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Carcass and non-carcass components of lambs fed with *Cenchrus ciliaris* and *Mimosa tenuiflora*

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ABSTRACT

The objective of this study was to evaluate the characteristics of carcass and the non-carcass components of lambs fed with different proportions of buffel grass hay (*Cenchrus ciliaris* L.) and 'jurema preta' (*Mimosa tenuiflora* (Willd.) Poir.). The study was developed at the Federal University of Campina Grande, Campus of Patos-PB. Twenty-eight uncastrated lambs with initial body weight of 20 ± 2.49 kg were used. The treatments were the different proportions of 'jurema preta' hays (BJH) and buffel grass hay (BGH) in the bulky portion of the diet: 0% of BJH + 100% of BGH; 33% of BJH + 67% of BGH; 67% of BJH + 33% of BGH; 100% of BJH + 0% of BGH. A quadratic effect was observed for loin eye area, conformation and GR measure ("grade rule"). The thickness measurements of subcutaneous fat and marbling presented negative linear behavior, with the substitution of BGH by BJH. The substitution of BGH in the proportion of 20 to 50% by the BJH of the bulky portion in the lambs' diet allows for a good conformation, loin eye area and non-carcass components.

Key words: liver, morphometry, sheep, bulky

Carcaça e não constituintes de cordeiros alimentados com capim-buffel e jurema-preta

RESUMO

Objetivou-se avaliar as características de carcaça e seus não constituintes, de cordeiros alimentados com diferentes proporções de feno de capim-buffel (*Cenchrus ciliaris* L.) e jurema-preta (*Mimosa tenuiflora* (Willd.) Poir.). O estudo foi desenvolvido na Universidade Federal de Campina Grande, Campus de Patos-PB. Foram utilizados 28 cordeiros, não castrados, com peso corporal inicial de 20 ± 2,49 kg. Os tratamentos foram as diferentes proporções dos fenos de jurema-preta (FJP) e feno de capim-buffel (FCB) na porção volumosa da dieta: 0% de FJP + 100% de FCB; 33% de FJP + 67% de FCB; 67% de FJP + 33% de FCB; 100% de FJP + 0% de FCB. Observou-se efeito quadrático para área de olho de lombo, conformação e medida GR ("grade rule"). As medidas espessura de gordura subcutânea e marmoreio apresentaram comportamento linear negativo, com a substituição do FCB pelo FJP. A substituição do FCB na proporção de 20 a 50% pelo FJP da porção volumosa na dieta de cordeiros permite uma boa conformação, área de olho de lombo e não constituintes da carcaça.

Palavras-chave: fígado, morfometria, ovinos, volumoso

Introduction

Sheep breeding is a good option for meat production and has gained representativeness in Brazil's livestock production, mainly at the level of small producers in the Northeast region.

However, this activity periodically faces difficulties in the region due to drought, which can extend for long periods. On the other hand, the food base of the herds is the native pasture called *Caatinga*, which is totally dependent on rainfall, an aspect that reinforces the need for confinement, associated with the use of supplementation with bulky and concentrated diet. In this way, it is crucial to search for alternatives in production to reduce food costs and to ensure greater economic sustainability.

Among the alternatives, confinement and hay production of plants present in the region, such as 'jurema preta', associated with drought-resistant exotic species, such as buffel grass, may become interesting for sheep farmers, since 'jurema preta' can contribute positively to the feeding of goats and sheep of the Northeast region. Cordão et al. (2008) indicate that exclusive feeding with leaves or branches of 'jurema preta' should be avoided, however, when used in association with other foods, its potential is reiterated and it can participate with up to 50% of the diet of ruminants, especially for sheep and goats.

Regarding sheep, one of the races that has a great efficiency in converting its feed into quality meat is the Santa Inês breed, since it has a fast growth, becoming a good alternative for intensive meat production (Marques et al., 2007) by using well-adapted native and/or exotic plant hays.

The evaluation of the carcass and the non-carcass components can contribute to the knowledge of its composition and factors that influence the consumer, thus gaining importance in the research (Silva et al., 2008). These aspects are visible when the measurements of carcasses are analyzed and they allow making inferences about the constituent tissues of the carcass, thus estimating the characteristics of the carcasses, avoiding the delayed process of tissue dissection (Yáñez et al., 2004).

An aspect to be considered in the production is that the carcass is the live-weight component of greater commercial value, but the components of the body weight not belonging to the carcass, or non-carcass components, should be valued, since some components such as heart, kidneys and liver can be used as food; and others, such as fur, can be used prominently in the footwear and apparel industry (Mendonça et al., 2003). However, the intention is to make the most of all the components of the carcass, because, according to Carvalho et al. (2007), it may represent up to 60% of the animal's body weight.

The objective of this study was to evaluate the characteristics of carcass: conformation and finishing, and the non-carcass components of Santa Inês lambs submitted to diets with different proportions of buffel grass (C*enchrus ciliaris* L.) and 'jurema preta' (*Mimosa tenuiflora* (Willd.) Poir.) hays, in the bulky portion of the diet.

Material and Methods

The study was developed at the Federal University of Campina Grande, Campus of Patos-PB, and approved by the Ethics Committee of Use of Animals (CEUA) on March 21, 2013 (CEP Protocol nº. 32-2012).

The climate of the region is classified as BSH`w (hot and dry), with two well defined seasons, one rainy, from January to May, and another drought, from June to December, with annual rainfall of 500 mm. The maximum and minimum temperatures during the study were on average 36.14 and 22.99 °C, respectively, and the average relative humidity of the air was 56.91%.

'Jurema preta' hay was obtained from plants with full vegetation, harvested in the middle of the native pasture, by using branches with a diameter of up to 10 mm. In the haymaking process of fodder (buffel grass and 'jurema preta'), the whole plants (stem and leaves) were ground, transported to a dryer, distributed in a single layer and revolved periodically until they were approximately 10% of humidity. After dehydration, both 'jurema preta' and buffel grass were again ground and stored in nylon bags.

The experimental diet consisted of 60% of bulk and 40% of concentrate (Table 1), with different proportions of 'jurema preta' (BJH) and buffel grass (BGH) hays in the bulky portion of the diet: 0% of BJH + 100% of BGH; 33% of BJH + 67% of BGH; 67% of BJH + 33% of BGH; 100% of BJH + 0% of BGH constituting the treatments.

Twenty eight uncastrated lambs aged 100 to 120 days with mean live weight (LW) of 20 ± 2.49 kg were used. The animals were dewormed and kept in confinement in individual wooden cages with dimensions of 1.60 m x 0.80 m, provided with individual feeders and drinkers, distributed in a shed with suspended slat floor and covered with ceramic tiles.

Table 1. Participation of ingredients in feed and chemical composition of experimental diets (g kg^{-1})

Ingredients (kg)	Levels of *Cenchrus ciliaris* hay in the voluminous portion of the diet			
	0%	33%	67%	100%
Hay *Cenchrus ciliaris*	60.00	40.20	19.80	-
Hay *Mimosa tenuiflora*	-	19.80	40.20	60.00
Corn bran	24.17	25.08	24.63	26.83
Soybean meal	13.74	12.81	13.82	11.09
Urea	0.50	0.50	0.17	0.46
Soy oil	0.23	0.24	-	0.22
Calcitic limestone	0.36	0.38	0.38	0.41
Mineral blending [1]	1.00	1.00	1.00	1.00
Chemical composition of diet (g kg^{-1})				
Dry matter	916.60	914.50	911.60	909.80
Crude protein	128.35	128.66	128.30	128.92
NDF	538.96	524.07	512.81	494.21
ADF	344.50	349.64	357.38	360.32
NDFap	517.53	495.89	477.63	452.33
ADFca	330.13	329.15	330.29	327.36
Mineral matter	74.76	61.98	46.28	35.62
Organic matter	912.97	925.74	943.76	952.31
Ethereal extract	28.69	30.96	32.31	35.30
TOCH	786.51	794.05	796.98	809.13
NFC	268.97	298.15	319.33	356.79
TDN*	613.22	613.80	617.89	615.46
CE (Mcal kg^{-1}MS)**	2.22	2.22	2.23	2.22
TAN	0.00	43.40	88.12	131.52

DM = dry matter; CP = crude protein; NDF = Neutral detergent fiber; ADF = acid detergent fiber; NDFap = Neutral detergent fiber corrected for ash and protein; ADFca = acid detergent fiber corrected for ash and protein; MM = Mineral matter; OM = Organic matter; TOCH = Total carbohydrate; NFC = Non-fibrous carbohydrates; TDN = Total digestible nutrients; CE = Crude Energy Mcal kg-1MS; TAN = Tannin; * = Obtained from Petterson (2000); ** = obtained from Rodrigues (2009).

The animals had been confined for 76 days, of which the first 15 days were aimed at adaptation and experimental conditions and 61 days were intended for data collection. The diets were adjusted to meet the protein and CE requirements described by (NRC, 2007) for gain of 200g dia^{-1}. The animals received the diet twice a day according to the treatments.

At the end of the 76 days of confinement, the animals were fasted for 24 hours, where they were weighed and the slaughter weight (SW) were considered, with an average of 26.95; 28.00; 26.61; 22.00 kg for treatments 0, 33, 67 and 100% of proportion of BJH, respectively. The animals were slaughtered by stunning with concussion and bleeding; then, they were skinned, eviscerated, decapitated and to the extremities of the limbs were removed in the level of the carpal and tarsal bones, obtaining the carcasses.

The full gastrointestinal tract (FGIT) was removed and weighed, then emptied and weighted again to obtain the empty gastrointestinal tract (EGIT), and consequently the empty body weight (EBW), which was calculated by subtracting the slaughter weight (SW) of the weights referring to the gastrointestinal content and to the liquids contained in the bladder and gallbladder.

The carcass was obtained after separating the head and legs, which revealed the hot carcass weight (HCW). All components of the animal's body that were not included in the carcass weight were referred to as "non-carcass components", which were obtained by subtracting the HCW from the EBW. The carcasses were then kept in a cold chamber for 24 hours at a temperature of 4 ° C and were hung by the calcaneus tendon in appropriate hooks to obtain, at the end of 24 hours, the cold carcass weight (CCW).

In the carcass, the conformation and finishing (1 = very poor to 5 excellent) and the pelvic-renal fat (1 = very thin to 5 = very fat) were evaluated subjectively. The pelvic, perirenal and mesenteric fat were separated and their weights and yields were measured.

The external length of the carcass was measured: distance between the base of the neck and the base of the tail; width of the rump: maximum width between the trochanters of the femurs; width of the thorax: maximum distance between the ribs; perimeter of the rump: taken around the rump measured from the trochanters of the femurs; and perimeter of the leg. From the cold carcass weight and its length, the compactness of the carcass was calculated (Cezar & Sousa, 2007).

In the right half carcass the internal carcass length was evaluated: maximum distance between the anterior border of the ischio-pubic symphysis and the anterior border of the first rib at its midpoint; chest depth: maximum distance between the sternum bone and the back of the carcass at the level of the sixth thoracic vertebra; leg length: distance between the perineum, 23 at its most distal edge, and the inner border of the tarsal-metatarsal joint surface, from the inner side of the leg. All measures of length and perimeter were made with tape measure and the width measures were made with compass (Cezar & Sousa, 2007).

After the carcass was obtained, on the exposed muscular surface between the 12th and 13th thoracic vertebrae, after the cross section of the *Longissimus dorsi* (loin) muscle, its profile was drawn in transparent sheets and measured to obtain the loin eye area (LEA) according to the methodology described by Cezar & Sousa (2007), by using the formula [(LEA = A/2 x B/2) x π], with π equal to 3.1416. It was also evaluated the thickness of cover fat in the dorsal-ventral direction of the subcutaneous fat exposed by the LEA and the GR, by measuring, in the abdominal wall, the soft tissue depth (muscle and fat) deposited on the 12th rib at a point 11 cm from the midline of the loin.

In the exposed muscle surface, after the section of the *Longissimus dorsi* muscle, the coloration was evaluated (1 = light pink to 5 = dark red), as well as the texture (1 = very thick to 5 = very thin) and marbling (1 = nonexistent to 5 = excessive) of muscular fibers, also following the methodology recommended by Cezar & Sousa (2007).

The design was completely randomized with four treatments and seven replicates, with data submitted to analysis of variance and regression, always at the 5% probability level, using the SAS program (2003).

Results and Discussion

The substitution of buffe lgrass hay by 'jurema preta' hay affected the weights of mesenteric and inguinal fat quadratically and the perirenal fat in a linear way (p <0.05), whereas the finishing and the pelvic fat weight were not affected (p > 0.05) (Table 2).

The lambs presented similar finishing, which can be justified by the fact that the animals were slaughtered still young, as fat is a tissue of late deposition, and therefore it did not bring differences as to the different proportions of 'jurema preta' and grass buffel hays. According to Cordão et al. (2012), many studies still have to be carried out in search of better conditions to obtain the ideal finishing, given its importance in meat quality.

The average slaughter weights of the animals in treatments 0, 33, 67 and 100% of 'jurema preta' hay were 26.95; 28.00; 26.61; 22.00 kg, respectively, which were statistically similar and could be directly related to the effects observed in Table 2. Marques et al. (2007) observed similar behavior when

Table 2. Evaluation of carcass adiposity of Santa Inês lambs fed with different proportions of buffel grass and 'jurema preta' hay

Variables	Hays ratio BJH:BGH in the bulk of the diet				Regression equation	p	R²
	0:100%	33:67%	67:33%	100:0%			
Finishing (1-5)	2.33	2.58	2.64	1.75	Ŷ = 2 . 34	0.2897	0.05
G. mesenteric (g)	585.33	591.66	603.14	179	$\hat{Y} = 549.57+5.14x- 0.08x^2$	0.0010	0.40
G. perirenal (g)	2.00	1.70	1.65	1.43	$\hat{Y} = 2.585 - 0.004x$	0.0153	0.23
Inguinal fat (g)	60.33	58.50	65.71	19.0	$\hat{Y} = 56.87+ 0.7x- 0.01x^2$	0.0066	0.28
Pelvic fat (g)	17.66	18.00	20.57	7.33	$\hat{Y} = 16.08$	0.0899	0.12

BJH: BGH: 'Jurema Preta' Hay: Buffel Grass Hay; Ŷ = Dependent variable; X = Level of 'jurema preta' hay; p = Probability; R^2 = Coefficients of determination.

verifying that sheep fed with 0, 33, 66 and 100% of silk flower hay and slaughtered with 70 days of confinement presented slaughter weights of 27.47; 27.82; 20.27 and 18.44 kg.

The behaviors observed in fats, in general, tended to reduce, as buffel grass hay was replaced by 'jurema preta' hay. This can be related to the presence of tannins in the 'jurema preta' (Table 1), because according to Cordão et al. (2010), the presence of tannins is associated with adverse effects such as antinutritional factors, causing reduction in dry matter intake and reduction in the digestion of proteins and fiber, which impair the absorption of food.

The conformation, leg length, internal carcass length, chest width, perimeter of the croup and perimeter of the leg had quadratic effect. On the other hand, the external carcass length, rump width and chest depth were affected in a linearly decreasing manner when substituting buffel grass hay by 'jurema preta' hay (Table 3).

The substitution of buffel grass hay by 'jurema preta' hay in the lambs's diet promoted a quadratic effect on the carcass conformation, estimating a maximum point in 25%, confirming the direct relation with the slaughter weight, corroborating with the results described by Silva et al. (2012) in a study with effect of silk flower hay on the carcass and body constituents of lambs.

The conformation obtained a mean of 2.77, which corroborates with the work of Murta et al. (2009), who evaluated carcass characteristics of Santa Inês lambs slaughtered with 67 days of confinement, fed with sugarcane bagasse hydrolyzed with calcium oxide, and obtained a mean for conformation of 2.73.

It was also observed that the leg length, the internal carcass length, the perimeter of the rump, the perimeter of the leg and chest width were affected quadratically (p <0.05) in the substitution of buffel grass hay (BGH) by 'jurema preta' hay, with inflection points of 22.00; 23.89; 27.00; 22.22; 33.33%, respectively.

Results similar to this study were obtained by Araújo Filho et al. (2007), when evaluating the effect of diet and genotypes on morphometric measures in Morada Nova, Santa Inês and Dorper x Santa Inês crossbred lambs confined and slaughtered with approximately 30 kg. They did not observe a significant effect (p > 0.05) on the characteristics related to morphometry of the carcass, except the measurements of perimeter of thorax and chest width. This behavior may be associated with the characteristics of the Santa Inês breed and its greater ability to cut (Sousa et al., 2009).

For the loin eye area (LEA) and the GR measurement, there was a quadratic effect of the substitution of buffel grass hay for 'jurema preta' hay, whereas subcutaneous fat thickness (SFT) and marbling obtained a linear decreasing effect, and color and texture were not affected (p > 0.05) (Table 4).

Considering LEA as a parameter of choice, the best combination estimated by the equation is 18.75% of 'jurema preta' hay and 81.25% of buffel grass hay in the bulky portion of the diet, as it was demonstrated that carcasses with good musculature are obtained with these percentages. According to Bonvillani et al. (2010), the LEA measurement performed on the *Longissimus* muscle has been directly related to the total of muscles in the carcass, and it can be used to express carcass muscularity.

In a study evaluating Santa Inês lambs finished in confinement, using a single diet, with a bulk:concentrate ratio of 30:70, Cartaxo & Sousa (2008) reported LEA values of 9.21 cm². This result was higher than the present study, where an average of 7.8 cm². This inferiority can be explained by the composition of the diet, as well as by the presence of antinutritional substances, such as tannins. According to Cordão et al. (2013), 'jurema preta' has a low digestibility level (11 to 41%) and contains tannins, which may interfere with digestibility, and consequently on the animal's performance in general.

The SFT presented a mean value of 0.76 mm (Table 4). It is observed that for each replacement of 1% of BGH by the BJH, a 0.004 cm reduction in the thickness of the subcutaneous fat

Table 3. Evaluation of conformation and morphometry of the carcass of Santa Inês lambs fed with different proportions of buffel grass and 'jurema preta' hay

Variables	Hays ratio BJH:BGH in the bulk of the diet				Regression equation	*p*	R²
	0:100	33:67	67:33	100:0			
Conformation	3.06	3.11	3.01	1.93	$\hat{Y}$ = 3.020+ 0.01 x- 0.0003x²	0.0001	0.65
LL (cm)	37.91	37.5	37.71	36.16	$\hat{Y}$ = 37.784 + 0.01x -0.0003x²	0.0499	0.24
ELC (cm)	55.16	55.16	54.00	50.33	$\hat{Y}$ = 644.90 - 3.302x	0.0030	0.32
ILC (cm)	58.08	59.33	56.21	53.00	$\hat{Y}$ = 58.309 + 0.04x -0.0001x²	0.0007	0.48
RW (cm)	22.00	21.58	21.00	19.58	$\hat{Y}$ = 22.21 - 0.02x	0.0001	0.51
TW (cm)	20.33	20.75	20.5	18.33	$\hat{Y}$ = 20.263 + 0.04x 0.00059x²	0.0060	0.37
PR (cm)	55.00	54.75	53.714	48.41	$\hat{Y}$ = 54.804 + 0.05x - 0.001x²	0.0001	0.71
PL (cm)	36.50	37.00	35.07	31.66	$\hat{Y}$ = 36.546 + 0.04x -0.0009x²	0.0007	0.49
PT (cm)	25.75	25.33	24.92	20.57	$\hat{Y}$ = 26.005 - 0.02x	0.0025	0.33

BJH: BGH: 'Jurema Preta' Hay: Buffel Grass Hay; $\hat{Y}$ = Dependent variable; X = Level of 'jurema preta' hay; p = Probability; R^2 = Coefficients of determination; LL = Leg length; ELC = External length of the carcass; ILC = Internal length of the carcass; RW = Rump width; TW = Thorax width; PR = Perimeter of the rump; PL = Perimeter of the leg; PT = Perimeter of the thorax.

Table 4. Evaluation of muscle *Longissimus dorsi* of Santa Inês lambs fed with different proportions of buffel grass and 'jurema preta' hay

Variables	Hays ratio BJH:BGH in the bulk of the diet				Regression equation	*p*	R²
	0:100	33:67	67:33	100:0			
LEA (cm²)	8.49	9.04	7.54	6.26	$\hat{Y}$ = 8.61 + 0.015x - 0.0004x²	0.0093	0.34
Color	4.16	4.13	4.21	4.41	$\hat{Y}$ = 4.23	0.0893	0.12
SFT (mm)	0.95	0.84	0.79	0.49	$\hat{Y}$ = 0.987 - 0.004x	0.0002	0.45
GR (grade rule) (mm)	9.03	9.2	9.2	5.02	$\hat{Y}$ = 8.85 + 0.058x - 0.0009x²	0.0001	0.75
Marbling (1-5)	0.96	1.01	0.91	0.66	$\hat{Y}$ = 1.042 - 0.002x	0.0001	0.04
Texture	4.25	4.08	4.14	4.41	$\hat{Y}$ = 4.22	0.2474	0.06

BJH: BGH: 'Jurema Preta' Hay: Buffel Grass Hay; $\hat{Y}$ = Dependent variable; X = Level of 'jurema preta' hay; p = Probability; R^2 = Coefficients of determination; LEA = Loin Eye Area; SFT = Subcutaneous fat thickness.

is estimated, a fact that may be related to the carcass weight, which can be considered low in relation to specialized breeds. Medeiros et al. (2009) say that the fat cover affects the value of the carcass. If reduced, it impairs the quality of the meat; when appropriate, it favors the cooling and maturation of the meat; but in excess, it can be rejected by the consumer market.

As for the GR measurement, there was a quadratic effect, since animals with 100% of replacement of buffel grass hay by 'jurema preta' hay obtained an average of 5.02 mm, being the only ones that were below that indicated by Cezar & Sousa (2007), who recommend a minimum thickness of 7 mm and a maximum thickness of 12 mm, where the carcass below 7 mm is considered to be of poor finishing and above 12 mm is considered to be excessively finished.

There was a quadratic effect ($p < 0.05$) in the replacement of buffel grass hay by 'jurema preta' hay on the testicles, lung, paws, blood, skin and kidneys. As for liver, heart, penis/urethra, there was linear decreasing effect ($p < 0.05$). The weight of head, gall bladder and spleen were not affected ($p > 0.05$) (Table 5).

The observed effects, whether quadratic or linearly decreasing, show that the substitution causes an effect of reducing the weight of these viscera. However, it did not decrease to the point of losing economically, since the reduction was minimal. Liver, heart and kidneys are the non-carcass components most sought by consumers, being more valued when compared to the other viscera (Costa et al., 2005). Medeiros et al. (2009) stated that there is a need for studies aimed at improving the microbiological quality of these components, as well as ways of processing, preserving and presenting the product, so that they can add more commercial value.

Organs such as liver and spleen have high metabolic rates and require further development to meet the demand for nutrient metabolism (Camilo et al., 2012); and their respective sizes are related to the higher consumption of nutrients by the animal, especially energy and protein. Based on this statement, it was expected a linear decrease. These differences in viscera, due to the substitution of buffel grass hay by 'jurema preta' hay, indicate that the feeding system influences the non-carcass components.

Differently from this study, Voltolini et al. (2011) when evaluating the non-carcass components of lambs kept in buffel grass pastures and receiving increasing doses of supplement (0, 0.33 and 0.66), observed that the weight and yield of non-carcass components (blood , kidney, head, whole intestine, heart, lung and liver), were not influenced ($p > 0.05$) by the concentrated supplementation.

It is observed that there was a quadratic effect for the yields of testicles, lung, mesenteric fat and empty bladder. For the liver, heart and paws there was a linear decrease of 0.002; 0.0009; 0.0002%, respectively, for each percentage unit of replacement (Table 6).

Table 5. Weight of non-carcass components of Santa Inês lambs fed with different proportions of buffel grass and 'jurema preta' hay

Variables	Hays ratio BJH:BGH in the bulk of the diet				Regression equation	*p*	R²
	0:100	33:67	67:33	100:0			
Testicle (g)	246.33	305.66	451.714	366.33	$\hat{Y}$ = 251.09 + 2.470x - 0.037x²	0.0001	0.60
Liver (g)	424.33	398.00	373.14	268.00	$\hat{Y}$ = 440.22 - 1.46x	0.0001	0.51
Lung (g)	576.33	579.33	451.71	366.33	$\hat{Y}$ = 585.486 - 0.371x -0.019x²	0.0001	0.62
Heart (g)	186.33	176.00	156.57	126.00	$\hat{Y}$ = 191.31 - 0.59x1	0.0001	0.52
Heads (g)	1234.00	1129.33	1191.714	1044.00	$\hat{Y}$ = 1151.44	0.1278	0.07
Legs (g)	646.66	642.66	585.428	520.00	$\hat{Y}$ = 648.97 + 0.054x - 0.013x²	0.0001	0.55
Penis/urethra (g)	67.66	65.33	56.57	44.66	$\hat{Y}$ =70.23 -0.23x	0.0014	0.36
V. Biliar (g)	8.33	7.66	6.28	4.33	$\hat{Y}$= 6.64	0.0828	0.12
Blood (g)	885.66	885.83	700.28	622.66	$\hat{Y}$ = 901.317 - 1.332x-0.016x²	0.0220	0.29
Skin (g)	2043.00	2310.33	1912.85	1220.33	$\hat{Y}$ = 2062.17 + 12.91x-0.215x²	0.0001	0.75
Spleen (g)	71.00	60.00	61.42	46.00	$\hat{Y}$ = 59.68	0.0585	0.14
Kidneys (g)	78.33	77.33	73.42	58.33	$\hat{Y}$ = 77.861 + 0.132 - 0.0032x²	0.0001	0.66

BJH: BGH: 'Jurema Preta' Hay: Buffel Grass Hay; $\hat{Y}$ = Dependent variable; X = Level of 'jurema preta' hay; *p* = Probability; R^2 = Coefficients of determination; GB = Gall bladder.

Table 6. Yield of non-carcass components in relation to live weight at slaughter of Santa Inês lambs fed with different proportions of buffel grass and 'jurema preta' hay

Variables (%)	Hays ratio BJH:BGH in the bulk of the diet				Regression equation	*p*	R²
	0:100	33:67	67:33	100:0			
Testicle	0.90	1.10	0.90	0.58	$\hat{Y}$ = 0.92 + 0.007x - 0.0001x²	0.0006	0.49
Liver	1.58	1.41	1.43	1.24	$\hat{Y}$ = 1.56 - 0.002x	0.0015	0.40
Lung	2.17	2.06	1.73	1.70	$\hat{Y}$ = 2.20 - 0.007x- 0.00002x²	0.0085	0.35
Heart	0.69	0.63	0.60	0.58	$\hat{Y}$ = 0.67 - 0.0009x	0.0491	0.15
Heads	4.59	4.59	4.61	4.83	$\hat{Y}$ = 4.34 + 0.003x	0.0443	0.31
Legs	2.41	2.30	2.26	2.40	$\hat{Y}$ = 2.35 - 0.0002x	0.0022	0.82
Penis/urethra	0.25	0.23	0.21	0.20	$\hat{Y}$ = 0.22	0.1242	0.08
G. Mesenteric	2.18	1.91	2.31	0.86	$\hat{Y}$ = 0.25 - 0.0006x 0.000002x²	0.0113	0.33
Empty bladder	0.16	0.20	0.17	0.11	$\hat{Y}$ = 2.04 + 0.01x - 0.0002x²	0.0113	0.33
Empty V. biliar	0.03	0.02	0.02	0.01	$\hat{Y}$ = 0.02	0.1906	0.07
Blood	3.31	3.16	2.68	2.83	$\hat{Y}$ = 2.98	0.0892	0.12
Skin	7.61	8.21	7.38	5.65	$\hat{Y}$ = 7.64 + 0.032x - 0.0005x²	0.0001	0.70
EGIT	8.30	8.15	8.60	8.70	$\hat{Y}$ = 8.44	0.4765	0.02
Spleen	0.26	0.21	0.23	0.21	$\hat{Y}$ = 0.22	0.2543	0.05
Kidneys	0.29	0.27	0.28	0.26	$\hat{Y}$ = 0.28	0.2421	0.05

BJH: BGH: 'Jurema Preta' Hay: Buffel Grass Hay; $\hat{Y}$ = Dependent variable; X = Level of 'jurema preta' hay; *p* = Probability; R^2 = Coefficients of determination; EGIT = Empty gastrointestinal tract; GB = Gall bladder.

The empty gastrointestinal tract was not affected (P> 0.05) by the substitution of 'jurema preta' hay for buffel grass hay. These results are similar to those found by Silva et al. (2012), when evaluating the effect of silk flower hay on the body constituents of confined and slaughtered lambs with 75 days of confinement; as well as to those fund by Vieira et al. (2010), who evaluated the non-carcass components of sheep fed with castor-based feed and did not observe differences for the variable viscera, FGIT, EGIT, organs, head and paw; except for the skin, which presented a quadratic effect. These results may be related to the chemical composition of the diets, since according to Moreno et al. (2011), the diet can affect the GIT.

GIT is a determinant variable of carcass yield, and if the objective is to adequately express the performance of the animal according to carcass yields and non-carcass components, one must consider the weight of the empty body, rather than the weight at the slaughter, for not considering GIT (Mattos et al., 2006). These results have demonstrated that non-carcass components have a large participation in carcass yields. From the commercial point of view, a lower proportion of gastrointestinal content can generate a higher yield of edible parts available for commercialization.

Conclusions

The substitution of buffel grass hay by 'jurema preta' hay influences the carcass characteristics of lambs.

For a good conformation, loin eye area and non-carcass components of lambs, the substitution of buffel grass hay by 'jurema preta' hay in proportions of 20 to 50% of the bulky portion of the diet allows satisfactory results.

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