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Effects of including scrapes of residual dehydrated cassava in sheep feeding on intake and nutrient digestibility

Raspa de mandioca residual desidratada na alimentação de ovinos sobre o consumo e digestibilidade dos nutrientes

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Abstract

The objective of the present study was to evaluate the inclusion of 0%, 10%, 20%, and 30% of scrapes residual dehydrated cassava (SRDC) in sheep feed on the intake and total digestibility coefficient (DC) of nutrients. We used four sheep with body weight (BW) of 26.0 kg, distributed in a Latin square design. The sheep were placed in metabolism cages and received two meals a day. The variables studied were subjected to analysis of variance and differences were tested using regression analysis at the 5% significance level. We determined that the inclusion of different concentrations of SRDC in sheep feeding did not modify (p>0.05) the intake of intake of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fiber (NDF), acid detergent fiber (ADF), or total carbohydrates (TC) expressed in g animal^{-1} day^{-1}, g kg$^{0.75-1}$ and %BW). On average 2.83%, 2.58%, 0.34%, 0.07%, 1.62%, 0.91%, and 2.24% of the BW were obtained for intake of DM, OM, CP, EE, NDF, ADF, and TC, respectively. However, the four experimental diets negatively affected the NFC intake and %BW (p<0.05). Different concentrations (0%, 10%, 20%, and 30%) of SRDC in sheep diets did not influence (p>0.05) the digestibility coefficient of most of the variables measured (DM, OM CP, EE, NDF, ADF, TCH, NFC, with average values of 67.79%, 67.61%, 53.87%, 81.42%, 55.61%, 39.07%, 70.95%, and 91.48%, respectively. Thus, we conclude that the inclusion of up to 30% of SRDC in sheep diets would not affect intake or nutrient digestibility.
Key words: Crude protein. Dry matter. Neutral detergent fiber. Total carbohydrates.

Resumo

Objetivou-se avaliar a inclusão de 0%; 10%; 20% e 30% de raspa de mandioca residual desidratada (RMRD) na alimentação de ovinos sobre o consumo e o coeficiente de digestibilidade total (CD) dos nutrientes. Foram utilizados quatro ovinos com peso corporal (PC) médio de 26,0 kg, distribuídos em delineamento em quadrado latino. Os ovinos foram alocados em gaiolas de metabolismos e receberam duas refeições por dia. As variáveis estudadas foram submetidas à análise de variância e as diferenças

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observadas foram testadas utilização equação de regressão a 5% de significância. A inclusão dos diferentes níveis de RMRD na alimentação de ovinos não alterou (p>0,05) o consumo de matéria seca (MS), matéria orgânica (MO), proteína bruta (PB), extrato etéreo (EE), fibra em detergente neutro (FDN) e ácido (FDA) e carboidratos totais (CHT) expressos em g animal^{-1} dia^{-1}, g kg$^{0,75-1}$ e %PC. Os valores médios de 2,83%; 2,58%; 0,34%; 0,07%; 1,62%; 0,91% e 2,24% do PC foram obtidos para o consumo de MS; MO; PB; EE; FDN; FDA e CHT, respectivamente. Porém, os níveis de 0%, 10%; 20% e 30% de inclusão de RMRD influenciaram de maneira linear decrescente (p<0,05) o consumo de carboidratos não fibrosos (CNF) expressos em g animal^{-1} dia^{-1}, g kg$^{0,75-1}$ e % do peso corporal (PC). A inclusão de 0%; 10%; 20% e 30% de RMRD nas rações de ovinos não influenciaram (p>0,05) o CD da MS; MO; PB; EE; FDN; FDA; CHT e CNF, com valores médios de 67,79%; 67,61%; 53,87%; 81,42%; 55,61%; 39,07%; 70,95% e 91,48%, respectivamente. Desta maneira, conclui-se que pode ser fornecida até 30% de raspa de mandioca residual desidratada na alimentação de ovinos sem alterar o consumo e o coeficiente de digestibilidade dos nutrientes.

Palavras-chave: Carboidratos totais. Fibra em detergente neutro. Matéria seca. Proteína bruta.

Introduction

In recent years, there has been an increasing interest in intensifying processes associated with termination lambs, aiming to speed their arrival to the market and produce carcasses with better quality (GARCIA et al., 2000). In this context, confinement has become an adequate system, as it also facilitates parasites control, due to the restricted contact between animals and pasture, which is considered the main source of contamination (REIS et al., 2001).

An adequate supply of energy and protein in food results in better utilization of nutrients during the productive and reproductive processes of animals. Particularly in meat production, energy is an important element for food conversion; therefore, it is necessary to include energetic supplements (FREITAS et al., 2002). However, the high price of these supplements is an important factor that influences the final costs of livestock production in countries such as Brazil, where nutritional elements such as corn are widely used Therefore, technicians and rural entrepreneurs are searching for alternative energy sources to be used for livestock animals. In this context, food sources such as agricultural and/or agro-industry residues may arise as an efficient product with plausible commercialization (BURGI, 2000), becoming a valuable source of protein, energy, and fiber. However, a major inconvenient is their higher variability in nutrient content compared with conventional foods; thus, if these alternative food sources are used, there need frequent to perform analyzes of their chemical composition (LIMA, 2005).

In Brazil, corn is one of the main ingredients used in the formulation of concentrated rations. However, despite its high nutritional quality, it is expensive, and hence various products have been studied with the aim of replacing corn in concentrated feed (RAMOS et al., 2000; GERON et al., 2014a).

Cassava and its waste can be used as alternative sources of energy; once, more noble grains are used in human food and non-ruminant animals, which have better response to the use of this type of food in relation to ruminants (MARQUES et al., 2000; ZEOULA et al., 2003).

According to Cunha et al. (2006), cassava is used with low frequently in animal nutrition, but owing to its ease of cultivation even with low technological input, has considerable advantages over other commonly used high-energy foods. However, it is classified by its content of cyanogenic acid (HCN) as moderately poisonous, with (wild) 50 to 100 mg of HCN kg^{-1} of fresh root; as soft, with less than 50 mg kg^{-1} of HCN from fresh root shelled, as poison and above 100 mg of HCN kg^{-1} of fresh root shelled (OLIVEIRA, 2009).

Scrapes of residual cassava *in natura* (SRC) are obtained from the cassava starch industry, after the scraping and extraction of starch root, and contain high levels of water (80%) and fiber, and low amounts of starch (GERON, 2007), beyond contain excess water.

These SRC go through a process of dehydration directly in the sun or into dryers, producing scrapes of residual dehydrated cassava (SRDC). These SRDC have lower concentrations of cyanogenic acid; thus, it can be safely used as food for ruminants. However, SRDC contains low levels of easily fermentable carbohydrates (i.e., starch) and total digestible nutrients, which may affect intake and animal performance (GERON, 2007). In contrast, scrapes of integral dehydrated cassava (SIDC), contain higher levels of starch compared to SRDC (GERON et al., 2014b).

Considering the aforementioned need of exploring new sources for nutrients in animal industry, this study aimed to contribute with quantitative data concerning the effects of the sub product SRDC in animal nutrition. Specifically, this study assessed the inclusion of different concentrations of SRDC in sheep food, considering the effects on animal intake and digestibility.

Material and Methods

This study was conducted at the Setor de Metabolismo Animal (SeMA) and the Laboratório de Análise de Alimentos e Nutrição Animal, in the Pontes and Lacerda *Campus*, Universidade do Estado de Mato Grosso (15°19′05″ S; 59°13′26″ W), at an altitude of 295 m above sea level.

According to description of Geron et al. (2013), the climate of the Upper Valley region of Guapore-MT is classified as tropical continental, or as a wet and dry type of Aw second Koppen.

We used four castrated mongrel sheep with an average body weight (BW) of 26.0 ± 2.0 kg. The sheep were housed in metabolic cages, which had individual feeders and waterers. Fifteen days before the beginning of the trial, sheep were dewormed with ivermectin-based products.

We used a Latin square (4 × 4) experimental desing with four animals, four periods, and four experimental diets with various inclusion levels of SDRC to evaluate its effects on intake and the coefficient of total digestibility of nutrients in sheep.

The scrapes of residual cassava *in natura* (SRC) was obtained from a cassava starch industry located in the city of Cáceres, MT, Brazil. After the process of scraping and extraction of root starch, this residue is dehydrated in sunlight to remove excess water and residues called scrapes of residual dehydrated cassava (SRDC) result, which have low levels of cyanogenic glycosides, depending on the variety of soft cassava processed by the industry.

Feed concentrates used in the preparation of the experimental rations were as follows: grain ground corn, SDRC, soybean meal, soybean oil, and urea. The roughage food given to animals was corn silage. The chemical compositions of the food is presented in Table 1.

Experimental rations were formulated to contain 0%, 10%, 20%, or 30% scrapes of SRDC. The proportion of roughage used in the experimental rations was 50% corn silage and 50% concentrate. The rations were balanced to contain an average of 15% crude protein (isoproteic) and 69% of total digestible nutrients (isoenergetic) as recommended by the NRC (2007) as shown in Table 2.

The sheep had access to water in individual troughs. They were supplied 10 g of mineral mixture per day per animal (5 g of salt meal $^{-1}$ animal-^{1}), added to the experimental diets twice a day when the sheep were fed. The chemical composition of the mineral salt used in this study was 120 g of Ca kg^{-1}, 85 g of P kg^{-1}, 16 g of S kg^{-1}, 148 g of Na kg^{-1}, 50 mg of Co kg^{-1}, 500 mg of Cu kg^{-1}, 16 mg of Se kg^{-1}, and 4,800 mg of Zn kg^{-1}.

Table 1. Chemical composition of experimental foods.

Variables	Alimentos experimentais expresso em % da MS					
	Corn silage (CS)	Corn ground grain (CG)	Scrapes of residual dehydrated cassava (SRDC)	Soybean meal (SM)	Soy oil (SO)	Ureia
Dry matter %	28.40	88.63	90.22	90.75	99.00	97.68
Organic matter %	92.16	97.84	96.00	93.37	99.00	-[1]
Crude protein %	8.50	9.73	2.03	50.19	-	282.60
Ether extract %	1.61	4.07	0.30	1.51	99.00	-
Neutral detergent fiber %	68.58	22.64	73.09	24.74	-	-
Acid detergent fiber %	41.03	11.31	14.95	27.04	-	-
Crude fiber %	32.83	9.05	13.46	21.63	-	-
No-nitrogen extract %	52.27	75.50	-	20.28	-	-
Total carbohydrates %	82.05	84.04	93.67	41.66	-	-
No-fibrous carbohydrate %	13.47	61.40	20.58	16.92	-	-
Mineral matter %	4.79	1.66	4.00	-	6.38	-
Total digestible nutrients %	62.30	86.03	74.0	80.73	250.0.	-

[1] Trace nutrient in the experimental food. Total carbohydrates (TC) = OM - [EE + CP] and not fibrous carbohydrate (NFC) = 100 - (CP +NDF + EE + MM) second Sniffen et al. (1992).

Table 2. Percentage and chemical composition of experimental diets containing different levels of inclusion of the scrapes of residual dehydrated cassava (SRDC) provided to sheep.

Foods	Inclusion levels of the scrapes of residual dehydrated cassava (SRDC) in experimental diets			
	0%	10%	20%	30%
Corn silage	50.0	50.0	50.0	50.0
Corn ground grain	40.0	26.0	13.0	0.00
scrapes of residual dehydrated cassava	0.00	10.0	20.0	30.0
Soybean meal	8.5	11.5	13.5	16.0
Soy oil	0.5	1.5	2.5	3.0
Ureia	1.0	1.0	1.0	1.0
Total	100.00	100.00	100.00	100.00
Chemical composition	0%	10%	20%	30%
Dry matter %	58.84	59.16	59.47	59.73
Organic matte %r	93.65	93.34	93.08	92.79
Crude protein %	15.20	15.60	15.50	15.70
Ether extract %	3.10	3.60	4.10	4.10
Neutral detergent fiber %	45.45	50.33	55.19	60.18
Acid detergent fiber %	27.34	28.06	28.63	29.33
Crude fiber %	21.87	22.60	23.20	23.91
Total carbohydrates %	58.10	56.10	54.70	53.40
Non-fibrous carbohydrates %	32.73	26.70	21.12	15.16
Mineral matter %	3.60	3.96	4.97	4.62
Total digestible nutrients %	73.70	74.00	74.30	73.80

The rations were supplied ad libitum to attain approximately 10% of leftovers each day. Animals were fed twice a day, at 06:00 and at 18:00. The leftovers were assessed before the first daily meal.

Nutrient digestibility testing lasted 80 days and was divided into four experimental periods lasting 20 days each. The animals were allowed to adapt for 14 days and leftovers and feces were collected and sampled for 6 days. The experimental collection period included the measurement of the total amount of feces and leftovers generated per animal day^{-1} beyond the sampling of food, leftovers, and fecal samples. Management of the adaptation and collection period was carried out as described by Silva and Leão (1979).

Feces from each animal were collected in a napa bag, then were weighed and homogenized, from which we generated feces samples with 10% of the total original weight. These feces samples were inserted in individual plastic bags, with information of the corresponding sheep and period, and stored at -10°C for further analysis.

Foods, leftovers, and feces samples were dried at 55°C for 72 hours, and processed in a Wiley mill using a 1 mm sieve. Then, based on the dry weight, equal amounts of each sample were homogenized to form composite samples of feces and leftovers animal^{-1} period^{-1} experimental diet^{-1}.

The corresponding composites obtained from feces samples, leftovers and food were analyzed to explore their composition. Nitrogen content was obtained via the semi-micro-Kjeldahl method, using 6.25 as the conversion factor for CP. The mineral matter (MM) measurement was developed based on the incineration method in a muffle at 600°C. The content of organic matter (OM) was estimated by subtraction from the mineral matter (100-MM); ether extract (EE) was determined by extraction with petroleum ether (SILVA; QUEIROZ, 2002).

The determination of the neutral detergent fiber (NDF) and acid detergent fiber (ADF) content was performed adapting the method proposed by Van Soest et al. (1991), with two modifications: we did not use sulfite, and did not correct the NDF and ADF values regarding the content of MM of the fiber. The determination of total carbohydrates (TC) was obtained by the equation: TC = OM - [EE + CP] (SNIFFEN et al., 1992). The non-fibrous carbohydrate (NFC) was determined by the equation: NFC = 100 - (CP + NDF + EE + MM) (SNIFFEN et al., 1992).

The content total digestible nutrients (TDN) of the experimental diets were obtained by the equation proposed by Sniffen et al. (1992), in which TDN = DCP + 2.25 EED + DTC (DCP: digestible crude protein; EED: digestible ether extract; and DTC: digestible total carbohydrates). The determination of the coefficient of total digestibility (DC) of nutrients was obtained using the equation: DC = [((nutrient contained in feed supplied g - leftover g of nutrient) - nutrient contained in feces g) / nutrient consumed g] x 100 (GERON et al., 2013).

The effect of the experimental diets (i.e., of different concentrations of SRDC) on food intake and digestibility were analyzed with an analysis of variance (ANOVA), using the SAEG software (UFV, 2007), considering a significance level at $p \leq 0.05$. If the effect was significant, we developed additional regression analysis.

Results and Discussion

The inclusion of 0%, 10%, 20%, and 30% of SRDC in sheep feeding did not modify significantly ($p>0.05$) the intake of the DM, OM, CP, EE, NDF, ADF, and TC, expressed as g animal^{-1} day^{-1}, g kg$^{0.75\,-1}$ and % BW (Table 3). Were observed mean values of 2.83%; 2.58%; 0.34%; 0.07%; 1.62%; 0.91% and 2.24% of the BW to the intake of DM; OM; CP: EE; NDF; ADF and TC, respectively (Table 3).

These results agree with previous studies; for example, Zeoula et al. (2003), described that a replacement of 100% from corn grain to cassava flour did not modify the DM intake, and produced only a minor change in sheep body weight (2.9%).

Table 3. Daily average intake of dry matter (IDM), organic matter (IOM), crude protein (ICP), ether extract (IEE), neutral detergent fiber (INDF) and acid (IADF), total carbohydrates (ICT), and non-fiber carbohydrates (INFC) by sheep fed with rations containing scrapes of residual dehydrated cassava (SRDC).

Variables	Inclusion levels of the scrapes of residual dehydrated cassava (SRDC) in experimental diets				Regres.	CV (%)
	0%	10%	20%	30%		
IDM g $kg^{0,75\ -1}$	61.72	60.48	61.96	65.65	Y = 62.45	20.80
IDM % BW	2.83	2.73	2.78	2.97	Y = 2.83	22.02
IDM g day^{-1}	646.23	660.99	695.50	719.89	Y = 680.66	17.34
IOM g $kg^{0,75\ -1}$	56.39	54.97	56.61	60.75	Y = 57.18	20.78
IOM % BW	2.58	2.48	2.54	2.75	Y = 2.58	22.08
IOM g day^{-1}	591.59	601.95	637.39	666.22	Y = 624.29	17.16
ICP g $kg^{0,75\ -1}$	7.27	7.28	7.23	7.97	Y = 7.43	21.65
ICP % BW	0.33	0.32	0.32	0.36	Y = 0.34	23.06
ICP g day^{-1}	76.32	79.59	81.74	81.34	Y = 81.25	17.67
IEE g $kg^{0,75\ -1}$	1.43	1.44	1.65	1.90	Y = 1.60	29.34
IEE % BW	0.065	0.065	0.073	0.086	Y = 0.072	30.64
IEE g day^{-1}	14.91	15.78	18.68	20.89	Y = 17.54	25.57
INDF g $kg^{0,75\ -1}$	32.47	33.34	36.18	41.21	Y =35.80	27.69
INDF % BW	1.49	1.50	1.62	1.86	Y = 1.62	29.38
INDF g day^{-1}	339.67	366.78	409.55	451.68	Y = 391.92	22.91
IADF g $kg^{0,75\ -1}$	19.17	19.24	19.97	22.22	Y = 20.15	18.34
IADF % PCV	0.88	0.87	0.89	1.00	Y = 0.91	27.15
IADF g dia^{-1}	200.31	211.80	226.10	243.19	Y = 220.35	21.70
ITC g $kg^{0,75\ -1}$	49.12	47.76	49.23	52.32	Y = 49.61	19.32
ITC % BW	2.25	2.16	2.21	2.36	Y = 2.24	20.55
ITC g day^{-1}	515.63	522.41	553.01	573.91	Y = 541.24	15.94
INFC g $kg^{0,75\ -1}$	16.65	14.42	13.05	11.10	[1]	10.36
INFC % BW	0.76	0.65	0.59	0.50	[2]	10.62
INFC g day^{-1}	175.96	155.62	143.46	122.23	[3]	10.23

[1]Y=16.5105-0.36064X (R^2=61.11%) [2]Y= 0.752248-0.0168347X (R^2=57.68%); [3]Y=175.326-3.46745X (R^2=44.87%).

g $kg^{0,75\ -1}$: grams per kilogram of metabolic weight; % BW: body weight; g day^{-1}: grams per day; Regres.: regression equation; and % CV: coefficient of variation.

Furthermore, previous studies suggested that sources of starch and non-fibrous carbohydrates with lower ruminal degradation may promote a more balanced fermentation, without modifying the DM intake (NOCEK; TAMMINGA, 1991; SAUVANT et al., 1994). This is a plausible explanation for our findings, since the SRDC has a low content of NFC (Table 1).

According to Zeoula et al. (2003), starch fermentation causes an increase in the production and absorption of volatile fatty acids in the rumen environment. The accumulation of these acids in the rumen may cause damage into the rumen epithelium and inhibit the activity of cellulolytic microorganisms, which may produce reductions in the intake of roughage or DM, and consequently reduce fiber digestibility (ØRSKOV et al., 1986). However, we found that the inclusion up to 30% of SRDC in the sheep diet did not affect DM intake (Table 3) or the NDF digestibility coefficient (Table 4).

Concerning the potential effects of cassava, Conceição et al. (2009) explored the effects of different concentrations of SIDC in sheep feeding (0%, 12%, 24%, 36%, and 48%), where they found that it did not affect the DM intake, OM or CP, with BW average values of 4.21%, 4.12%, and 0.70%, respectively. However, our study described a lower intake of DM in relation to the BW, compared with the study conducted by Conceição et al. (2009); this situation may be related to differences in the BW of sheep used in both studies, and thus to the requirement for weight gain.

Table 4. Coefficients of variation (CV) and total digestibility coefficients (DC) for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fiber (NDF) and acid fiber (ADF), total carbohydrates (TC) and non-fibrous carbohydrate (NFC) for sheep fed with diets containing different amounts of scrapes of residual dehydrated cassava (SRDC).

Variables	Inclusion levels of the scrapes of residual dehydrated cassava (SRDC) in experimental diets				Regres.	CV %
	0%	10%	20%	30%		
DC DM %	68.00	69.26	67.16	66.72	Y = 67.79	2.89
DC OM %	67.93	68.85	66.74	66.92	Y = 67.61	2.72
DC CP %	54.13	53.43	53.40	54.52	Y = 53.87	4.72
DC EE %	83.40	80.95	80.72	80.65	Y = 81.42	3.73
DC NDF %	54.55	55.49	55.81	56.70	Y = 55.61	8.35
DC ANF %	40.02	39.77	39.31	37.17	Y = 39.07	16.69
DC TC %	71.09	72.69	69.99	70.02	Y = 70.95	2.23
DC NFC %	92.23	92.99	91.20	89.50	Y = 91.48	2.53

Regres.: regression equation.

According to Geron et al. (2014c), dietary fiber is the fraction of structural carbohydrates in food that may have slow digestion due to its chemical composition, and may limit the animal DM intake and energy. However, in ruminants, the dietary fiber is necessary to present an adequate digestion of DM and other nutrients. Thus, in this study it was observed that the ration with 0% of SRDC (Table 2) presented 45.4% of NDF, which was 24.5% lower compared to the ration with 30% of SRDC (60.2% of NDF); nonetheless, this variation in NDF content did not modify ($p>0.05$) NDF intake by sheep (mean value: 391.2 g animal^{-1} day^{-1}; Table 3).

However, the inclusion of different concentrations of SRDC provoked a negative linear effect ($p<0.05$) on NFC intake in g animal^{-1} day^{-1}, g kg$^{0.75\ -1}$ and % BW (Table 3). This effect may be due to the differences in NFC content between the ground corn grain (61.4%) and SRDC (20.6%) (Table 1). Considering this, a diet with 0% of SRDC presented a NFC content of 32.7% (Table 2), whereas the ration with 30% of SRDC presented 15.2% of NFC, i.e., a reduction of approximately 53.7%. Therefore, this strong variation in the NFC content between our experimental diets may have contributed to the negative linear effect on the NFC intake.

We described a DM average intake of 680.7 g animal^{-1} day^{-1} (Table 3); this value is 18.7% above the estimations obtained by the equation suggested by Geron et al. (2013) to predict DM intake (predicted: 553 g animal^{-1} day^{-1}), which considers lambs with approximately 20 kg of BW fed with diets containing 50% of concentrate (equation: IDM = 446.055 + 7,39372X-0, 0105236X^2, where, x is the level of concentrated). This difference obtained in DM intake may be due to differences in the BW of the animals, and variations in other elements from the diets, such as protein concentration and energy.

Concerning digestibility, the inclusion of different concentrations of SRDC in sheep feeding did not influence (p>0.05) DC of DM, OM, CP, EE, NDF, ADF, TC or NFC, with average values of 67.8, 67.6, 53.8, 81.4, 55.6, 39.1, 70.9, and 91.5%, respectively (Table 4).

These results differ with some previous studies, which suggest that the supply of cassava or some of its sub products promote greater ruminal digestion values, ruminal degradability and digestibility in the gastrointestinal tract in relation to cereal grains, particularly in relation to maize – *Zea mays* L (MARQUES et al., 2000; CALDAS NETO et al., 2001). However, this could be explained considering that the SRDC used in this study is a residue obtained from of agro-industry, in which most of the starch was extracted for the production of cassava starch.

Other studies are in agreement with our digestibility outcomes: Zeoula et al. (2003) described no changes in digestibility of DM, OM, CP and NDF (average values of 69.5%, 71.2%, 65.8% and 53.9%, respectively) when replacing up to 100% of the grain of corn for cassava.

Similarly, Abrahão et al. (2006) replaced 100% of corn grain by wet residue of cassava in food for cattle, and did not detect any significant modifications in the DC of DM (average 65.4%). However, they reported that although there was no difference between treatments, diets with higher percentages of replacement presented higher absolute values DC of DM (71.4% for the diet with total replacement); this was probably due to the greater inclusion of the residue, which, because of the particular starch properties, had higher degradability and digestibility compared with corn. Here, we did not observe this variation in the DM digestibility coefficients, probably due to the general composition of our experimental diets (Table 1). The experimental diet with 30% of SRDC contained 0% of corn grain (Table 2); however, diets containing higher concentrations of SRDC contained soybean oil, which may have provided associative effects for fermentation and nutrients absorption.

Conclusion

The inclusion of scrapes residual dehydrated cassava concentrations up to 30% in sheep feeding can be used without modifications in the intake or in digestibility coefficient of dry matter, organic matter, crude protein, ether extract, neutral detergent fiber, acid detergent fiber, or total carbohydrate.

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