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RESEARCH ARTICLE

PERFORMANCE AND MEAT QUALITY OF SHEEP FED DIFFERENT SOURCES OF FIBER AS A SUPPLEMENT TO DIETS BASED ON CACTUS PEAR (*OPUNTIA FICUS INDICA* MILL)

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ABSTRACT

The objective of this research was to evaluate the effect of different fiber sources (forage fiber and non-forage fiber) in diets based on Cactus pear on non-descript breed sheep in Northeastern of Brazil, by analyzing the resultant meat quality. Intact male sheep (21 hing legs), weighing 17.10±0.98 kg, were allocated to three treatments: tifton hay, soybean hull and whole cotton seed. Proximate composition (moisture; total dry extract; mineral matter; fat and protein), physical parameters (pH; cooking loss and shear force) and sensory scores (firmness; juiciness; flavour; odour and colour) did not differ significantly ($p > 0.05$) between the different fiber sources. The experimental results showed high sensory quality for the sheep meat. So the non-forage fiber sources (by-products of agro-industry) adequately replaced the forage fiber. The objective of this research was to evaluate the effect of different fiber sources (forage fiber and non-forage fiber) in diets based on Cactus pear on non-descript breed sheep in Northeastern of Brazil, by analyzing the resultant meat quality. Intact male sheep (21 hing legs), weighing 17.10±0.98 kg, were allocated to three treatments: tifton hay, soybean hull and whole cotton seed. Proximate composition (moisture; total dry extract; mineral matter; fat and protein), physical parameters (pH; cooking loss and shear force) and sensory scores (firmness; juiciness; flavour; odour and colour) did not differ significantly ($p > 0.05$) between the different fiber sources. The experimental results showed high sensory quality for the sheep meat. So the non-forage fiber sources (by-products of agro-industry) adequately replaced the forage fiber.

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INTRODUCTION

The sheep breeding exercises important socio-economic role in Northeastern Brazil, especially in relation to meat production, appearing as an alternative to increasing the supply of animal protein of high quality. The consumption of meat from this activity has increased in recent years, however this still appears foolish compared to the consumption of other species. Despite this increased activity is characterized as low income, due to the predominance of the type of extensive farming on most farms, which have great influence of climatic conditions (Nunes *et al*., 2007). Furthermore, the sheep production chain is not yet fully organized, because the number of farmers who know the need to produce good quality meat, placing on the market carcasses of animals with advanced age, with terrible physical, chemical and organoleptic, hindering the establishment of the habit of consumption. It is emphasized that the lamb meat quality and its chemical composition, are also related to factors relating to the animal, the environment, nutrition, the management before slaughter and the conditions of processing and storage of carcasses after slaughter (Sañudo *et al*., 1996). It is still, problems in the lamb meat production, such as irregularity in the bid, meat with high fat percentage, and cuts that do not maintain the quality standards, such as tenderness, colour and juiciness (Zeola, 2002). Thus, quality is the combination of sensory attributes associated with low body fat, muscle and very affordable (Silva Sobrinho, 2001). Thus, it is essential to implementation of appropriate technologies for breeding, targeting higher productivity and quality, to meet a more demanding consumer market, there is no need to use only animals with high genetic potential, but animals that have carcasses with quantitative traits and sufficiently good quality

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of meat to meet demand. Because of the climatic uncertainties and periodic droughts phenomenon that occur in semi-arid, the cactaceas represent a source of supply of water and an alternative food for animals. Native specimens Caatinga have been used during periods of prolonged droughts, as a major media fodder for ruminants. The cactus pear, unlike other fodder is characterized by having low percentage of dry matter and cell wall and high concentration of total digestible nutrients and non-fibrous carbohydrates, with approximately, 28% neutral detergent fiber, 48% of non-structural carbohydrates, 7.4% galacturonic acid and 12% of starch (Batista *et al*., 2003). The low dry matter, crude protein and neutral detergent fiber, found in the cactus pear, limit its use as the main ingredient in the diets. Once the proper consumption of fiber is essential to maximize production and health of ruminant animals. When minimum levels of fiber are not met, or when the size of particles of forage is inadequate, there is the commitment of the production of saliva, reduction of ruminal pH and reduced rumination (Lopes *et al*., 2008). Therefore, we have sought techniques to control the supply of this nutrient, and allied to this, try to also reduce costs in the implementation of these techniques, since these methods of production must prioritize production and economic aspects simultaneously (Turino *et al* ., 2007). In this context, the feedlot is a food system that has been used, and replacement of concentrate by fibrous diets by the use of agro-industrial residues (Carvalho & Brochier, 2008). The by-products of agro-industrial appear as viable alternatives, and the soybean hulls and whole cotton seed two of the most important, for they have as excellent sources of fiber, and high concentrations of energy and protein, allowing the replacement of roughages without affecting ruminal fermentation, and are produced in large scale and have no problems with the seasonality of its production. According to the subject, the purpose of this study was to investigate the importance of using different sources of fiber in diets based on cactus pear, as an alternative source to feed sheep on chemical, physical and sensory parameters of meat quality sheep.

MATERIALS AND METHODS

Animal management and experimental design

The experiment was conducted at the Department of Animal Science, Rural Federal University of Pernambuco, at the municipality of Recife, located in the coastal region of Northeastern Brazil (8°04'03"S and 34°55'00"W), with altitude of 4 meters and two well established seasons dry (September to January) and rainy (February to August). According to the classification of Köppen the climate is rated as the type Ams', which is characterized by being hot and humid, with average annual temperature of 25.2 ° C. Twenty one intact male sheep were used, non descript breed, having an initial live weight 17.10±0.98 kg (mean ± standard deviation). The distribution of animals was randomized to three experimental diets and seven replicates. The animals were confined in individual stalls with dimensions of 1.0 x 2.8 m, equipped with feeders and drinkers. The animals were weighed, identified and subjected to an initial adaptation period (14 days). The weightings occurred every two weeks, prior to fasting for 16 hours, starting from the beginning of the experiment until slaughter. The experimental diets (Table 1) were composed of Tifton hay (*Cynodon dactylon*, (L.) Pers), Soybean hull and Whole cotton seed, like fiber sources, Cactus pear (*Opuntia ficus indica* Mill), Ground corn, Soybean meal and Mineral supplement, the aim being a weight gain of 150 g day^{-1}. Sheep were fed with the diet mixture twice daily at 08:00 and 16:00 h. The water was provided *ad libitum* and the orts were weighed and recorded existing in the morning the following day, setting up daily to contain 10% of orts.

Table 1. Proportions of ingredients used in diets based on cactus pear (*Opuntia ficus indica* Mill) offered to sheep and the composition of the diets

Ingredients (% DM)	Treatments		
	Tifton hay	Soybean hull	Whole cotton seed
Cactus pear (*Opuntia ficus indica* Mill)	54.28	53.92	54.40
Tifton hay (*Cynodon dactylon*, (L.) Pers)	17.88	-	-
Soybean hull	-	20.86	-
Whole cotton seed	-	-	27.29
Ground corn	6.90	6.72	8.89
Soybean meal	19.39	16.96	7.86
Mineral supplement	1.55	1.54	1.56
Composition[a]			
Dry matter (%)	19.12	19.25	19.15
Organic matter (% DM)	88.58	88.67	88.05
Mineral matter (% DM)	11.42	11.33	11.95
Crude protein (% DM)	12.81	12.63	13.15
Ether extract (% DM)	1.40	1.19	6.96
Neutral detergent fiber (% DM)	33.41	33.15	29.32
Total digestible nutrientes (% DM)	67.59	69.27	70.54
Metabolisable energy (Mcal of ME/kg of DM)[b]	2.44	2.50	2.55

[a]Analysed values.
[b]Obtained from TDN estimation NRC (1981) and from the relations: 1 kg total digestible nutrients = 4409 Mcal of digestible energy and metabolisable energy = 81.7% digestible energy.

Slaughter and samples collection

The animals were slaughtered when attaining a mean live weight of 30 kg, is disregarding the time of confinement. Sheep were slaughtered after fasting for 16 h, when water only was available. At the time of slaughter, the animals were stunning in the case-hardened by atla-occipital region, followed by bleeding through the section of the carotid and jugular. After slaughter, it is the cooling of the carcass for 24h at 4° C. The s*emimembranosus* muscle was removed from chilled carcasses, and separately vacuum packaged, frozen and stored at -18°C, prior to physico-chemical and sensory evaluations. The other muscles were wrapped in plastic bags, identified and refrozen at -18° C. The total lean meat from the *semimembranosus* was defrosted overnight and divided into two pieces: one was cut into cubes (1.5 cm thickness, 3 cm length, 2.5 cm width) and used for cooking loss and shear force determinations, the other was thoroughly minced and mixed removing the subcutaneous fat and connective tissue to obtain a homogeneous mass, before subsampling took place for the chemical composition and pH analyses. A minimum of three replicate chops and samples of minced lean meat was obtained from each s*emimembranosus*.

Meat quality attributes

Moisture, ash, and protein contents were determined by method numbers 985.41, 920.153, and 928.08, respectively

(A.O.A.C, 2000). The lipids were extracted following the method described by Folch *et al*. (1957). The ultimate pH values were measured on a portable digital potentiometer (SEM 205) with sensitivity of 0.01 units of pH and the pH reading was held in two locations of the muscle. Cooking loss was calculated by weighing cubes of muscle wrapped in aluminum foil, and subsequently cooked in a pre-heated oven at 170 °C until the internal temperature of the meat reached 70 °C (monitored with a probe). The samples were then allowed to cool at room temperature, patted dry with paper towels, and reweighed, the cooking loss was determined using the method described by Duckett *et al*. (1998a). This was expressed in percentage (g/100g). These samples were also used to determine shear force. Cylinders (1.27 cm diameter) parallel to the muscle fiber axis were taken from each sample and sheared perpendicular to this axis using a Warner-Bratzler shearing (WBS) device, equipped with Stable Micro System TA-XT2i. The crosshead speed was maintained at 20 cm/min, according to methodology described by Duckett *et al*. (1998b). The results were expressed in kgf/cm^2.

Assessment for eating quality of cooked sheep meat

Sensory evaluation was carried out on quadriceps muscles after being defrosted overnight. Portions of 200 g were cut into cubes of 3 cm^3, which were cooked using the same method described for shear force measurements. The samples were subjected to the process of cooking on electric *grill* coupled with thermostat (KITCHEN FUN, Family model). Dividing the heated part of the *grill* geometrically into three equal parts and is pre-warmed to 170° C for 2 minutes. Samples on different treatments were placed in each geometric division of the *grill* for 4 minutes on each side, which is until the geometric center of the meat cube reaches 70° C. The sensory evaluation of cooked meat samples for odour, colour, tenderness, juiciness and flavour was performed by a taste panel consisting of eight trained panelists using a 9 - points scale (1 denoting the least favorable condition and 9 the most favorable).

Statistical analysis

The data were submitted to analysis of variance and Tukey test to evaluate the effect of treatments. The tests were performed using the program Statistical Analysis System (SAS, 2000). The mathematical model used was: $Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$; where Y_{ij}: observations of the dependent variables corresponding to the repetition of independent j under treatment of order i; μ: overall mean of the observations; τ_i: effect of treatment (T1: tifton hay; T2: soybean hulls and T3: whole cotton seed) of order i; ε_{ij}: residual random error associated with the observation of order j in the treatment of order i.

RESULTS AND DISCUSSION

Live weights

The data presented in Table 2 show that, due to similarity in the initial and final weights of animals, no significant differences were found in the variable analyzed (hind leg). Although the experimental diets were made with different fiber sources resulted in similar values for neutral detergent fiber, crude protein and energy, which may have contributed to the similarity of the results. That is, the similarity of the weights of the hind leg confirms the law of anatomical harmony, which calls for weighing animals slaughtered and carcass characteristics similar inevitably present weight and yield also similar for almost all body regions, regardless of the type of food and conformation of the genotype considered (Rosa *et al*., 2002; Pinto *et al*., 2011).

Proximate composition of *Semimembranosus* muscle

The mean values determined by chemical analyses of *semimembranosus* muscle are presented in Table 3. The different sources of fiber presents in experimental diets didn't significantly affect the chemical composition of meat. This may be attributed to the similarity on the levels of fiber, protein and energy. The equality of gender, age and weight at slaughter, should also be considered, because the characteristics of muscle depends greatly of the intrinsic traits of animal (Sañudo *et al*., 1998). Regarding the chemical composition of experimental diets, it is necessary to consider the differences on EE levels (Table 1), which are derived from ingredients used (tifton hay; soybean hull; whole cotton seed) in formulating diets. However, these different fat contents in ingredients didn't influence the chemical attributes of meat, especially the lipid content, which according Sañudo *et al.* (1998) readily affect the other concentrations, especially protein and moisture. Although with isoenergetic diets, the protein level only produces slight (frequently insignificant) modifications in fatness (Iason & Mantecon, 1993) unless rumen undegradable nitrogen is added to the roughage diet. So the proximate composition values of meat can vary with the animal completion status, since the animals of this experiment were slaughtered at a young age, there wasn't time for this increase on the fat content. Due to the use of the confinement regimen, the animals gained weight more rapidly reducing the confinement period, not showing significant fat accumulation, as indicated by the concentration of lipids observed. The levels of moisture, ash, fat and protein found in this study are similar to those reported by Zeola *et al*. (2004), Madruga *et al*. (2006) and Costa *et al*. (2009) analyzing the proximate composition of the *semimembranosus* muscle of Morada Nova sheep subjected to diets with different levels of concentrate; effect of genotype and sex on proximate composition and fatty acid profile of sheep meat; and chemical characterization of lamb meat from different genotypes submitted to diet with different fiber contents, respectively. The authors claim in studies that the diet has significant influence on chemical parameters of meat, so that these variables depend basically on chemical composition of diets. So the dietary, as a source of variation of the amount of moisture, ash, fat and protein, is a complex factor, as the results will vary depending on the comparison criterion used: equal live or carcass weight, equal age, equal degree of maturity or equal percentage of adult live weight. These results demonstrate that the by-products agroindustry', soybean hulls and cottonseed, can efficiently replace the tifton hay as a source of fiber in diets for sheep.

Physical parameters

The mean values of pH, cooking loss (CL) and shear force (SF) of *semimembranosus* muscle are found in Table 4. The different sources of fiber presents in experimental diets didn't significantly affect the physical parameters of meat. According to Okeudo & Moss (2005) these parameters are closely correlated with the level of intramuscular fat and moisture of muscle. So no significant differences in these chemical variables, there will be any change in physical attributes. Warner *et al*. (2010) however admits that these attributes depend primarily on factors such as gender, genetics and environment production to which animals are submitted.

in pH within the normal values. Among the factors that affect the pH, are gender, species, breed, age, nutritional status, pre-slaughter stress and temperature of cooling (Martínez-Cerezo *et al*, 2005 and Ekiz *et al*., 2009). Bressan *et al*. (2001) report that the greatest change in pH occurs in groups of animals that have body weight between 35 and 45 kg, supposedly because of the greater amount of subcutaneous fat found in the heavier animals, where it acts as a thermal insulator accelerating the glycolysis and this increase in glycolytic potential can result in

Table 2. Performance characteristics of sheep fed diets based on cactus pear (*Opuntia ficus indica* Mill) with different sources of fiber (mean ± SEM)

Variable	Treatments			Mean	CV(%)
	Tifton hay	Soybean hull	Whole cotton seed		
Initial live weight (kg)	17.08 ± 1.07	17.71 ± 0.97	16.52 ± 0.90	17.10	15.01
Final live weight (kg)	29.66 ± 1.09	29.83 ± 2.25	29.30 ± 1.35	29.59	15.33
Hind Leg weight (kg)	2.18 ±0.09	2.25 ±0.16	2.11 ±0.13	2.18	15.44

Differences between treatments are not significant (P > 0.05).

Table 3. Proximate composition of *semimembranosus* muscle samples from sheep fed diets based on cactus pear (*Opuntia ficus indica* Mill) with different sources of fiber (mean ± SEM)

Variable	Treatments			Mean	CV (%)
	Tifton hay	Soybean hull	Whole cotton seed		
Moisture (g/100g)	74.19 ± 0.36	73.93 ± 0.21	74.02 ± 0.47	74.05	1.24
Total dry extract (g/100g)	25.80 ± 0.37	26.07 ± 0.21	25.98 ± 0.47	25.95	3.54
Mineral matter (g/100g)	1.09 ± 0.04	1.06 ± 0.03	1.10 ± 0.03	1.08	8.52
Fat (g/100g)	1.88 ± 0.17	2.22 ± 0.34	2.60 ± 0.29	2.23	32.33
Protein (g/100g)	25.34 ± 0.34	24.55 ± 0.44	24.89 ± 0.33	24.93	3.97

Differences between treatments are not significant (P > 0.05).

Table 4. Physical attributes of *semimembranosus* muscle samples from sheep fed diets based on cactus pear (*Opuntia ficus indica* Mill) with different sources of fiber (mean ± SEM)

Variable	Treatments			Mean	CV (%)
	Tifton hay	Soybean hull	Whole cotton seed		
pH	5.66 ± 0.09	5.62 ± 0.08	5.67 ± 0.11	5.68	4.15
Cooking loss (%)	32.71 ± 1.46	33.49 ± 1.42	32.97 ± 3.49	33.06	19.43
Shear force (kgf)	3.58 ± 0.45	3.42 ± 0.48	3.37 ± 0.22	3.47	31.15

Differences between treatments are not significant (P > 0.05).

Table 5. Sensory attributes of *semimembranosus* muscle samples from sheep fed diets based on cactus pear (*Opuntia ficus indica* Mill) with different sources of fiber (mean ± SEM)

Variable	Treatments			Mean	CV (%)
	Tifton hay	Soybean hull	Whole cotton seed		
Firmness	3.55 ± 0.49	2.85 ± 0.37	3.02 ± 0.37	3.14	56.16
Juiciness	3.94 ± 0.54	4.07 ± 0.54	4.12 ± 0.53	4.04	56.24
Flavour	3.90 ± 0.47	4.12 ± 0.47	4.12 ± 0.46	4.05	49.03
Odour	4.06 ± 0.41	4.22 ± 0.51	4.05 ± 0.48	4.11	48.27
Colour	3.62 ± 0.35	3.90 ± 0.44	3.94 ± 0.38	3.82	43.43

Differences between treatments are not significant (P > 0.05).

The pH of *semimembranosus* muscle ranged from 5.62 to 5.66. It appears that the pH values found in this study are within the range considered normal (5.4 - 5.6) by Hoffman *et al*. (2003); Young *et al*. (2004); Teixeira *et al*. (2005) and Rodrigues *et al*. (2008). The decrease curve in pH *post mortem* is it extremely important to the quality of meat, furthermore, one of the main defects associated with meat concerns the acquisition of meat that have unusual curves of pH, since this drop in pH influences the properties of colour, texture and water retention of meat, with repercussions on tenderness, flavour, shelf life and nutritional value. According to Devine *et al*. (1993), the sheep show little susceptibility to stress, leading to a decrease a final pH of meat below normal (5.3), which present a lower technological performance for its lower capacity to retain water. The mean CL values obtained in the current study ranged between 32.71% and 33.49%. Nevertheless, the observed values for this variable is within the range considered normal by Webb *et al*. (2005). These results are in accordance with Kannan *et al*. (2006), who reported that dietary treatment didn't have any effect on CL. Differences in CL are often linked to the differences in time and temperature of cooking, pH, genotypes, methodology, type of equipment used and different fat contents (Dhanda *et al*., 2003; Kadim *et al*., 2004 and Madruga *et al*., 2008). When there is equivalence of these variables, the CL are often related to low temperature cooling, which causes a negative effect due to the formation of ice crystals inside the cell, causing cellular damage at the time of thawing and the excessive loss of water and other nutrients, such as comments Puga *et al*. (1999). Abdullah & Qudsieh (2009) asserts that the CL variations are more related to slaughter weight and the different muscles, heavier carcasses had lower CL percentage. This is mainly because the amount of moisture in each designated muscle decreases as a percent of the increased muscle weight. In this sense, the similarity of values found in this study is justified by equality of the aforementioned variables, and the dietary management of minor influence on fluctuations in the percent of CL. The texture of processed meat by instrumental meat tenderness measurement is within range from 3.37 to the 3.58 kgf/cm^2 (Table 4). According to classification Boleman *et al*. (1998) the meat of intact male sheep is defined as moderately soft. In study conducted by Arguello *et al*. (2005), the authors classify the meat with shear force above 11 kgf as hard, between 8 and 11 kgf, as acceptable, and below 8 kgf as soft. So but the values found in this study is meat with a high standard of tenderness, ie, is below the limit of SF desirable for marketing, according with Shackelford *et al*. (1997). Several authors attribute the differences in SF are often associated to the differences in collagen content, slaughter weight, muscle, gender, genotypes, age, nutrition, animal management and ph (Arguello *et al*., 2005; Johnson *et al*., 2005; Ferguson & Warner, 2008; Resconi *et al*., 2009 and Costa *et al*., 2009). So these variables are interdependent, and the similarity of these features allowed the equality of results. However the pH values may have contributed to the desirable levels of tenderness, since the tenderness of meat from sheep measured by SF, is directly related to minors sarcomere lengths, which in turn is dependent on pH. Purchas *et al*. (1993) affirm that the sarcomere length is increased when the pH is below 6.2, therefore, greater tenderness. Watanabe *et al*. (1996), studying the relationship tenderness and pH, observed higher SF to pH of 6.1 and lower to pH of 5.4. Being attributed to the greater tenderness to direct effects of pH on the activity of proteolytic enzymes that degrade the myofibrillar structure of muscle.

Sensory attributes

The attributes of firmness, juiciness, flavour, odour and colour of meat weren't influenced by different sources of fiber contained in experimental diets and have average values of 3.14, 4.04, 4.05, 4.11 and 3.82, respectively on scale of 9 cm unstructured. The *semimembranosus* muscle used in study lacks subcutaneous fat, which may have caused the lack of difference in some sensory parameters (Table 5).

The sensory analysis showed that the firmness attribute had similar values to the SF, which objectively quantify this variable. The not variation observed for firmness, when instrumental and sensory evaluation, can be attributed to the similarity in levels of lipids from the diets. According to Dhanda *et al*. (2003), the content of lipids is the main causative agent of change in this attribute, so that this increase in nutrient content, promotes the consequent increase in the number of chemical bonds between the molecules heat the collagen. The sensory parameter firmness had overall average of 3.14, considered good value for this characteristic, since, on a scale of 9 cm unstructured, the tenderness, an attribute that is inversely proportional to this, averaging 5.86. This value is above the separate threshold between a meat with higher firmness and greater tenderness. This fact relates the high standard of quality of the meat from these animals, whereas the *semimembranosus* muscle' is anatomically in a region subject to greater efforts, which could over time, cause a muscular hypertrophy and consequently increase the firmness of the meat. However, the feedlot system used in this study may have been a favoring maintaining the tenderness of the meat, due to little exercise performed by animals in search of food. Astiz (2008) adds further that the lamb does not present many problems related to firmness, as with other animal species. The experimental diets also didn't influence the sensory parameter, juiciness, showing that the equivalence of diets, as the levels of fiber, protein and energy, has equal effect for this attribute. According Batista *et al*. (2010) this attribute is related to the ability of the muscle to release its constitutive water and infiltrate lipid content. Beriain *et al*. (2000) stated that diets with higher energy intake, promote greater concentration of intramuscular fat, which therefore increases the water holding capacity, which favors greater succulence of the meat.

According to Priolo *et al*. (2002), the production system adopted is responsible for changes in use of diets, which, in turn, modify the feed conversion, so that, the animals in intensive production systems have higher juiciness in meat animals on graze. The sensory attribute increase is due to greater concentration and solubility of collagen in the meat of animals confined (Diaz *et al*., 2002). However, the values observed in this study is less than reported by Siqueira *et al*. (2002), who found for the average value of 6.4 for this variable in the loin of sheep slaughtered at 32 kg live weight in feedlot. These variations can be attributed to the different muscles used in these studies because the *semimembranosus* muscle (muscle evaluated in this study), is more prone to the development of fiber. The sensory parameters of flavour and odour followed the pattern of other physical attributes of quality, since, the values of these also did not differ by the different experimental diets. According Cañeque *et al*. (1989), food is essential in determining the sensory characteristics of meat, promoting changes in the composition of fatty acids. Among the main responsible for characteristic flavour of the sheep are the branched-chain fatty acids, volatile compounds in meat, which depend primarily on systems of food and diets (Vasta & Priolo, 2006). So that, more energy diets, promote the increase in the concentrations of these fatty acids. It is therefore possible that the similarity in content of total digestible nutrients contained in the diet has provided similar production of branched-chain fatty acids, with consequent similarity in taste to the three treatments. Monte *et al*. (2007), claim that the odour of meat is directly related to fat content in the muscle. Martinez-Cerezo *et al*. (2005), commented that this attribute of the meat is closely linked to the increase in weight of slaughter, which in absolute terms, finds itself in the present study, where all animals were slaughtered with equal weight and the lipid content of the meat weren't affected to the different sources of fiber. It is observed that the marks awarded to the colour of the meat did not differ between animals fed with forage fiber sources and not forage fiber, showing that equality in the nutrition provided similar behavior for this variable. Colour plays an important role on the sensory quality of meat, such as the main factor of acceptance. This in turn, is dependent on myoglobin, the main protein involved in the process of oxygenation of the muscle; it is characterized as the main pigment responsible for the colour of meat and is likely not only to the nutrition plan, but the system production, genotype, age and weight at slaughter (Costa *et al*., 2008).

Conclusion

The by-products of agro-industry as alternative sources of fiber to the diet from sheep, don't affect the chemical, physical and sensory parameters meat.

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