (kg)	1.37b	1.65a	1.70a	7.56	0.0001
Shoulder (%)	18.29a	17.40b	17.15b	4.15	0.0024
Rack (kg)	2.19b	2.80a	2.94a	9.72	0.0001
Rack (%)	29.13	28.54	29.49	6.64	0.9435
Neck (kg)	1.08a	1.17a	1.04b	10.30	0.0012
Neck (%)	7.20a	6.17b	5.25c	10.86	0.0001
Hindquarter (kg)	0.818b	1.09a	1.113a	13.55	0.0001
Hindquarter (%)	5.41	5.75	5.65	10.36	0.4596

SI = Santa Inês; ½DP + ½SI = ½Dorper + ½Santa Inês; ¾DP + ¼SI = ¾Dorper + ¼Santa Inês. Means followed by distinct letters differ (P<0.05) from each other by Tukey's test; CV= coefficient of variation, P= probability.

The averages of the weights of the primal cuts of leg (2.95 vs. 2,27kg), loin (1.58 vs. 1.09kg), shoulder (1.68 vs. 1.37 kg), and rack (2.87 vs. 2.19kg) obtained by the ¾Dorper + ¼Santa Inês and the ½Dorper + ½Santa Inês animals were 23.1, 30.8, 18.2 and 23.7%, respectively, being heavier when compared to the cut weights showed for the Santa Inês lamb carcasses. This fact indicates that the Dorper crossbred lambs, regardless of their genetic composition, deposited a greater amount of muscle and fat tissue in the anterior and lumbar region and in the posterior portion of the carcass. According to Hashimoto *et al*. (2012), shoulder and leg are the cuts that better predict the total content of the tissues since they represent more than 50% of the carcass.

Similar results were obtained by Souza *et al*. (2016) when evaluating the performance, alimentary efficiency, carcass traits and meat of Santa Inês, ½Dorper + ½Santa Inês and ¾Dorper + ¼Santa Inês sheep in the Northeast region of Brazil.

Significant differences between the cut weight averages of sheep with different genetic groups were also reported by Ferreira *et al*. (2016). The authors observed greater loin weight for the ½Dorper sheep when compared to undefined breed sheep. A similar result was found by Cartaxo *et al*. (2011), when they observed that the loin weight and loin percentage of crossbred ½Dorper + ½Santa Inês lambs were greater when compared to Santa Inês lambs and to the ½Santa Inês + ½undefined breed animals.

Regarding the percentages of the primal cuts, there was a similarity to the verified for loin weight, as the carcasses of the Dorper crossbred lambs also showed higher ($P<0.05$) loin yield than those of the Santa Inês breed. This higher percentage is important since the loin is classified as a first-class or special cut (Cezar and Sousa, 2018). This may be related to the better meat-type conformation that the Dorper breed presents, which is related to the greater amount of muscle and fat tissue in the medial region of the carcass.

The carcasses of Santa Inês lambs, in turn, showed a higher ($P<0.05$) proportion for neck and shoulder in relation to the average of ½Dorper + ½Santa Inês and ¾Dorper + ¼Santa Inês crosses (Table 4). According to Nobrega *et al*. (2013), high neck percentages are not advantageous since the neck is not a first-class cut. It is worth noting that, according to Cezar and Sousa (2007), the neck is a third-class cut, and the shoulder is a second-class cut; however, the shoulder is highly appreciated and valued in other regions of the country, especially when marketed as a specialized secondary (boneless or sliced shoulder) or tertiary cut (boneless rolled shoulder).

The genetic group influenced ($P<0.05$) the weight of the sub primal cuts in the lamb carcasses (Table 5). The sub primal cuts from the posterior region of the lamb carcass, such as the boneless leg, and the cuts from the medial region of the carcass, such as sirloin and tenderloin, which are classified as first-class or sub primal lamb cuts, underwent an effect of the genetic group. For these cuts, the carcasses of the ¾Dorper + ¼Santa Inês and ½Dorper + ½Santa Inês lambs had higher weights ($P < 0.05$) for the boneless leg and tenderloin. The carcasses of the ¾Dorper + ¼Santa Inês lambs showed greater weight ($P<0.05$) of the sirloin cut than the carcasses of the remaining genetic groups evaluated, whereas the carcasses of the ½Dorper + ½Santa Inês lambs obtained an intermediate average, and the carcasses of the Santa Inês lambs obtained the lowest average value.

The weight of the frenched rack cap on was influenced ($P<0.05$) by the genetic group, in which the carcasses of the ¾Dorper + ¼Santa Inês (0.727 kg) lambs obtained the highest average ($P<0.05$), followed by the carcasses of the ½Dorper + ½Santa Inês (0.648kg) lambs, with an intermediate mean, and then by the Santa Inês (0.500kg) carcasses, with the lowest average value. It is worth noting that although the frenched rack cap on is a second-class cut due to the relatively high bone portion in relation to its musculature, it still presents unique culinary plasticity unparalleled even by the best sub primal cuts (Cezar and Sousa, 2018), which is possibly the reason of the preference by consumers for this secondary cut, with high marketing value.

Regarding the remaining weights of the sub primal cuts, the carcasses of the Dorper crossbreds, regardless of their genetic composition, showed greater weights ($P<0.05$) when compared to the sub primal cuts of the

carcasses of Santa Inês lambs. It is highlighted that the frenched rack cap off and the sliced shoulder cuts are highly appreciated and demanded by consumers.

Table 5. Weights and yields of the primal cuts in lamb carcasses as a function of the genetic group

Variable	Genetic group			CV (%)	P
	SI	½ DP + ½ SI	¾DP + ¼SI		
Boneless leg (kg)	1.89b	2.35a	2.50a	7.20	0.0001
Boneless l (%)	12.58	12.38	12.60	3.77	0.2599
Sirloin (kg)	0.204c	0.267b	0.323a	16.44	0.0001
Sirloin (%)	1.35b	1.39b	1.60a	12.28	0.0159
Tenderloin (kg)	0.077b	0.112a	0.120a	13.82	0.0001
Tenderloin (%)	0.51b	0.59a	0.60a	11.93	0.0437
Sliced hindquarter (kg)	0.760b	1.02a	1.07a	12.93	0.0001
Sliced hindquarter (%)	5.04	5.37	5.35	9.75	0.2961
Frenched rack cap on (kg)	0.500c	0.648b	0.727a	9.13	0.0001
Frenched rack cap on (%)	3.32b	3.41ab	3.65a	7.81	0.0503
Frenched rack cap off (kg)	0.458b	0.598a	0.663a	14.02	0.0001
Frenched rack cap off (%)	3.06	3.13	3.31	12.70	0.5584
Sliced shoulder (kg)	1.25b	1.53a	1.56a	8.70	0.0001
Sliced shoulder (%)	8.33	8.04	7.88	5.40	0.0599

SI = Santa Inês; ½DP + ½SI = ½Dorper + ½Santa Inês; ¾DP + ¼SI = ¾Dorper + ¼Santa Inês. Means followed by distinct letters differ (P<0.05) from each other by Tukey's test; CV= Coefficient of variation, P= probability.

The leg weight (Table 4) and leg perimeter (Table 3) are greater, and the leg length (Table 3) is smaller in the carcasses of the ¾Dorper + ¼Santa Inês lambs when compared to the carcasses of the Santa Inês lambs. It averages that the legs of the ¾Dorper + ¼Santa Inês animals are more compact (smaller length + larger perimeter/depth + greater weight) than the carcasses of the Santa Inês lambs, and, therefore, these animals would present better boneless meat yield: greater meat weight (boneless) per each centimeter of leg length. However, the length of the boneless leg, in Table 5, did not differ.

According to Maysonnave *et al*. (2017), the sirloin, tenderloin, frenched rack, top sirloin, and ribeye cuts showed the highest price means, according to the survey performed by the authors in several countries, with values of 33.89, 30.07, 26.66, 25.15, and 23.70 US$/kg.

These higher values because these are considered first-class cuts in the sheep carcass, being marketed at higher prices as a function of the higher demand by consumers. This may be an indicator that the sheep raised in an improved system using creep feeding and meat-type genetic groups can provide the market with young animals, with greater muscular and fat deposition in some strategic regions of the carcass, which shall consequently add average to the lambs at marketing, increasing the profit of the production system. The importance of the Santa Inês breed is highlighted as a maternal breed in this production system for providing male and female ½Dorper + ½Santa Inês lambs for finishing in feedlot and reproduction, respectively, aiming at producing ¾Dorper + ¼Santa Inês animals.

There was an effect ($P < 0.05$) of the genetic group on the yield of several primal cuts. The carcasses of the ¾Dorper + ¼Santa Inês showed higher ($P < 0.05$) sirloin yield than the remaining lamb carcasses. According to Cezar and Sousa (2018), the sirloin is a secondary cut, originated from the loin primal cut. It is a first-class cut because of an excellent tissue constitution, that is, only muscles, with optimal softness. In this manner, this higher percentage is interesting from the commercial point of view.

The carcasses of the ¾Dorper + ¼Santa Inês and ½Dorper + ½Santa Inês lambs showed higher (P<0.05) tenderloin yield compared to the carcasses of the Santa Inês lambs, with the same

effect being verified for the weight of the referred cut. According to Cezar and Sousa (2018), the tenderloin is a secondary cut, originated from the loin primal cut, and, like the sirloin, it is a first-class cut. The tenderloin is formed almost exclusively by muscle tissue, and the Dorper crossbred carcasses showed greater weights and proportion than the Santa Inês lambs, demonstrating the better carcass conformation in the Dorper crossbreds, considering that the tenderloin is originated from the loin primal cut, which presents a good correlation with well-conformed carcasses.

The carcasses of the ¾Dorper + ¼Santa Inês lambs showed higher ($P < 0.05$) proportions of frenched rack cap on when compared to the lamb carcasses of the Santa Inês, a fact that was also verified in relation to the weight of the respective cut, suggesting that the composition of the meat-type breed can result in a higher absolute and proportional amount of muscle and fat tissue in the medial region of the carcass.

Besides the improved raising system to which the researched lambs were subjected during the growing phase, the diet used for finishing in feedlot containing a good nutritional level evidenced by the energy concentration, percentage of protein, fiber, and minerals was of utter importance to provide high weight gains, which reflected on the weight and yields of primal and sub primal cuts.

CONCLUSIONS

The crossbred lambs of the F1 and F2 generations in the terminal-cross breeding between the Dorper paternal breed and the Santa Inês maternal breed (½Dorper + ½Santa Inês and ¾Dorper + ¼Santa Inês), when subjected to practices of management intensification, such as creep feeding during the growing phase and during finishing in feedlot phase, when compared to Santa Inês lambs, show improvements in carcass yield, carcass morphometry (thorax and rump width, thorax, rump, and leg perimeter), and in the regional composition of the carcass (leg, loin, and shoulder weight, and loin yield), as well as in the sub primal cuts by the carcasses (weights of boneless leg, sirloin, tenderloin, frenched rack, and sliced shoulder, and tenderloin yield).

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