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Allometric growth of ½ Dorper + ½ Santa Inês lambs slaughtered with different subcutaneous fat thicknesses

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Abstract – The objective of this work was to evaluate the allometric growth, the correlation of the cuts with the half carcasses, and the muscularity index of the leg of ½ Dorper + ½ Santa Inês lambs slaughtered with 2.0, 3.0, and 4.0 mm of subcutaneous fat thickness (SFT). Twenty-four non-castrated male lambs were used, being distributed according to their weight into three collective pens. Slaughtering occurred as the lambs reached the SFT predetermined by ultrasound. The half carcasses were weighed, dissected, and separated into five cuts: neck, shoulders, rib, loin, and leg. These cuts were dissected and weighed into muscle, subcutaneous fat, intermuscular fat, and bone. In the shoulders, lambs with 2.0 and 4.0 mm SFT showed early growth. In the rib, this early precocity was observed in lambs with 4.0 mm SFT. The leg showed isogonic growth in lambs with 3.0 and 4.0 mm SFT and was the cut that best correlated with the half carcass, regardless of the SFT. The slaughter of ½ Dorper + ½ Santa Inês lambs with 4.0 mm of subcutaneous fat allows obtaining a better allometric growth of the shoulder, rib, and leg cuts, as well as a better leg muscularity index.

Index terms: allometry, commercial yield, cuts, muscularity, sheep.

Crescimento alométrico de cordeiros ½ Dorper + ½ Santa Inês abatidos com diferentes espessuras de gordura subcutânea

Resumo – O objetivo deste trabalho foi avaliar o crescimento alométrico, a correlação dos cortes com as meia-carcaças e o índice de musculosidade da perna de cordeiros ½ Dorper + ½ Santa Inês abatidos com 2,0, 3,0 e 4,0 mm de espessura de gordura subcutânea (EGS). Utilizaram-se 24 cordeiros machos, não castrados, distribuídos de acordo com seu peso, em três baias coletivas. Os abates ocorreram à medida que os cordeiros atingiram a EGS pré-determinada por ultrassonografia. As meia-carcaças foram pesadas, dissecadas e separadas em cinco cortes: pescoço, paleta, costilhar, lombo e perna. Estes cortes foram dissecados e pesados em músculo, gordura subcutânea, gordura intermuscular e osso. Na paleta, cordeiros com 2,0 e 4,0 mm de EGS mostraram crescimento precoce. No costilhar, observou-se essa precocidade em cordeiros com 4,0 mm de EGS. A perna mostrou crescimento isogônico em cordeiros com 3,0 e 4,0 mm de EGS e foi o corte que melhor correlacionou-se com a meia-carcaça, independentemente da EGS. O abate de cordeiros ½ Dorper + ½ Santa Inês com 4,0 mm de espessura de gordura subcutânea permite obter melhor crescimento alométrico dos cortes paleta, costilhar e perna, bem como melhor índice de musculosidade da perna.

Termos para indexação: alometria, rendimento comercial, cortes, musculosidade, ovinos.

Introduction

Although the sheep herd in Brazil is of approximately 18.9 billion (FAO, 2018), the per capita consumption of sheep meat per year corresponds only to 0.6 kg (OECD, 2018). Despite this low consumption, Brazil is not able to supply the domestic demand for sheep meat, with Uruguay representing at least 80% of the imported volume (Viana et al., 2015).

One of the strategies to meet the demand for sheep meat production is to produce lambs with a high proportion of lean meat and adequate fat cover, generating a high proportion of first category cuts (Souza et al., 2013). For this purpose, one of the most used crosses in Brazil is between the Dorper and Santa Inês breeds, producing resistant lambs that adapt quickly to the adopted management regime and that have inherited characteristics such as rapid weight gain, good net income, and carcass conformation (Macedo et al., 2014). These characteristics were also observed for Dorper sheep crossed with Santa Inês and Brazilian Somalis (Souza et al., 2013).

An important parameter to obtain quality meat is body weight; however, it should not be the only criteria used for slaughtering (Osório et al., 2012), since lambs of different breeds with similar weights still present varying amounts of tissue deposition, which influences carcass characteristics (Camacho et al., 2015). The measurement of subcutaneous fat thickness (SFT) with the real-time ultrasound technique can be used as an indicator of the best time for the slaughter of lambs (Nascimento et al., 2018), as SFT allows predicting the composition and relative growth of other carcass cuts and tissues (Wood et al., 1980; Teixeira et al., 2006; Mora et al., 2014).

Allometry allows to better understand the growth rate and development of carcass regions, serving as a reference for a more precise slaughter time for each genetic group (Hashimoto et al., 2012). Although there are allometry studies related to sex, termination system, animal morphology, and SFT (Hashimoto et al., 2012; Mora et al., 2014; Sabbioni et al., 2018), the specific relative growth of ½ Dorper + ½ Santa Inês lambs slaughtered with different SFTs has not yet been evaluated. This crossing has shown reduced slaughter time, being an alternative for the production of sheep meat (Issakowicz et al., 2018).

In addition, it is also important to determine the best SFT for slaughter. There are reports that lambs in a confinement system should be slaughtered with 3.0 mm SFT, since lower thicknesses may result in deficient fat coverage in the carcass and higher ones, in a greater amount of fat and reduced feed conversion (Andrade et al., 2017; Nascimento et al., 2018).

The objective of this work was to evaluate the allometric growth, the correlation of the cuts with the half carcasses, and the muscularity index of the leg of ½ Dorper + ½ Santa Inês lambs slaughtered with 2.0, 3.0, and 4.0 mm of subcutaneous fat thickness (SFT).

Materials and Methods

The experiment began at the Canafístula farm, in the municipality of Nossa Senhora das Dores, in the state of Sergipe, Brazil (10º29'30"S, 37º11'36"W). There, at the third week after birth, ½ Dorper + ½ Santa Inês lambs were creep fed. At weaning, 24 non-castrated male lambs were chosen for the study, with an approximate age of 86 days and average body weight of 16.94 kg. The lambs were divided according to weight in order to avoid competition and were distributed into three collective pens, each with eight animals. During the entire feedlot period, the lambs received water and corn silage ad libitum, in addition to supplementation with 20 g kg^{-1} live weight concentrate, consisting of 750 g kg^{-1} ground corn, 190 g kg^{-1} soybean meal, 10 g kg^{-1} urea, and 50 g kg^{-1} commercial premix (Núcleo Ovino Crescimento/Terminação, Nutron, Cargill, Itapira, SP, Brazil), with 211 g kg^{-1} crude protein, Kjeldhal method, nº 976.05 (Horwitz, 2000) and 786 g kg^{-1} total digestible nutrients (Aldai et al., 2010).

During the experimental period from January to April 2016, SFT was measured every 15 days, using the HS-1500 veterinary ultrasound (Honda Electronics Co., Ltd., Aichi, Japan) with a linear multifrequency transducer of 50 mm and frequency of 7.5 MHz. The pressure of the transducer head was kept minimal to avoid fat compression, and all measurements were taken by the same technician, on the left side, between the twelfth and thirteenth ribs. After the image was captured, the thickness of the subcutaneous fat was measured using the electronic ultrasound cursor.

Upon reaching the pre-determined SFT for each treatment, the animals were transported to a slaughterhouse, under the federal inspection service, at the municipality of Propriá, in the state of Sergipe, where they spent 16 hours fasting solids. After the skinning and evisceration procedures, the carcasses were weighed, cooled to 4°C in a cold chamber during 24 hours, and subsequently sectioned longitudinally in half.

The left-half carcasses were divided into five commercial and heavy cuts: neck, composed of the seven cervical vertebrae, separated from the first dorsal vertebra; shoulder, comprising the scapula, disjointed from the carcass; ribs, consisting of the carcass part sectioned between the last cervical and first thoracic vertebrae and the thirteenth thoracic and first lumbar vertebrae; loin, between the first and sixth lumbar vertebrae; and leg, between the last lumbar and first sacral vertebrae. Then, the cuts were packaged, identified, and transported frozen to the meat technology laboratory of Universidade Federal de Sergipe, where they were stored in a freezer at -18°C. Each commercial cut, after thawing under 4ºC, in a refrigerator for 12 hours, was weighed and dissected into muscle, subcutaneous fat, intermuscular fat, and bone (Cezar & Sousa, 2007). When the leg cut was dissected, the *adductor femoris*, *biceps femoris*, *quadriceps femoris*, *semimembranosus*, and *semitendinosus* muscles were removed and weighed. The length of the femur was measured to determine the leg muscularity index (Purchas et al., 1991), according to the formula: LMI = [√(MW5 / FL) / FL], where LMI is the leg muscularity index, MW5 is the weight in grams of the five evaluated muscles, and FL is femur length in centimeters.

The statistics used to determine the allometric growth of the commercial cuts were related to the half carcass and to the tissue components of each cut, through the following equation (Huxley, 1932): $Y = aX^b$, which was linearized using the logarithmic model $Y = \ln \alpha + \beta \ln X$, where Y is the weight of the commercial cuts or tissue components, X is the weight of the corrected half carcass or weight of the corrected commercial cuts, α is the intersection of the logarithmic linear regression over Y and β, and β is the allometric growth coefficient. The REG procedure of the SAS software (SAS Institute Inc., Cary, NC, USA) was used to obtain the allometric coefficients.

The t-test was applied to verify the null hypothesis $\beta = 1$, which was found to be: isogonic ($\beta = 1$), when the studied part grew at the same speed as the whole sample (Furusho-Garcia et al., 2006); or heterogeneous ($\beta \neq 1$), presenting a growth rate that was either higher ($\beta <1$) or lower ($\beta > 1$) than that of the whole sample.

To indicate the commercial cut that best represented the half carcass, Pearson's correlation was performed. The values obtained for the tissue components present in the half carcass and the leg muscle with different SFTs were subjected to the analysis of variance and to Tukey's test, at 5% probability.

Results and Discussion

The body weight and average age at slaughter were 33.50 kg and 139 days for lambs with 2.0 mm SFT; 42.81 kg and 159 days for lambs with 3.0 mm SFT, and 46.19 kg and 179 days for lambs with 4.0 mm SFT. According to the allometric coefficient of the cuts in relation to the half carcass (Table 1), the neck cut was characterized as negative heterogonic ($\beta < 1$), i.e., there was an early growth of the cut in relation to the development of the half carcass. A similar growth rate was observed for the Cornigliese breed, with differences regarding gender and a proportional development of the head (Sabbioni et al., 2018). However, for lambs of other breeds finished in confinement (Furusho-Garcia et al., 2006) and slaughtered with different SFT (Mora et al., 2014), the neck cut showed isogonic growth.

Table 1. Allometry of the commercial cuts in relation to the half carcass of ½ Dorper + ½ Santa Inês lambs slaughtered with different subcutaneous fat thicknesses (SFTs)[(1)].

Cut	SFT (mm)	β	Standard error (β)	T-test Ho: β≠1	R^2
Neck	2.0	0.114	0.285	*	0.419
	3.0	-0.182	0.79	*	0.351
	4.0	0.474	0.419	*	0.081
Shoulder	2.0	-0.619	0.484	*	0.860
	3.0	3.75	1.875	*	-0.420
	4.0	-1.03	1.389	*	0.682
Rib	2.0	-0.084	1.529	ns	0.515
	3.0	1.677	1.186	ns	0.340
	4.0	-1.56	0.649	*	0.948
Loin	2.0	0.148	0.652	*	0.450
	3.0	-1.015	1.612	*	0.480
	4.0	0.409	0.894	ns	0.359
Leg	2.0	-0.057	0.477	*	0.920
	3.0	0.148	1.403	ns	0.664
	4.0	0.416	1.317	ns	0.720

[(1)]β, allometry coefficient; Ho, null hypothesis; and R^2, coefficient of determination. *Significant by the t-test, at 5% probability. [ns]Nonsignificant.

The shoulder cut presented a fast growth rate (β < 1) in relation to the development of the half carcass in lambs with 2.0 and 4.0 mm SFT. A similar result was observed for Texel x Ile de France lambs in a feedlot system (Galvani et al. 2008) and Texel x Corriedale lambs that received grain and/or breast milk supplementation (Hashimoto et al., 2012). In these studies, the rapid growth was attributed to the quality of the provided feed; however, another possible explanation is the morphological evolution of most herbivores, whose limbs develop quickly to serve as a tool to escape predators in case of danger (Lawrence & Fowler, 2002). For lambs with the intermediate SFT of 3.0 mm, this cut showed a late growth, probably because of the greater variation in their weight when slaughtered.

Unlike the other half-carcass cuts, the rib presented an isogonic growth in lambs slaughtered with 2.0 and 3.0 mm SFT. This same type of growth was observed for confined Texel x Ile de France (Galvani et al., 2008) and Pantaneiro (Mora et al., 2014) lambs, being considered unrelated to race. In the present study, an opposite result (β <1) was found for lambs slaughtered with 4.0 mm SFT. This characteristic may have been inherited from the Dorper breed, which, in a confinement system, showed an increasing daily average gain (Brand et al., 2017), besides trunk depth and compactness (López-Carlos et al., 2010). Dorper x Santa Inês lambs have also been known to show a more robust profile, including a larger chest size (Figueiredo et al., 2019).

The loin proved to be an early cut (β <1) in lambs slaughtered with the lower SFTs of 2.0 and 3.0 mm, as reported for Cornigliese lambs (Sabbioni et al., 2018). However, for lambs with 4.0 mm SFT, the cut was characterized as isogonic. The growth rates obtained for the loin cut in the present study were differed significantly from those observed for the Santa Inês, Texel x Santa Inês, Bergamácia x Santa Inês (Furusho-Garcia et al., 2006), Texel x Corriedale (Hashimoto et al., 2012), and Dorper x Santa Inês (Souza Júnior et al., 2009) breeds. These differences may be due to the adopted production system, responsible for optimizing the productive characteristics of the genotypes.

Lambs slaughtered with 2.0 mm SFT showed a negative heterogeneous growth (β <1) in the leg in relation to the half carcass. However, when the SFT of the lambs increased to 3.0 and 4.0 mm, the growth rate of this cut decreased, becoming isogonic, as verified for the leg growth of female Pantaneiro lambs (Mora et al., 2014). This allows inferring that smaller breeds are more precocious than larger ones (Figueiredo et al., 2019), especially regarding fat deposition (Van der Merwe et al., 2020).

The precocity of most cuts in relation to the half carcass indicates that the Dorper breed contributed to the formation of a carcass with an accelerated growth and better cut yields (Cartaxo et al., 2017), providing desirable characteristics of compactness that are transmitted to its progeny (Nascimento et al., 2018). It should be noted that, despite their greater SFT and weights, these lambs did not reach physiological maturity in the present study, since their bone and muscle tissues continued to show accelerated growth.

All cuts had a medium to high correlation with the half carcass (neck = 0.58, shoulder = 0.82, rib = 0.92, loin = 0.68, and leg = 0.94), considering the three SFTs evaluated. However, the rib and leg cuts stood out, with higher correlation rates. Therefore, the leg cut was more suitable to be correlated with the half carcass of ½ Dorper + ½ Santa Inês lambs slaughtered with different SFTs. This cut also showed the best correlation with the half carcass of Pantaneiro lambs with 3.0 and 4.0 mm SFT (Mora et al., 2014).

The proportions of muscle and subcutaneous fat of the half carcass – with an average of 61.17 and 6.8%, respectively – were constant in the lambs slaughtered with 2.0, 3.0, and 4.0 mm SFT (Table 2). The maintained growth rate of these tissues presupposes that the lambs had not yet reached their mature weight. Therefore, the SFT at slaughter did not affect the muscle yield of the carcass; however, a greater thickness of the subcutaneous fat may protect carcasses from losses during their freezing process (Nascimento et al., 2018).

The proportion of intermuscular fat in the half carcass of lambs with 2.0 mm SFT was lower than that of lambs with 3.0 and 4.0 mm SFT. However, fat growth was considered constant regardless of SFT since the total fat (intermuscular fat + subcutaneous fat) of the half-carcass did not differ significantly. This result allows inferring that a high accumulation of energy in the carcass is more evident in more prolific and smaller sheep breeds (Wood et al., 1980).

The proportion of bone tissue was lower in lambs slaughtered with 3.0 mm SFT, affecting the leg muscularity index, and was similar to that of lambs slaughtered with 2.0 mm SFT. This result may be explained by the smaller amount of bone and the higher proportions of fat in the carcass of lambs with the intermediate SFT.

Although the lower leg muscularity index in lambs with 3.0 mm SFT was lower, it was still considered satisfactory when compared with those of Santa Inês (Santos et al., 2011) and ½ Dorper x ½ Santa Inês (Cartaxo et al., 2009) lambs terminated in confinement. Therefore, the genotypes obtained with the cross between the Dorper and Santa Inês breeds show better levels of conformation (Cartaxo et al., 2017).

The relative growth of the neck tissue components was heterogeneous and negative in the lambs with 2.0, 3.0, and 4.0 mm SFT (Table 3). Therefore, the higher growth rate of the neck tissue components justifies the early growth of this cut for the different SFTs evaluated. However, in Merino sheep, when related to their empty body weight, the neck cut showed isogonic behavior (Pillar et al., 2008). This difference in the growth speed of the neck tissues may be due to the breed, since Merino lambs are considered as being of late maturity (Brand et al., 2017).

The tissue components of the shoulder – muscle tissue, adipose tissues (subcutaneous fat and

Table 2. Means and standard errors of the tissue composition yield of the half carcass of ½ Dorper + ½ Santa Inês lambs slaughtered with different subcutaneous fat thicknesses[1].

Tissue	Subcutaneous fat thickness			F-value	P-value
	2.0 mm	3.0 mm	4.0 mm		
Muscle (%)	62.73±1.18	60.41±1.14	60.37±1.26	1.27	0.301
Subcutaneous fat (%)	6.73±1.03	6.76±0.46	6.91±0.90	0.014	0.985
Intermuscular fat (%)	9.37±0.56b	12.89±0.92a	12.55±0.79a	6.344	<0.006
Total fat (%)	16.10±1.21	19.65±1.26	19.47±1.19	2.672	0.092
Bones (%)	21.17±0.34a	19.93±0.39b	20.16±0.25a	3.893	0.036
Leg muscularity index (LMI, g cm^{-1})	0.46±0.01ab	0.45±0.01b	0.50±0.01a	4.42	0.024

[1]Means followed by different letters, in the same lines, differ by Tukey's test, at 5% probability.

Table 3. Allometry of the tissue components of the commercial neck and shoulder cuts of ½ Dorper + ½ Santa Inês lambs slaughtered with different subcutaneous fat thicknesses (SFTs)[1].

Tissue component	SFT (mm)	Commercial neck cut				Commercial shoulder cut			
		β	Standard error (β)	T-test Ho: β ≠ 1	R^2	β[2]	Standard error (β)	T-test Ho: β ≠ 1	R^2
Muscle	2.0	-0.037	0.024	*	0.972	-0.064	0.085	*	0.974
	3.0	0.066	0.053	*	0.842	-0.167	0.246	*	0.894
	4.0	-0.014	0.065	*	0.881	-0.177	0.196	*	0.984
Subcutaneous fat	2.0	0.009	0.012	*	0.069	-0.023	0.068	*	0.473
	3.0	-0.001	0.018	*	0.310	0.029	0.064	*	0.350
	4.0	-0.046	0.011	*	0.913	0.011	0.112	*	0.293
Intermuscular fat	2.0	0.015	0.028	*	0.251	-0.199	0.026	*	0.979
	3.0	-0.002	0.034	*	0.533	-0.063	0.237	*	0.367
	4.0	0.017	0.026	*	0.427	-0.137	0.212	*	0.563
Total fat	2.0	0.025	0.038	*	0.213	-0.223	0.092	*	0.874
	3.0	-0.003	0.05	*	0.484	-0.002	0.239	*	0.396
	4.0	-0.028	0.025	*	0.837	-0.117	0.246	*	0.578
Bone	2.0	0.005	0.031	*	0.840	0.262	0.022	*	0.545
	3.0	-0.026	0.037	*	0.890	0.18	0.126	*	0.490
	4.0	0.043	0.051	*	0.583	0.245	0.162	*	0.347

[1]β, allometry coefficient; Ho, null hypothesis; and R^2, coefficient of determination. *Significant by the t-test, at 5% probability.

intermuscular fat), and bone tissue – showed a negative heterogonic behavior in lambs slaughtered with 2.0, 3.0, and 4.0 mm SFT (Table 3). However, the muscle developed earlier than the other tissues, such as fat. Despite this, a similar behavior was observed for the total development of the cut due to the general precocity of all parts of the shoulder. The precocious growth of the shoulder muscle was also observed for Texel (Carvalho et al., 2016), pure Santa Inês, Santa Inês x Texel, Santa Inês x Ile de France, and Santa Inês x Bergamácia (Furucho Garcia et al., 2009) lambs.

Regarding the tissue components of the rib cut, muscle growth showed an isogonic behavior in lambs with 2.0 and 3.0 mm SFT (Table 4), but was higher in those with 4.0 mm. The growth rate of the rib for the different SFTs was significantly affected by the deposition of muscle tissue, which has priority in cuts from other body regions, such as the limbs (shoulder and leg). Subcutaneous fat grew in the same proportion as the rib cut in lambs with 2.0 mm SFT, but showed a negative heterogeneous growth in those with 3.0 mm SFT. In contrast, intermuscular fat and bone tissue had an earlier growth, regardless of the SFT at slaughter. Despite this, the tissue with the greatest influence on the rib was still the muscle, directing the relative growth of this cut. In Texel lambs, the muscle tissue showed a constant growth rate, independently of weight (Carvalho et al., 2016).

The tissue components of the loin cut were characterized as negative heterogonic for all the SFTs evaluated (Table 4). In Santa Inês and Santa Inês x Bergamácia (Hashimoto et al., 2012) and Pantaneiro (Mora et al., 2014) lambs, a faster growth of the loin muscle was observed with the greater SFTs of 3.0 and 4.0 mm. This high growth of the loin cut may be attributed to the better yield due to the larger rib eye area inherited from the Dorper breed (Cartaxo et al., 2017), which has a high growth of fat coverage in this region (Brand et al., 2017). Therefore, lambs with different SFTs proved to be efficient both in the deposition of fat cover in the lumbar region and in the accumulation of intermuscular fat, confirming that ½ Dorper + ½ Santa Inês lambs present an efficient deposition of adipose tissue when confined. Muscle and bone also showed an early behavior in this cut. Because of the varying commercial value of the loin, the growth of different tissues is desirable.

Table 4. Allometry of the tissue components of the commercial rib and loin cuts of ½ Dorper + ½ Santa Inês lambs slaughtered with different subcutaneous fat thicknesses (SFTs)[(1)].

Tissue component	SFT (mm)	Commercial rib cut				Commercial loin cut			
		β	Standard error (β)	T-test Ho: β ≠ 1	R^2	β	Standard error (β)	T-test Ho: β ≠ 1	R^2
Muscle	2.0	1.310	0.687	ns	-0.140	0.080	0.081	*	0.880
	3.0	0.796	0.754	ns	0.269	0.105	0.082	*	0.893
	4.0	0.223	0.346	*	0.841	-0.047	0.059	*	0.971
Subcutaneous fat	2.0	0.341	0.886	ns	-0.068	-0.011	0.069	*	0.340
	3.0	-0.102	0.917	*	0.118	-0.072	0.056	*	0.780
	4.0	0.487	0.561	*	-0.195	-0.029	0.064	*	0.642
Intermuscular fat	2.0	-0.275	0.209	*	0.743	-0.044	0.054	*	0.612
	3.0	-0.257	0.993	*	0.323	0.026	0.074	*	0.429
	4.0	-0.624	0.214	*	0.919	0.055	0.047	*	0.540
Total fat	2.0	0.066	0.841	*	0.200	-0.056	0.11	*	0.518
	3.0	-0.359	1.639	ns	0.264	-0.046	0.109	*	0.696
	4.0	-0.137	0.583	*	0.553	0.025	0.092	*	0.675
Bone	2.0	-0.128	0.223	*	0.720	-0.08	0.066	*	0.758
	3.0	0.526	0.484	*	-0.005	-0.006	0.029	*	0.857
	4.0	0.235	0.189	*	0.693	0.032	0.066	*	0.424

[(1)]β, allometry coefficient; Ho, null hypothesis; and R^2, coefficient of determination. *Significant by the t-test, at 5% probability. [ns]Nonsignificant.

In the leg cut, the tissue component showed a negative heterogeneous growth in lambs slaughtered with 2.0, 3.0, and 4.0 mm SFT (Table 5). This same type of growth was reported in other studies with lambs slaughtered at different weights (Carvalho et al., 2016; Hashimoto et al., 2012). However, a proportional growth was observed for muscle tissue, subcutaneous fat, intermuscular fat, and bone in Pantaneiro lambs slaughtered with the greater SFTs of 3.0 and 4.0 mm, since this genotype has not yet been improved for meat (Mora et al., 2014). The obtained results are indicative that the genotype of the present study, under confinement conditions, may show accelerated growth for different tissues, defining a better quality for this cut.

It is recommended to slaughter lambs with all or most of the cuts showing precocious behavior. Therefore, considering the development of the leg and, especially, shoulder cuts, the slaughter of lambs with 3.0 mm SFT is not justified. However, due to the accelerated development of the shoulder and rib cuts, the slaughter of lambs with 4.0 mm SFT becomes an option.

Table 5. Allometry of the tissue components of the commercial leg cut of ½ Dorper + ½ Santa Inês lambs slaughtered with different subcutaneous fat thicknesses (SFTs)[(1)].

Tissue component	SFT (mm)	β	Standard error (β)	T-test Ho: β ≠ 1	R^2
Muscle	2.0	0.034	0.133	*	0.982
	3.0	0.062	0.353	*	0.916
	4.0	0.198	2.026	ns	0.385
Subcutaneous fat	2.0	-0.032	0.11	*	0.564
	3.0	0.439	0.237	*	-0.361
	4.0	0.344	0.046	*	-0.665
Intermuscular fat	2.0	-0.132	0.106	*	0.732
	3.0	-0.069	0.238	*	0.420
	4.0	-0.239	0.158	*	0.778
Total fat	2.0	-0.073	0.198	*	0.690
	3.0	0.37	0.325	*	0.056
	4.0	0.104	0.181	*	0.648
Bone	2.0	0.375	0.105	*	0.389
	3.0	-0.255	0.14	*	0.921
	4.0	-0.169	0.109	*	0.951

[(1)]β, allometry coefficient; Ho, null hypothesis; and R^2, coefficient of determination. *Significant by the t-test, at 5% probability. [ns]Nonsignificant.

Conclusions

1. The slaughter of ½ Dorper + ½ Santa Inês lambs with 4.0 mm of subcutaneous fat thickness allows obtaining a better allometric growth of the shoulder, rib, and leg cuts, as well as a better leg muscularity index.
2. The leg is the cut that shows a better correlation with the half carcass, regardless of the subcutaneous fat thickness at slaughter.

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