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Performance of feedlot sheep receiving diets with Cupuassu Cake (*Theobroma grandiflorum* Schum., Sterculiaceae)

Desempenho de ovinos em confinamento recebendo dietas com torta de cupuaçu (*Theobroma grandiflorum* schum., sterculiaceae)

Célia Maria Costa Guimarães[1]; Eziquiel de Morais[2]; Laurena Silva Rodrigues[3]; Luciano Fernandes Sousa[4]; Stefano Juliano Tavares de Andrade[5]; José de Brito Lourenço Júnior[6]; André Guimarães Maciel e Silva[6]*

Highlights

Cupuassu cake is a coproduct with potential use as feed for feedlot sheep.
This coproduct can be used in as a nutritional food option for ruminant production.
Cupuassu cake can be used in diets for feedlot sheep at up to 30% of total dry matter.

Abstract

This study evaluated the inclusion of cupuassu cake (*Theobroma grandiflorum* Schum.) in the diet of feedlot sheep. Intake (kg day^{-1}, % LW and kg LW$^{-0,75}$), weight gain, feed conversion, carcass characteristics and measurements, ingestive behavior, and meat quality were assessed. Twenty-five mixed breed castrated sheep, with initial mean live weight (LW) of 17.4 (± 1.90) kg, were fed under feedlot management conditions until they reached 35 kg LW. The diet consisted of 26 % elephant grass silage (*Pennisetum purpureum*, Schum) and 74 % concentrate, composed of ground corn, soybean meal, wheat bran, limestone and cupuassu cake at 0 (control), 7.4; 14.8; 22.2 and 29.6 % of total dry matter. The experimental design was completely randomized, with five treatments and five repetitions. No statistical differences (P>0.05) were observed for the substitution of standard feedstuff by cupuassu cake in the

[1] Dr[a]. in Animal Science from the Animal Science Graduate Program, UFPA/Embrapa/UFRA, Universidade Federal do Pará, UFPA, Castanhal, PA, Brazil; Prof[a]. Dr[a]., Instituto Federal do Pará, IFPA, Castanhal, PA, Brazil. E-mail: celia.guimaraes@ifpa.edu.br
[2] Prof. Dr., IFPA, Castanhal PA, Brazil. E-mail: eziquiel.morais@ifpa.edu.br
[3] Dr[a]. in Animal Science, from the Animal Science Graduate Program, UFPA/Embrapa/UFRA, UFPA, Castanhal, PA, Brazil. E-mail: laurenazootec@gmail.com
[4] Prof. Dr., Center of Agrarian Sciences, Universidade Federal do Norte do Tocantins, UFNT, Araguaína, TO, Brazil. luciano.sousa@mail.uft.edu.br
[5] Prof. Dr., Institute of Veterinary Medicine, UFPA, Castanhal, PA, Brazil. E-mail: stefano.andrade@gmail.com
[6] Profs. Drs., Animal Science Graduate Program. UFPA/Embrapa/UFRA, Institute of Veterinary Medicine, UFPA, Castanhal, PA, Brazil. E-mail: joselourencojr@yahoo.com.br; andregms@gmail.com
* Author for correspondence

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variables evaluated, indicating that cupuassu cake can be used for feedlot sheep at up to 30 % of total dry matter, without affecting performance, intake, carcass characteristics or meat quality.
Key words: Co-product. Cupuassu. Meat quality. Sheep. Ruminant nutrition.

Resumo

Esse estudo avaliou o efeito da inclusão da torta de cupuaçu (*Theobroma grandiflorum* Schum.) na alimentação de ovinos em confinamento. Foram avaliados o consumo (em kg dia^{-1}, % PV e kg PV$^{-0,75}$), ganho de peso, conversão alimentar, medidas morfométricas da carcaça, características de carcaça, comportamento ingestivo e qualidade da carne. Foram utilizados vinte e cinco ovinos castrados, sem raça definida (SRD), com peso médio vivo inicial de 17,4 (±1,90) kg, mantidos em confinamento até que atingissem 35 kg de peso vivo (PV). As dietas experimentais eram compostas por 26 % de silagem de capim-elefante (*Pennisetum purpureum*, Schum) e 74 % de concentrado, composto de milho moído, farelo de soja, farelo de trigo, calcário calcítico e torta de cupuaçu, e consistiram na substituição do milho e do farelo de trigo pela torta de cupuaçu nos níveis 0 (controle), 7,4, 14,8, 22,2 e 29,6 % da matéria seca total. O delineamento experimental foi inteiramente casualizado, com cinco tratamentos e cinco repetições. A substituição dos alimentos padrões pela torta de cupuaçu não influenciaram (P>0,05) nas variáveis avaliadas, indicando que a torta pode ser utilizada em dietas para ovinos em confinamento em até 30 % da matéria seca total, sem comprometer consumo, características da carcaça e qualidade da carne.
Palavras-chave: Coproduto. Cupuaçu. Qualidade da carne. Ovinos. Nutrição de ruminantes.

Introduction

Cupuassu (*Theobroma grandiflorum* Schum. Sterculiaceae) is a plant with economic potential native to the Amazon region, which has the ideal conditions for its development, enabling it to be grown in all the region’s states (R. M. Alves et al., 2014; PARÁ, 2020). The increasing interest in exploiting it is due primarily to the organoleptic characteristics of its pulp, used by the food industry for juice and ice cream production, among others. Its oil (cupuassu butter) is used by the cosmetic industry to manufacture shampoo, conditioner, and hair cream, among other products (Oliveira & Genovese, 2013).

After oil extraction, a residue known as cupuassu cake is obtained. This cake is produced after fermentation, drying and roasting, grinding and kernel pressing, where around 80% of its oil is removed. It is a compound with bromatological values of around 17.38-20.4% ether extract (EE), 17.79-20.20% crude protein (CP) and 82.48-93.60 dry matter (DM) (Mota et al., 2014; Rodrigues et al., 2015).

With respect to the use of cupuassu cake in animal feed, Mota et al. (2014) assessed its use as a substitute for wheat bran and maize, in feedlot Nelore cattle, demonstrating that 5% substitution caused no negative effects on nutrient intake and digestibility. Rodrigues et al. (2015) assessed the potential of using the cake at 0, 10, 20, 40 and 60% of cupuassu cake in sheep feed as a substitute for Guinea grass (*Megathyrsus maximus*), and recommend the use of up to 20% cupuassu cake. Silva et al. (2021) included 50% cupuassu cake in the feed of lactating buffalo, observing that the partial substitution of maize and soybean bran had a positive effect on milk production and quality.

Thus, the aim of the present study was to assess the effect of cupuassu cake on dry matter intake, performance, ingestive behavior, yield, carcass quality and sensory quality of feedlot sheep meat.

Materials and Methods

The experiment was conducted at the Federal Institute of Education, Science and Technology of Pará (IFPA/Castanhal Campus). The experimental design and procedures were approved by the Animal Experimentation Research Ethics Committee (CEPAE-UFPA), under number 120-2013.

A total of 25 castrated sheep, with no defined breed and average initial live weight (LW) of 16.72 (±1.96) kg, were used. After general clinical assessment, identification and deworming, the animals were individually housed in bays with a cement floor, sawdust bed, feeders and water dispensers, periodically cleaned.

The isonitrogenous diets, consisting of elephant grass (*Pennisetum purpureum* Schum.) silage and concentrate based on ground maize, wheat bran, soybean bran, calcitic limestone and cupuassu cake (Table 1), were formulated to meet the nutrient requirements of feedlot sheep, with daily gains of 200 g, following the Nutrient Requirements of Small Ruminants (National Research Council [NRC], 2007). The experimental diets were supplied ad libitum, in two equal meals at 7 am and 6 pm, allowing leftovers of 10% DM/day. The volume:concentrate ratio of the diet was 26:74, based on the DM. The animals also had access to the commercial mineral mixture for sheep and water *ad libitum.* The experimental diets consisted of cupuassu cake as a substitute for maize and wheat bran at 0 (control); 7.4; 14.8; 22.2 and 29.6 % of total diet (Table 1).

Table 1
Treatment and nutrient composition of experimental diets with cupuassu cake for sheep

Feed (%)	Experimental diets (%)				
	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Voluminous	26	26	26	26	26
Concentrate	74	66.6	59.2	51.8	44.4
Cupuassu cake in total diet	0	7.4	14.8	22.2	29.6
Ingredients (%)	Proportion of the ingredients in the concentrates				
Maize	35.72	33.96	31.67	29.65	28.37
Wheat bran	37.16	28.11	19.05	9.99	0
Soybean bran	25.16	26.24	27.32	28.4	29.67
Limestone	1.96	1.96	1.96	1.96	1.96
Cupuassu cake	0	10	20	30	40
Nutrients (%)	Diet composition (26% V:74% C)[(a)]				
DM	71.22	71.52	71.48	71.6	71.57
MM	5.15	5.48	5.82	6.15	6.47
OM	93.4	93.27	92.73	90.65	92.08
CP	15.92	16.12	16.29	16.47	16.66
EE	2.27	3.03	3.78	4.54	5.29
NDF	35.14	34.83	34.45	34.11	33.63
ADF	15.85	16.44	17.02	17.61	18.14
LIG	3.57	3.74	3.89	4.05	4.2
NFC	50.98	39.29	38.21	37.28	36.51

[(a)]Voluminous:concentrate ratio (26% V:74% C). Dry matter (DM), mineral mixture (MM), organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fiber (NDF), acid detergent fiber (ADF), lignin (LIG), non-fibrous carbohydrates (NFC), elephant grass silage (EGS), cupuassu cake (CC). NFC was obtained by the Sniffen et al. (1992) Equation: NFC (% DM) = 100 - (% MM + % CP + % EE + % NDF).

In order to assess performance, the animals were weighed at the onset of the experimental period, after 14 days of adaptation to the diets and pens and every 14 days thereafter, until they reached a weight of 35 kg. Average daily gain (ADG) was obtained by the difference between final and initial LW divided by the number of experimental days. For weighings, the animals were submitted to 12-hour solid fasting. Daily DM intake was determined by the difference in DM supplied and left over. Feed conversion was obtained by the ratio between DM intake and ADG.

In order to determine loin eye area (LEA) and subcutaneous fat thickness (SFT), one day before the weighings, ultrasound images were collected in the region between the 12th and 13th ribs, transversally to the longissimus *lumborum* muscle. The images were obtained using a DP33000 Midray Ultrasound, with a 3.5 MHz linear probe.

Digestive behavior was determined after 30 days of confinement. The animals were observed by trained individuals, using an alternating system, with 5-minute intervals between observations, for 24 hours. The following behaviors were observed: idleness, rumination or feeding (Johnson & Combs, 1991). Night observations used incandescent lights, which were left on throughout the experimental period.

When they reached 35 kg LW, the animals were slaughtered by brain concussion followed by immediate bleeding, skinning and evisceration, according to recommendations of the Industrial and Sanitary Inspection of Animal Products Guidelines (RISPOA). Next, the head (antlanto-occipital joint cut) and extremities were removed (metacarpal and metatarsal joint cut) and the carcass weighed to obtain hot carcass weight (HCW). Hot carcass yield (HCY) was calculated from the equations [HCY (%) = HCW/SW x 100].

Carcass finishing, conformation and perirenal fat were visually assessed, considering muscle and adipose layer thickness in relation to the size of the skeleton that supports them (Cezar & Sousa, 2007). To that end, scores between 1 and 5 were assigned for finishing (1 – Very lean; 2 - Lean; 3 - Median; 4 - Fat; 5 – Very fat) and conformation (1 - Poor; 2 - Fair; 3 - Good; 4 – Very good; 5 – Excellent); and for perirenal fat between 1 and 3: 1 (low score, partially covered left kidney and little fat in the pelvic cavity), 2 (medium score, totally covered left kidney and median fat layer in the pelvic cavity) and 3 (high score, totally covered left kidney and thick fat layer in the pelvic cavity) (Cezar & Sousa, 2007). At the end of assessment, the carcasses were refrigerated at a temperature of 4ºC, for 24 hours.

After 24 hours of refrigeration, the carcasses were weighed to obtain cold carcass weight (CCW), cooling loss (CL) (CL = [(Hot carcass weight (HCW) – CCW/HCW) x 100)]) and cold carcass yield (CCY) (CCY = (CCW/Slaughter weight (SW) x 100)) (Cezar & Sousa, 2007).

Next, the carcasses were divided in half and the left side used to obtain the following morphometric measures: internal carcass length (ICL), rump width (RW), rump circumference (RC), chest circumference (CC), chest width (CW), leg circumference (LC), chest depth (CD) and leg length (LL). (Cezar & Sousa, 2007). The haunches were then removed from the carcasses, packed in transparent plastic bags, without vacuum and frozen for subsequent sensory analysis.

For sensory analysis, the haunches were slowly thawed, under refrigeration, for 24 hours. Next, they were roasted in a conventional gas oven at 170ºC, until the internal temperature reached 75ºC, measured with a digital thermometer. Pieces measuring approximately 4 cm², weighing between 25 and 28 g, were cut and wrapped in aluminum foil and maintained in a water bath at 60ºC, until they were served to the evaluators.

Sensory assessment of global acceptance of the samples was determined by a panel of 40 untrained lamb-eating tasters of both sexes, on a 9-point hedonic scale, as follows: 1. Dislike extremely, 2. Dislike very much, 3. Dislike moderately, 4. Dislike slightly, 5. Neither like nor dislike, 6. Like slightly, 7. Like moderately, 8. Like very much, and 9. Like extremely) (Moraes, 1993). Each evaluator received five cubes of meat, one from each treatment, in plastic cups, coded with random four-digit numbers, in addition to mineral water.

A completely randomized design (CRD), with five treatments and five repetitions, was used. Performance, consumption, ingestive behavior and carcass assessment data were submitted to regression analysis as a function of cake inclusion levels, using the SAS statistical package. The subjective carcass measurements and sensory analysis were submitted to the Kruskal-Wallis nonparametric test (Kruskal & Wallis, 1952), followed by the Conover (1999) procedure. All the variables underwent analysis of variance at 10% significance, also using the SAS statistical package.

Results and Discussion

No statistical differences (P>0.05) were observed in dry matter intake, in kg day^{-1}, % LW and kg LW$^{0,.75-1}$ weight gain and feed conversion. Although traditional food such as maize and wheat flour were substituted, the animals showed no negative behavioral effects (Table 2).

Table 2
Consumption, performance and feed conversion of sheep fed increasing levels of cupuassu cake

Variables	Inclusion of cupuassu cake in the diet (%)[(a)]					Mean	P		CV (%)
	0	7.4	14.8	22.2	29.6		LE	QE	
[(b)]DMI kg day^{-1} [(1)]	1.009	0.937	0.915	0.946	0.905	0.942	0.413	0.353	12.5
[(c)]DMI % LW[(2)]	3.85	3.56	3.51	3.64	3.56	3.62	0.462	0.280	11.6
[(d)]DMI g kgLW$^{-0.75}$[(3)]	88.19	81.56	80.22	83.31	80.84	82.82	0.445	0.292	11.7
[(e)]DWG[(4)] (kg day^{-1})	0.205	0.177	0.170	0.162	0.160	0.175	0.092	0.555	20.6
[(f)]FC[(5)] (kg DM kg gained^{-1})	4.93	5.3	5.39	5.97	6.42	5.6	0.203	0.847	20.5
Days of confinement	88	107	109	112	126	108	0.264	0.553	27.2

[(a).]Levels of cupuassu cake in total diet; [(b).]Dry matter intake in kilograms per day (DMI kg day^{-1}); [(c).]Dry matter intake as a percentage of live weight (DMI % LW); [(d).]Dry matter intake in relation to metabolic weight (DMI g kg LW$^{-0.75}$); [(e).]Daily weight gain (DWG); and [(f).]Feed conversion (FC) of sheep fed with different levels of cupuassu cake.
Equations: 1- $\hat{y} = 0.942^{ns}$; 2- $\hat{y} = 3.62^{ns}$; 3- $\hat{y} = 82.82^{ns}$; 4- $\hat{y} = 0.175^{ns}$; 5- $\hat{y} = 5.60^{ns}$. P = Type 1 error probability; CV = Coefficient of variation. LE = Linear effect and QE = Quadratic effect.

Mean dry matter intake (0.942 kg day^{-1}) was less than expected, given the value predicted by the NRC (2007), which describes an intake between 1.0 and 1.3 kg DM day^{-1} for the sheep used in the present study, except the control diet, which obtained an intake of 1.009 kg day^{-1}. The other diets maintained average intake near the overall mean values. Likewise, daily weight gain also reached the expected value (0.200 kg day^{-1}) only in the control diet, with average gain of 0.205 kg day^{-1}. The overall mean recorded was 0.175 kg day^{-1}. Thus, the use of a particular diet depends on its cost and availability on the market.

It is important to note that growth and development, as well as weight gain, are influenced by feed, sex and genotype (Silva et al., 2008). From a particular age, bone growth ceases as a function of skeletal maturity and body length tends to stabilize. However, in the present study, live weight and chest circumference increased simultaneously for longer as a function of fat and muscle deposition. Live weight is an easy-to-obtain valuable characteristic, and its use is important when combined with length, which is indispensable in determining growth and development (G. S. Costa et al., 2006).

Animal live weight can be used to estimate carcass weight, where an increase would be positively correlated with yield, conformation and compactness, serving as the basis for herd selection (Osório et al., 2002). The most widely used method to measure animal growth is weight variation over established periods, with speed of growth determined by daily weight gain, an important variable for productive performance and assessment of diet efficiency (Zundt et al., 2006).

The chemical and physical composition of diet interferes directly in ingestive behavior. Diets with high fiber content increase rumination time, while those with large particles can lengthen feeding and rumination time (Van Soest, 1994; Gomes et al., 2012; Pazdiora et al., 2019). Cupuassu cake content in diets had no effect (P>0.05) on ingestive behavior (feed, rumination and idleness) (Table 3). However, the nutritional characteristics of the diets used in the experiment (Table 1) did not limit intake (Table 2), maintaining rumination activities and demonstrating that levels up to 29.6% of cupuassu cake in diet does not interfere in the feeding behavior of the animals. A similar result was reported by Mota et al. (2014), who assessed intake, nutrient digestibility and ingestive behavior of feedlot cattle fed different cupuassu cake contents in their diet (0; 5; 10; 15 and 20%), as a replacement for soybean bran and maize. Rodrigues et al. (2015) observed that increasing levels of cupuassu cake, as a substitute for Mombasa grass, increases the voluntary intake of sheep, representing an alternative for the feed supplementation of ruminants.

Table 3
Ingestive behavior of sheep fed increasing levels of cupuassu cake

Variables	Inclusion of cupuassu cake in diet (%)					Mean	P		CV (%)
	0	7.4	14.8	22.2	29.6		LE	QE	
Feed[1] (min/day)	164	174	202	173	183	179.2	0.375	0.251	15.5
Rumination[2] (min/day)	462	438	434	448	446	445.6	0.797	0.543	13.8
Idle[3] (min/day)	819	833	809	824	816	820.2	0.878	0.965	8.5

Equations: 1- $\hat{y} = 179.2^{ns}$; 2- $\hat{y} = 445.6^{ns}$; 3- $\hat{y} = 820.2^{ns}$. P = Type 1 error probability; CV = Coefficient of variation; LE = Linear effect and QE = Quadratic effect.

The variables hot and cold carcass yield, cooling loss, fat thickness and loin eye area did not differ (P>0.05) with cupuassu cake incorporation (Table 4) and were within the range reported for sheep in Brazil, with HCY and CCY between 47.11 and 51.16% and 45.43 and 49.38%, respectively (L. G. C. Alves et al., 2020; Carneiro et al., 2019; Cartaxo et al., 2011; R. G. Costa et al., 2011a). The lack of difference between carcass yields and fat thickness may be due to standardized slaughter weights, given that cuts and yields are expected to be similar in animals with similar genetic patterns and slaughter weights (Cezar & Souza, 2007; Osório et al., 2002; Ribeiro & Giotto, 2019).

Table 4
Carcass characteristics of sheep fed increasing levels of cupuassu cake

Variables	Inclusion of cupuassu cake in the diet (%)[(a)]					Mean	P		CV (%)
	0	7.4	14.8	22.2	29.6[(a)]		LE	QE	
[(b)]HCY (%)[(6)]	46.82	48.07	46.57	49.04	48.71	47.84	0.390	0.640	5.8
[(c)]CCY (%)[(7)]	45.55	46.74	45.66	47.73	47.24	46.58	0.312	0.710	5.3
[(d)]CL (%)[(8)]	2.685	2.738	1.93	2.663	2.954	2.594	0.797	0.646	61.4
[(e)]FT (mm)[(9)]	1.67	1.65	1.72	1.68	1.51	1.65	0.629	0.865	7.4
[(f)]LEA (cm^2)[(10)]	6.54	6.83	6.62	6.58	5.96	6.51	0.924	0.428	6.6

[(a).] Cupuassu cake levels in total diet. [(b).] Hot carcass yield (HCY); [(c).] Cold carcass yield (CCY); [(d).] Cooling loss (CL); [(e).] Fat thickness (FT) and [(f).] Loin eye area (LEA) of sheep fed different levels of cupuassu cake.
Equations: 6- $\hat{y} = 47.84^{ns}$; 7- $\hat{y} = 46.58^{ns}$; 8- $\hat{y} = 2.59^{ns}$; 9- $\hat{y} = 1.65^{ns}$; 10- $\hat{y} = 6.51^{ns}$. P = Type 1 error probability; CV = Coefficient of variation. LE = Linear effect and QE = Quadratic effect.

For cooling loss, fat thickness and loin eye area showed no statistical difference (P>0.05) in relation to cupuassu cake inclusion. Likewise, morphometric characteristics were not influenced (P>0.05) by experimental diets (Table 5). It is important to note that the similarity between the means of each variable assessed may be because the animals were slaughtered at 35 kg and exhibited the same breed profile.

Qualitative and quantitative carcass traits provide important information in classifying and standardizing the best carcasses. Taken together, finishing and conformation are parameters that best determine the amount of the edible portion, in the carcass classification system. No statistical effects were found (P>0.05) in the subjective variables as a function of including cupuassu cake in sheep diets (Table 6).

Table 5
Carcass morphometric measures of sheep fed increasing levels of cupuassu cake

Variables	Inclusion of cupuassu cake in the diet (%)[(a)]					Mean	P		CV (%)
	0	7.4	14.8	22.2	29.6		LE	QE	
[(b)]ECL (cm)[(1)]	58.50	58.00	58.60	59.60	57.88	58.52	0.413	0.470	3.8
[(c)]ICL (cm)[(2)]	62.50	62.00	62.20	63.60	61.38	62.34	0.296	0.198	2.5
[(d)]RL (cm)[(3)]	23.75	23.80	24.30	23.50	23.00	23.67	0.926	0.472	5.3
[(e)]RC (cm)[(4)]	60.88	60.00	62.80	60.30	59.75	60.75	0.851	0.517	4.4
[(f)]CC (cm)[(5)]	63.50	66.40	73.06	71.10	64.75	67.76	0.219	0.637	16.1
[(g)]CW (cm)[(6)]	30.00	31.20	31.20	32.30	29.25	30.79	0.116	0.957	6.4
[(h)]LC (cm)[(7)]	49.00	48.10	42.40	42.30	48.50	46.06	0.278	0.938	23.9

[(a).] Cupuassu cake levels in total diet. [(b).] External carcass length (ECL); [(c)] Internal carcass length (ICL); [(d).] Rump width (RW); [(e).] Rump circumference (RC); [(f).] Chest circumference (CC); [(g)] Chest width (CW); [(h).] Leg circumference (LC).
Equations: 1- $\hat{y} = 58.52^{ns}$; 2- $\hat{y} = 61.34^{ns}$; 3- $\hat{y} = 23.67^{ns}$; 4- $\hat{y} = 60.75^{ns}$; 5- $\hat{y} = 67.76^{ns}$; 6- $\hat{y} = 30.79^{ns}$; 7- $\hat{y} = 46.06^{ns}$. P = Type 1 error probability; CV = Coefficient of variation. LE = Linear effect and QE = Quadratic effect.

Table 6
Subjective carcass measures of sheep fed increasing levels of cupuassu cake

Variables	Inclusion of cupuassu cake in diet (%)					Median	P
	0	7.4	14.8	22.2	29.6		
Finishing[1] (index 1 to 5)	3.0	3.2	3.2	3.0	3.0	3.0	0.359
Conformation[2] (index 1 to 5)	1.0	1.0	1.0	1.0	1.0	1.0	1.000
Perirenal fat[3] (index 1 to 3)	2.0	2.0	2.0	2.0	2.0	2.0	0.431

[1]Index: 1 – Very lean; 2 - Lean; 3 - Median; 4 - Fat; 5 – Very fat.
[2]Index: 1 -Poor; 2 - Fair; 3 - Good; 4 – Very good; 5 - Excellent.
[3]Index 1 (low score, partially covered left kidney and little fat in the pelvic cavity), 2 (medium score, totally covered left kidney and median fat layer in the pelvic cavity) and 3 (high score, totally covered left kidney and thick fat layer in the pelvic cavity).

Subjective carcass assessment indicates that all the animals exhibited grade 3 finishing (average surface fat deposition), and grade 1 conformation (concave carcasses with poor muscle coverage), showing scarce, elongated, narrow and superficial muscles, characteristic of animals not suitable for meat production. Perirenal fat totally covered the left kidney, while the right exhibited no fat or was partially covered, resulting in a grade 2 carcass (average score) (Cezar & Sousa, 2007). Although sheep obtained poor carcass conformation, their finishing was considered median. The genetic factor, in this case, is likely the most responsible for these results, given that these breeds were not specialized for meat production, thus displaying poor muscularity.

The different compounds present in diet may change organoleptic carcass characteristics, primarily odor and taste, which are essential for good acceptance of the product (R. G. Costa et al., 2011b). Cupuassu cake did not alter these parameters (P>0.05) at any of the levels studied, with evaluators awarding an average score of 7.0 (like moderately) by the evaluators in overall sensory assessment (Table 7).

Table 7
Sensory assessment of meat from the left haunch of sheep fed with increasing levels of cupuassu cake

Variables	Scores	Inclusion of cupuassu cake in the diet (%)					Median	P
		0	7.4	14.8	22.2	29.6		
Global assessment	1 – 9	7.0	7.0	7.0	6.0	7.0	7.0	0.719

Global acceptance can be defined as the sum of quality factors that contribute to determining the degree of product acceptance. It was found that the use of cupuassu cake did not alter the organoleptic characteristics of sheep meat.

Conclusion

Cupuassu cake can comprise up to 30% of feedlot sheep diets without compromising carcass performance, yield and quality or the sensory characteristics of the meat. It is therefore an option for producers with access to this coproduct.

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