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Carcass muscularity and adiposity of different sheep and goat genotypes

Musculosidade e adiposidade da carcaça de diferentes genótipos caprinos e ovinos

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SUMMARY

Carcass muscularity and adiposity of different goat and sheep genotypes grazing in the Caatinga rangeland were evaluated. A total of 40 uncastrated males, with an initial average age and body weight of 120 days and 18.76 kg, respectively, were used: 10 mixed breed goats (MB), 10 cross Boer goats (½ Boer x ½ MB), 10 MB sheep and 10 cross Dorper sheep (½ Dorper x ½ MB). The cross Dorper had higher mean scores for rib eye area, leg muscularity index, weight of total muscles of the leg and conformation compared to MB goats. There was no significant difference between genotypes for the meat texture. Meat color was darker for goat genotypes than for sheep genotypes. The quantitative aspects of carcass adiposity, renal fat, inguinal fat, and subcutaneous and total leg fat showed to be higher for sheep than for goat genotypes. Carcass finishing and leg compactness index were superior for the cross Dorper genotype. Carcass muscularity and adiposity were better in sheep than in goat genotypes, indicating that sheep have a greater muscle and fat tissue development, giving to them a greater potential for beef production.

Keywords: Caatinga, crossbred, fat casing, fat thickness, small ruminants

RESUMO

Foram avaliadas a musculosidade e a adiposidade da carcaça de diferentes genótipos caprinos e ovinos em pastejo na Caatinga. Foram utilizados 40 animais machos, não castrados, com idade média de 120 dias e peso vivo inicial médio de 18,76 kg, sendo 10 caprinos SPRD, 10 mestiços Boer (½ Boer x ½ SPDR), 10 ovinos SPRD e 10 mestiços Dorper (½ Dorper x ½ SPRD). Os mestiços Dorper apresentaram maiores médias para área de olho de lombo, índice de musculosidade da perna, conformação e peso total dos músculos da perna quando comparados aos caprinos SPRD. Não houve diferença significativa para a textura da carne entre os genótipos. A cor da carne foi mais escura para os genótipos caprinos do que para os genótipos ovinos. Os aspectos quantitativos da adiposidade da carcaça, gordura renal, gordura inguinal, gordura subcutânea da perna e gordura total da perna nos genótipos ovinos superaram os observados nos genótipos caprinos. O acabamento da carcaça e o índice de compacidade da perna foram melhores para os mestiços Dorper. A espécie ovina obteve melhores aspectos de musculosidade e adiposidade que os caprinos, indicando que estes animais possuem maior desenvolvimento dos tecidos muscular e adiposo, conferindo-lhes maior aptidão na produção de carne.

Palavras-chave: Caatinga, cruzamento, espessura de gordura, gordura de cobertura, pequenos ruminantes

INTRODUCTION

Goat and sheep production is one of the main activities developed in the Northeast of Brazil, mainly due to the great adaptability of these animals to management practices and to the local climate.
In the Brazilian semiarid region, the Caatinga is the most widespread vegetation and is strongly affected by the seasonality and irregularity of the rain. As a consequence, there is considerable loss in the quantity and quality of dry matter in the forage during the dry season and, most of the times, animals have to receive feed supplementation.
Even with these difficulties, the Northeast of Brazil has the largest goat and sheep herd in the country, with 8.53 and 10.11 million animals, respectively (IBGE, 2011). Goats and sheep crossbreed predominate in northeastern Brazil making it difficult to adequately typify pure breeds or lineages. Animals of mixed breed (MB) are the most commonly studied genetic group. These animals are products of indiscriminate breeding of native types and Asian or Alpine goats of unknown origin (ZAPATA et al., 2001).
Although the MB herd is characterized by low weight and reduced ability to produce meat and milk, animals are highly resistant to diseases and to the climate, even in times of feed shortage.
Simplício et al. (2004) observed that this kind of activity is historically important, both from a social and an economic standpoint, mainly in countries that have arid and semiarid regions. In this context, the economic reality and the ever growing competitive ness and commercialization both demand the use of productive resources more professionally than the artisan kind of production that is found in the region.
In the search for new technologies that may improve performance and productivity in goat and sheep herds, many researchers have developed studies on genetic improvement using selection or planned breeding to solve the problem of low productive indexes, leading to improved carcass yield and meat.
Besides the study of traditional native breeds, farmers invest in new options, such as breeding MB goats with Boer goats, and MB sheep with Dorper sheep, both animals of African origin, that are rustic and have strong meat production aptitude.
Therefore, the objective of this study was to evaluate the muscularity and adiposity of the carcass of different goat and sheep genotypes of mixed breed and their cross products with Boer and Dorper, respectively, in Caatinga pastures.

MATERIAL AND METHODS

This study was developed in the Estação Experimental de Pendência, which belongs to the Empresa de Pesquisa Agropecuária da Paraíba S.A. (EMEPA-PB), located in the city of Soledade, occidental Curimataú region, in the semi-arid region of Paraíba, at 7° 8’ 18’’ S and 36° 27’ 2’’ W. Gr., at 534 m above sea level. This semi-arid region is found between the east and the west of the state of Paraíba, with low mean annual precipitation and a dry season that may last for 11 months. The climate, according to Koopen, is hot semi-arid, with mean maximum annual temperature of 24.5^{o}C and minimum of 16.4^{o}C, relative humidity around 50% and mean precipitation of 400 mm/year, according to data of the Estação Experimental (EMEPA, 2013). However, in the year when the study was carried out, annual precipitation was 329.2 mm/year.

The experimental area was 50 hectares of native Caatinga, with typical vegetation of the region, bushes and trees with many forage species that are normally part of the diet of sheep and goat, such as: *Poincianella pyramidalis* Tul. L. P. Queiroz, with mean crude protein (CP) 11.22%; *Croton blanchetianus* Baill (14.26% CP); *Aspidosperma pyrifolium* Mart. (10.65% CP); *Mimmosa tenuiflora* (Willd.) Poiret (10.50% CP); *Combretum leprosum* Mart. (14.85% CP); and *Bauhinia cheilantha* (Bong.) Steud. (5.80% CP); besides some grassy plants (2.61% CP) and dicotyledons (4.88% CP). Determination of the chemical composition (SILVA & QUEIROZ, 2002) was carried out three times, in the beginning, middle and end of the trial.

A total of 40 male animals were used. Animals were not neutered, mean age was 120 days, and initial live weight was 18.76 (±3.52) kg. A total of 10 MB goats (mixed breed), 10 cross Boer goats (½ Boer x ½ MB), 10 MB sheep and 10 cross Dorper sheep (½ Dorper x ½ MB) were used. The protocol for animal research was approved by an Ethics Committee correctly constituted institute nº 29-2012.

Animals were kept in Caatinga pasture for 280 days (from September to May), with water and mineral protein mix *ad libitum*. Mineral mix composition is presented in Table 1.

At the end of the experimental period, with mean weight of 37.41 (±6.89) kg, animals underwent an 18-hour liquid and solid fast, and post-fasting live weight (mean of 35.55kg) was recorded. After that, animals were stunned, raised by their hind legs and bled by cutting their jugular and carotid arteries. After dividing the animal into carcass and offal components, all carcasses were stored in plastic bags and transported to a cooling chamber at 4°C, where they were hanged by the back leg tendons for 24 hours.

Table 1. Composition of the protein salt offered to animals

Ingredients	Kg/100 kg
Corngrain	27.00
Salt	30.00
Soybeanmeal	15.00
Urea	10.00
Dicalciumphosphate	16.00
Sulfur	1.80
Coppersulphate	0.03
Cobaltsulphate	0.05
Zincsulphate	0.12

At the end of the cooling period, carcasses were weighted again for cold carcass weight (CCW), and then hanged by the calcaneal tendon with parallel legs for the visual and subjective evaluation and classification in conformation scores (ranging from 1 to 5 – bad, reasonable, very good and excellent), and finishing (very thin, thin, medium, fat, and very fat), as well as for perirenal fat score (1 to 3 – little, medium, a lot). After that, this last fat store was removed and weighted. Absolute and relative weights were recorded, according to the method by Cézar & Sousa (2007).

Then, carcasses were longitudinally divided in two half carcasses, with the aid of a chain saw. The left half-carcass was used for the measurement of internal length of the carcass (ILC), that was later used to determine the carcass compactness index (CCI = CCW / ILC). Also, the left half-carcass was cut between the 12thand 13th ribs, exposing a transversal section of the Longissimus dorsi muscle. Later on, the surface was covered with a plastic film where the contour of this muscle was drawn using an appropriate pen, in order to determine the rib eye area (REA). In this measurement, a ruler was used to measure the maximum width (A) and depth (B) to be used in the REA formula: REA = (A/2 x B/2) x (CÉZAR & SOUSA, 2007). The thickness of the subcutaneous fat layer (TSF) was also measured in the dorso-central point of the exposed surface, and grade rule (GR) value was measured on the 12^{th}rib, 11 cm away from the mean line of the ribs. Both measures were made with the aid of a paquimeter. Qualitative characteristics of the carcass were also analyzed: REA texture, marbling, and color, which were subjectively analyzed using a score ranging from 1 to 5.

The left half-carcass was cut in five commercial cuts. The leg, on its turn, was weighted and measured to determine the leg compactness index (LCI= width of the croup /length of the leg). After that, it was frozen for later dissection in bones, fat and muscles, according to Cézar & Sousa (2007). The muscle:bone ratio (MBR) and muscle:fat ratio (MFR) were determined based on these measurements. Later on, the leg muscularity index was calculated using the formula $LMI = \left[\sqrt{(WM/LF)}\right]/LF$, where WM corresponds to the sum of weight of the five muscle that involve the femur, that is, the Biceps femoris, the Semimembranosus, the Semitendinosus, the Quadriceps femoris and the Adductor, whereas LF refers to the length of the femur, according to Cézar & Sousa (2007).

The variables analyzed in relation to quantitative aspects of muscularity were:carcass compactness index (CCI), rib eye area (REA, cm^2), leg muscularity index (LMI), leg compactness index (LCI), absolute weight (g) and yield (%) of total muscles of the leg, as well as the muscle:bone ratio in the leg. Qualitative index were: Conformation, texture, and color of the L. dorsi muscle.

The following quantitative variables were analyzed for adiposity: for the carcass, subcutaneous fat thickness (TSF, mm), GR (mm), renal fat (g and % of empty body weight, EBW), pelvic fat (g and % of EBW), and inguinal fat (g and % of EBW); for the leg, subcutaneous fat (g e % of the reconstituted weight of the leg, RWL), intermuscular fat (g and % of RWL), total fat (g and % of RWL), and muscle:fat ratio. Finally, for the qualitative aspects, finishing, perirenal fat score, and marbling of the carcass were evaluated.

A completely randomized experimental design was used, with 4 treatments and 10 repetitions. Results were submitted to variance analysis and mean values were compared by Tukey test at 5% probability, using SAS (2003).

RESULTS AND DISCUSSION

In relation to the quantitative aspects of carcass muscularity, such as REA, LMI, LCI, and WML (g), a significant (P<0.05) effect of the genotype studies (Table 2) was observed for CCI, WML% and MBR, the effect was similar (P<0.05).

The LMI variable was superior in cross Dorper animals when compared with MB goats. As for REA, sheep were superior to goats, both in MB animals and cross ones. In this context, Cartaxo et al. (2011a), analyzing different sheep genotypes (Santa Inês, Dorper x Santa Inês, and Santa Inês x mixed breed) submitted to two different diets, found differences between the genotypes for the variables REA and LMI, with the Dorper x Santa Inês animals showing the highest values (12.42cm² and 0.42), results that were similar to the ones observed in the present study. REA and LMI are indirect ways to estimate the muscularity of the carcass, and REA showed to be greater in sheep genotypes than in goat genotypes. According to Pereira et al. (2010), REA is considered one indicator of animal muscularity. REA superiority in Dorper cross animals suggests that these animals produce more muscle under the same conditions of feeding and management and, therefore, may produce more meat.

Table 2. Averages, probabilities (P) and coefficients of variation (CV) of the quantitative aspects muscularity of carcass of sheep and goats of different genotypes grazing in the Caatinga

Variables	Genotypes				[a]P	CV (%)
	[1]MB Goat	MB Sheep	Boer x MB	Dorper x MB		
[2]REA (cm²)	9.07[b]	11.41[a]	9.10[b]	12.42[a]	<0.01	23.1
LMI	0.33[b]	0.38[ab]	0.34[ab]	0.41[a]	0.02	10.21
CCI (kg/cm)	0.24[a]	0.23[a]	0.23[a]	0.26[a]	0.25	16.56
LCI (cm/cm)	0.48[b]	0.50[b]	0.51[b]	0.57[a]	<0.01	8.72
WML (g)	1299.51[b]	1734.63[a]	1529.57[ab]	1896.23[a]	0.02	20.74
WML (%)	67.57[a]	69.50[a]	67.10[a]	67.39[a]	0.57	4.53
MBR	2.66[a]	2.76[a]	2.73[a]	2.99[a]	0.37	9.92

[a]Means followed by different letters in the same row differ by Tukey test ($P<0.05$).
[1]MB = Mixed breed; [2]REA = Rib eye area; LMI=Leg muscularity index; CCI = Carcass compactness index; LCI = Leg compactness index; WML = Weight of total muscles of the leg; MBR = Muscle:bone ratio.

Mean CCI was 0.24, similar to the values reported by Soares et al. (2012) in cross Santa Inês x Texel sheep, and superior to the indices found for cross¾ Boer x ¼ Saanen (GRANDE et al., 2009) goats, which reached a mean of 0.20, both confined, fed different sources of fat, and slaughtered with 30kg. The same authors found a mean of 0.28 for LCI, values that are very inferior to the mean observed for goats (0.50), shown in Table 2. This difference may be related to the age, body weight at slaughter, and goat breed used. CCI translates the deposition of muscle and fat per unit of carcass length and, therefore, the comparison between the results of the present study and those of Soares et al. (2012) and Grande et al. (2009) enabled the conclusion that, for this index, there is no difference between animals finished in confinement or in pastures, supplemented with mineral protein mix.

WML values in MB sheep and cross Dorper animals were 1734.63 g and 1896.23g, respectively, which were greater than the values of all treatments in the study by Santos et al. (2011), who evaluated the muscularity and adiposity of the carcass in Santa Inês lambs finished in confinement and recorded WML values of 1615.50; 1664.70; 1659.80; and 1554.10g, for animals treated with different levels of palm meal (0; 33; 66, and 100%) replacing ground corn, and slaughtered with 35kg. There results were very satisfactory, because they demonstrate that even for animals finished in Caatinga pasture have good muscular mass index, once the evaluation of leg muscles is of great importance in the prediction of muscularity, as it presents a high correlation with the carcass, making it a good indicator of the proportion of this tissue (CÉZAR & SOUSA, 2010).

Relative weight of total muscles of the leg (WML%), with a mean of 67.89%, did not show significant differences (P>0.05) when cross genotypes and MB animals were compared. Similar proportion was found by Fernandes et al. (2010) who found mean WML% of 66.39% in an evaluation of tissue composition in the carcass of Suffolk lambs in different finishing systems (pasture, creep feeding, and confinement). The similarity indicates, as well as in WML variation, that animals finished in pasture, supplemented with mineral protein mix, have good proportion of muscles.

The muscle:bone ratio is related to the relative amount of muscle in the carcass, and serves to estimate the muscularity of the carcass. The greater the ratio, the greater the muscle yield. The mean observed for MBR for the genotypes was 2.89, similar to the one obtained by Grande et al. (2009) for ¾ Boer + ¼ Saanen goats in confinement (2.79), and a little greater than the one reported by Nóbrega et al. (2013) in a study of Santa Inês sheep finished in confinement (3.50), indicating that animals that graze in pastures supplemented with mineral protein mix show good muscularity, because their muscle:bone ratio is similar to the one of animals finished in confinement.

As for the qualitative aspects of carcass muscularity (Table 3), there was a significant difference between the genotypes for conformation and color. However, there was none for the variable texture (P>0.05).

Table 3. Averages, probabilities (P) and coefficients of variation (CV) of the qualitative aspects muscularity of carcass of sheep and goats of different genotypes grazing in the Caatinga

Variables	Genotypes				[a]P	CV (%)
	[1]MB Goat	MB Sheep	Boer x MB	Dorper x MB		
Conformation	1.70[b]	1.99[ab]	2.47[ab]	3.03[a]	0.01	42.02
Texture	4.07[a]	4.08[a]	3.91[a]	4.30[a]	0.61	9.45
Color	2.96[a]	2.01[b]	2.29[b]	1.83[b]	<0.01	20.59

[a]Means followed by different letters in the same row differ by Tukey test (P<0.05).
[1]MB = Mixed breed.

Cross Dorper sheep had better conformation scores than MB goats. Cartaxo et al. (2011b) also found differences in conformation between the genotypes of lambs finished in confinement and receiving different levels of energy in the diet. Dorper x Santa Inês animals showed the highest value (3.27), a result that is close to the one of the present study. The authors reported that breeding with Dorper animals improves carcass conformation.

MB goats presented the darkest L. dorsi, and the other genotypes were similar to each other. Sheep meat was lighter, indicating better quality. According to Lucas et al. (2010), the lighter the meat, the younger the animal and, therefore, meat tenderness. Lighter color in sheep genotypes was also observed by Madruga & Bressan (2011).

The similar texture of the genotypes was mainly due to the fact that animals were the same age. According to Cézar

& Sousa (2010), the main factor that differentiates meat texture is the age of the animal. According to the same authors, most of the typification systems uses some aspects of visual appearance to indicate or predict meat quality in the carcasses, mainly the color and texture at the moment of purchase (which have a direct relationship with meat tenderness), and marbling (which is well correlated with flavor, juiciness and tenderness of the meat at the moment of consumption).

Qualitative aspects of carcass adiposity, RF (g and %), IF (g and %), LSF (g and %), and LTF (g and %) presented significant differences (P<0.05) among the genotypes (Table 4), and most were superior for cross Dorper sheep, except for RF (g and %), in which cross Boer animals showed greater means. TSF, GR, PF (g and %), LIF (g and %), and MFR did not differ between genotypes.

Table 4. Averages, probabilities (P) and coefficients of variation (CV) of the quantitative aspects of fatness of the carcass of goats and sheep of different genotypes grazing in the Caatinga

Variables	Genotypes				[a]P	CV (%)
	[1]MB Goat	MB Sheep	Boer x MB	Dorper x MB		
[2]TSF(mm)	1.09[a]	1.53[a]	0.89[a]	2.04[a]	0.25	65.64
GR (mm)	7.67[a]	7.80[a]	7.13[a]	10.63[a]	0.16	34.76
RF (g)	101.24[b]	135.27[ab]	181.98[a]	156.25[ab]	0.01	39.9
RF (%)	0.37[b]	0.46[ab]	0.59[a]	0.47[ab]	0.01	28.02
PF (g)	13.15[a]	18.52[a]	19.40[a]	20.25[a]	0.61	55.89
PF (%)	0.04[a]	0.06[a]	0.05[a]	0.05[a]	0.91	42.36
IF (g)	44.25[b]	74.02[b]	64.61[b]	123.81[a]	<0.01	52.68
IF (%)	0.16[b]	0.26[b]	0.22[b]	0.38[a]	<0.01	39.95
LSF (g)	21.54[b]	47.75[b]	33.79[b]	94.18[a]	<0.01	70.38
LSF (%)	1.07[b]	1.91[b]	1.53[b]	3.40[a]	<0.01	59.47
LIF (g)	22.40[a]	18.76[a]	30.88[a]	18.97[a]	0.54	59.03
LIF (%)	1.10[a]	0.72[a]	1.39[a]	0.61[a]	0.32	59.49
LTF (g)	42.60[b]	65.05[b]	63.35[b]	112.45[a]	<0.01	50.5
LTF (%)	2.15[b]	2.50[b]	2.93[ab]	4.04[a]	0.01	42.42
MFR	37.07[a]	31.74[a]	21.60[a]	19.50[a]	0.06	48.78

[a]Means followed by different letters in the same row differ by Tukey test (P<0.05).
[1]MB = Mixed breed; [2]TSF = Thickness of the subcutaneous fat; GR = Grade rule value; RF = Renal fat; PF = Pelvic fat; IF = Inguinal fat; LSF = Leg subcutaneous fat; LIF = Leg intermuscular fat; LTF = Leg total fat; MFR = Muscle:fat ratio.

According to Cézar & Sousa (2006), body condition of the animal at the moment of slaughter may predict the amount of fat in the carcass, mainly subcutaneous fat (TSF). The similarity observed in TSF between the different genotypes may be explained by the results of another study of our group. In trials in the EMEPA-PB comparing body condition and fat distribution in unwooled and semi-woolled sheep and their crossbreeds, we assessed lower deposition of subcutaneous fat and greater accumulation of internal fat in unwooled animals than in semi-wooled and cross animals, indicating that the fat distribution in unwooled sheep is similar to that of goats.

In spite of the statistical similarity found in TSF, numerically, cross

Dorper animals were superior to the other genotypes, with a mean of 2.04mm, where as cross Boer animals showed the lowest values (0.89 mm). This is certainly due to the fact that CV was 65.64%, demonstrating the heterogeneity of the data on this variable.

GR is a measurement that aims at predicting the amount of subcutaneous fat in the carcass. All the genotypes had measurements considered to be ideal, according to Cézar & Sousa (2007), who indicate a minimum (7mm) and a maximum (12mm). Cartaxo et al. (2011a), in studies with sheep of different genotypes receiving two different diets and slaughtered at mean age of 213 days, found greater GR in Dorper x Santa Inês lambs (6.38mm), followed by Santa Inês x MB lambs (4.63mm), and Santa Inês lambs (3.27 mm), justifying that this measurement is influenced by the potential of the genotypes. Therefore, the similarity observed in this study for GR may be attributed to the level of maturity of the animals, as it is known that fat deposition is greater in more mature animals (ROSA et al., 2002). Age probably made this deposition reach similar levels in the different genotypes, as mean slaughter age of these animals was 400 days.

Santos et al. (2011), evaluating fat deposition in the carcass of Santa Inês lambs fed decreasing levels of ground corn replaced by palm meal and finished in confinement, described greater results for TSF, IF (g and %), LIF (g and %), and LTF (g and %), similar in the treatment 0% for GR in cross Dorper animals, and inferior for MFR in all treatments, demonstrating that animals finished in the Caatinga have very low adiposity.

It is know that the use of specialized breeds, either pure or crossbred, may significantly improve the performance of sheep herds, positively affecting productive indices and the quality of the carcasses and meat (FURUSHO-GARCIA et al., 2004). However, there were similarities in some variables (GR, PF, LIF), certainly because the animals were kept in the same management conditions (Caatinga). According to Leite (2002), these small ruminants may easily change their food preferences according to the availability of forage and the season of the year, confirming that these species have similar feeding strategies, when kept in the same management conditions, and considering the same age group.

MFR is considered a good indicator of the proportion of fat in the carcass (CÉZAR & SOUSA, 2010), and was statistically similar among the genotypes. However, numerically, the cross Dorper animals showed lower MFR in relation to the other genotypes, with a mean of 19.50, where as MB goats showed the greater MFR (37.07), indicating greater adiposity in cross Dorper sheep. As with other variables, this similarity between the means was probably due to the high CV.

As for finishing, there were statistical differences ($P<0.05$) between the genotypes, with cross Dorper animals showing greater finishing, and goat genotypes, lesser finishing. PFS and marbling were similar among the genotypes (Table 5).

Finishing was greater in cross Dorper sheep (3.55), indicating that breeding with animals specialized in meat production improves fat cover scores, which was observed by Sousa et al. (2012), when they studied the Santa Inês, F1 Dorper x Santa Inês, and F1 Santa Inês x MB genotypes, and reported that Dorper x Santa Inês products showed greater fat cover scores. This finding was also confirmed by Álvarez et al. (2013), in a study with different sheep genotypes. They reported that breeding improves subcutaneous fat cover, among other carcass characteristics, that is, it improves finishing. They concluded that this change may contribute for greater acceptance and better prices of these carcasses.

Table 5. Averages, probabilities (P) and coefficients of variation (CV) of the qualitative aspects of adiposity housing sheep and goats of different genotypes grazing in the Caatinga

Variables	Genotypes				[a]P	CV (%)
	[1]MB Goat	MB Sheep	Boer x MB	Dorper x MB		
Finishing	1.03[c]	2.39[b]	1.05[c]	3.55[a]	<0.01	59.35
[2]PFS	1.01[a]	0.98[a]	1.16[a]	1.38[a]	0.15	28.82
Marbling	1.57[a]	1.80[a]	1.62[a]	1.90[a]	0.80	27.31

[a]Means followed by different letters in the same row differ by Tukey test (P<0.05).
[1]MB = Mixed breed; [2]PFS = Perirenal fat score.

PFS did not show significant difference (P>0.05) among the genotypes, a similar result to that obtained by Sousa et al. (2009), who observed internal fat weight similar for goats and sheep in pasture conditions. Normally, goats show greater perirenal fat scores. However, unwooled sheep adapted to the semi-arid environment have great ability to accumulate reserves in the form of internal fat to be mobilized in periods of food scarcity (CAMILO et al., 2012).
Cross Dorper animals were superior in terms of quantitative and qualitative aspects of adiposity. Sheep, in general, showed better muscularity and adiposity than goats, whether genotypes were considered or not, indicating that these animals have greater development of muscle and fat tissue in their carcasses, making them more apt to meat production.

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