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Dehydrated cashew apple in different grinding sizes to sheep

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ABSTRACT. The cashew pseudo fruit can be used to animal feeding in tropical and subtropical countries as Brazil, Ivory Coast and Vietnam. Thus, our objective was to evaluate the intake, digestibility of nutrients and nitrogen balance of dehydrated cashew apple by-product to sheep. The experiment was carried out with 24 sheep in a completely randomized design with the treatments distributed in a 4 *x* 2 factorial scheme to test the inclusion (11, 21, 28 and 33% dry matter basis) and the grinding sizes (3 and 19 mm diameter) of dehydrated cashew apple by-product. To grinding sizes there was no effect to intake and digestibility, suggesting the use of dehydrated cashew apple by-product either finely or coarsely milled. The inclusion up to 33% of dehydrated cashew apple by-product inclusion did not affect voluntary intake and nitrogen balance. However, when including above 21%, there was a reduction of ether extract digestibility and more than 28% reduced dry matter and organic matter digestibility.

Keywords: agribusiness; alternative feeds; food particle size; lambs; small ruminants.

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Introduction

Small ruminants are adapted to semiarid climates, converting roughage with low quality to food and products with high quality demanded by humans. The Brazilian northeast was the only region in Brazil where sheep herd grew in the last ten years (Instituto Brasileiro de Geografia e Estatística [IBGE], 2017). This region accommodates approximately 65% of sheep (about 9 million heads) from Brazil. For lamb production in semiarid regions such as occurs in the northeast of Brazil, the use of native pasture in extensive systems is the main food source. To avoid malnutrition and unsatisfactory productivity especially during dry season, the energetic, protein and fibrous supplementation is necessary. Thus, to ensure the meat production in these areas, locally adapted animals as sheep as well as vegetal species such *Buffel* grass, *Caesalpineae* trees and fruits as cashew can be options.

The cashew apple (*Anacardium occidentale*) is a pseudo fruit whose tree belongs to the *Anacardiaceae* family concentrated in the tropical regions and is widespread in several countries such as Brazil, India, Mozambique, Tanzania, Kenya, Vietnam, Indonesia and Thailand (Mazzetto, Lomonaco, & Mele, 2009; Lima et al., 2014). Characterized as a fibrous and juicy fruit (Lima et al., 2014), the cashew apple pulp is rich in ascorbic acid (Queiroz, Lopes, & Mesquita, 2011), phenolic compounds, minerals (Sivagurunathan, Sivasankari, & Muthukkaruppan, 2010) and carotenoids.

Cashew harvest season occurs in the dry season, a period characterized by the low production of forages and rising prices of supplements. After agroindustry processing they can be used to animal feeding. Medeiros, Holanda and Leite (2013) reported that the main cashew by-products applied to animal feeding is cashew nut meal, the cashew apple residue after juice extraction and the cashew apple sun-dried on the field (dehydrated cashew apple). The cashew nut meal and cashew apple residue comes from agroindustry. To cashew apple residue according to Paiva (2010), after pressing, 60 to 80% of cashew pseudo fruit will turn into pulp to juice and other beverages. This variation is due to the pressing method. The remaining is dried and stocked in bags. The dehydrated cashew apple is sun-dried on the field, similarly applied to hay technique. After dried, it is milled in forage grinder and stocked in bags. Although promising results to by-products as alternative food in ruminant nutrition as dehydrated cashew pseudo fruit, they have limited use due to the lack of knowledge regarding nutritional value, production savings and palatability (Medeiros et al., 2013).

The use of fruits or their by-products in ruminant diets require attention because the decrease in particle size by fine grinding increases the surface area exposed to microbial attack, which increases the rate of digestion of the potentially digestible plant cells (Rogério et al., 2009). However, decreasing particle size does not necessarily raise the feed digestibility due to an increase in consumption and digestive flow through the gastrointestinal tract (Gomes et al., 2012). According to National Research Council [NRC] (2007), for forages milling has little impact on intake and digestibility. Our hypothesis is the dehydrated cashew apple can be added as an alternative ingredient to sheep diets. Given the above, the present work aimed to determine intake and digestibility of dehydrated cashew apple included in increasing levels of inclusion in diets for finishing sheep, under two processing forms (milled in sieves of 3.0 and 19.0 mm in diameter).

Material and Methods

The present study was conducted at State University Vale do Acaraú - Ceará, Brazil. This region has a weather BSh type (Köppen classification), megathermic, dry, where the rainfalls occur mainly between January to June (93%) with an average of 889 mm per year, the annual temperatures are around 33°C, with a relative humidity of 68%.

The cashew apple (without cashew nuts) was obtained from Cajubras S.A., Pacajus, Ceará - Brazil. This product was obtained after cashew pseudo fruit juice extraction and the bagasse was sun-dried on the ground during 15 days and turned over daily to homogenize drying. After dried (10% humidity approximately) representative samples of dehydrated cashew apple (DCA) by-product as well other ingredients (Aruana grass hay, corn and cottonseed meal) used to formulate experimental diets were taken for chemical analysis (Table 1).

Table 1. Means of chemical composition (g kg^{-1} of dry matter) and gross energy (Mcal kg^{-1}) of the ingredients offered in the experiment (DM basis).

Components (g Kg^{-1} of DM)	Dehydrated Cashew Apple	Aruana grass hay	Corn	Cottonseed meal
Dry matter (as fed)	883	873	884	927
Crude protein	153	91	112	276
Extract ether	40	29	39	92
Neutral detergent fibre	683	853	317	559
Acid detergent fibre	479	457	39	389
Lignin	218	42	0.30	106
Ash	52	87	16	43
Total carbohydrates[a]	756	792	833	588
NFC[b]	240	19	521	85
GE[c] (Mcal kg^{-1})	4.50	4.20	4.50	4.70

[a] Calculated using equation of Sniffen, O'Connor, Van Soest, Fox, and Russell (1992). [b] Non-fibrous carbohydrates, calculated using equation of Weiss (1999). [c] Gross Energy. The samples were analyzed in duplicates, except for NDF, ADF and Lignin analyzed in triplicates.

Twenty four Santa Inês breed growing lambs at an average body weight of 20.4 $\pm$ 1.58 kg and five months old were identified, weighed, dewormed and individually housed in metabolic cages. During the experiment, lambs were fed with a total mix ration (TMR) isoenergetic and isonitrogenous, *ad libitum* and adjusted to have a refusal between 15 and 20%. They were fed twice a day (8 AM and 5 PM).

The DCA was included in TMR (Table 2) at levels of 11, 21, 28, and 33% which corresponded to 110, 210, 280 and 330 g DCA kg^{-1} dry matter of TMR, respectively, with two different grinding sizes: 3.0 mm - fine grinding (FG) and 19.0 mm - coarse grinding (CG), respectively.

The experimental period was 21 days, which consisted of 14 days to adaptation plus seven of collections. During collection, before the morning feeding once a day, spot samples of diet offered, orts, urine, and faeces were collected, measured, stored and recorded. The means of daily intake was calculated by the difference of total diet offered minus orts. To determine nutrient intake and digestibility, a pooled sample of seven days collection was done to the diet, orts, and faeces. Then, the samples were prepared, weighed, dried at 55°C for 72h in an air oven and milled to 1 mm through a knife mill. To determine nitrogen balance urine were also collected using buckets with 100 mL HCl 2N to avoid fermentative process. The urine was weighed and measured, sampled and stored in plastic bottles to be frozen at -10° C. For TMR, orts and faeces analysis, the methodology proposed by Association of Official Analytical Chemists (Helrich & Association of Official Analytical Chemists [AOAC], 1990) was carried out to the determinations in duplicates of dry matter, organic matter, ash, ether extract, and nitrogen (*6.25). For fibre content in triplicates we used the sequential methodology proposed by Van Soest, Robertson and Lewis (1992). NDF was analysed without sodium sulphite and α-amylase. Gross energy was determined by combustion in an adiabatic calorimeter (PARR 6300). For nitrogen content in urine to nitrogen balance, the Kjeldahl method (Helrich & AOAC, 1990) was applied.

Table 2. Centesimal composition (%) and means of chemical composition, total digestible nutrients (TDN) (g/kg) and gross energy (Mcal kg^{-1}) of total mix ration containing increasing levels of dehydrated cashew apple (DM basis).

Ingredient	Total mix ration [a]			
	11%	21%	28%	33%
	Centesimal composition			
Aruana grass hay	11.0	6.1	3.2	0.00
Dehydrated cashew apple	11.0	21.0	28.0	33.0
Corn	47.9	47.6	45.5	43.5
Cottonseed meal	30.1	25.3	23.3	23.5
Total	100.0	100.0	100.0	100.0
	Chemical composition			
Dry matter (as fed)	896	894	893	894
Crude protein	164	161	161	164
TDCP[b]	138	128	122	121
NDIN/Total N[c]	72.8	64.3	79.4	78,3
ADIN/Total N[d]	27.8	26.0	40.3	43,3
Extract Ether	54	52	51	52
Neutral detergent fibre	489	487	493	495
Acid detergent fibre	239	245	257	267
Hemicelluloses	251	242	235	228
Cellulose	172	161	159	158
Lignin	61	76	89	99
Ash	23	35	35	34
Total carbohydrates	746	752	753	750
Non-fibrous carbohydrates	303	321	325	325
Crude energy (Mcal kg^{-1})	4.50	4.50	4.50	4.50
TDN (g kg^{-1})[e]	696	667	622	597

[a] 11, 21, 28 and 33% = treatments with 110, 210, 280 and 330 g DCA kg^{-1} of TMR respectively. [b] TDCP = Truly digestible crude protein. [c] NDIN = Neutral detergent insoluble nitrogen as percentage of total nitrogen (TN). [d] ADIN = Acid detergent insoluble nitrogen as percentage of total nitrogen (TN). [e] Calculated according to Sniffen et al. (1992). The samples were analyzed in duplicates, except for NDF, ADF and Lignin analyzed in triplicates.

The experiment design consisted of a completely randomized 4 *x* 2 factorial design, four levels of dehydrated cashew apple and two grinding sizes. For variables analyzed intake, digestibility and nitrogen balance were used the model: $Y_{ijk} = \mu + A_i + B_j + A_{Bij} + e_{ijk}$, in which: Y_{ijk} = Observed value to inclusion level *I*, grinding size *j* and repetition *k*; μ = general mean; A_i = inclusion level effect *i* (11; 21; 28 and 33%); B_j = grinding size effect *j* (3 mm and 9 mm); AB_{ij} = interaction inclusion level *i* x grinding size *j*; e_{ijk} = standard error. To check the homogeneity of variances, the Shapiro-Wilk test ($\alpha = 0.05$) was used. The means were compared by the SNK test ($\alpha = 0.05$). Pearson's correlation degree was also evaluated ($P < 0.05$). Data analysis was performed using R Software (R Core Team, 2019).

Results

For nutrients evaluated, there was no interaction for intake, digestibility, and nitrogen balance ($p > 0.05$). For the DM, OM, CP, NDF, and cellulose intakes (% BW; g $BW^{0.75}$), no differences were observed between grinding sizes as for levels of inclusion of DCA ($p > 0.05$) (Tables 3 to 6).

The inclusion of dehydrated cashew apple at 33% reduced the dry matter digestibility when compared to the 11% diet ($p < 0.05$) (Table 3). The same was observed in organic matter digestibility (Table 4).

For crude protein, digestibility was similar for the different degrees of grinding and inclusion levels ($p > 0.05$) (Table 5).

The diet with 11% of dehydrated cashew apple has higher neutral detergent fiber (NDF) digestibility than diets with 28% and 33% ($p < 0.05$). The NDF digestibility to diet with 21% of DCA was higher than the diet with 33% ($p < 0.05$) (Table 6).

Table 3. Means of daily dry matter (DM) intake as a percentage of body weight (% BW) and grams per unit of metabolic size (g kg^{-1} $BW^{0.75}$), of digestible DM (g kg^{-1} $BW^{0.75}$) and coefficient of apparent DM digestibility of diets containing increasing levels of dehydrated cashew apple to sheep (n=24)*.

Variables	Grinding Size		Inclusion Levels of DCA				***SEM
	3 mm	19 mm	11%	21%	28%	33%	
DM intake (%BW)	4.8ᵃ	5.2ᵃ	4.6ᵃ	5.0ᵃ	5.1ᵃ	5.4ᵃ	0.148
DM intake (g kg^{-1} $BW^{0.75}$)	101.1ᵃ	109.9ᵃ	98.1ᵃ	102.5ᵃ	108.0ᵃ	113.4ᵃ	2.805
Digestible DM intake (g kg^{-1} $BW^{0.75}$)	60.1ᵃ	66.7ᵃ	63.4ᵃ	63.7ᵃ	63.1ᵃ	63.3ᵃ	1.672
**CTTAD of DM	0.60ᵃ	0.60ᵃ	0.65ᵃ	0.62ᵃᵇ	0.58ᵃᵇ	0.56ᵇ	1.140

*Different subscripts indicate significant differences between treatments through SNK test (p< 0.05). **CTTAD - Coefficient of total tract apparent digestibility. ***SEM = Standard error of the mean.

Table 4. Means of organic matter (OM) daily intake as a percentage of body weight (% BW) and grams per unit of metabolic size (g kg^{-1} $BW^{0.75}$), of digestible OM (g kg^{-1} $BW^{0.75}$) and coefficient of apparent OM digestibility of diets containing increasing levels of dehydrated cashew apple to sheep (n=24)*.

Variables	Grinding Size		Inclusion Levels of DCA				***SEM
	3 mm	19 mm	11%	21%	28%	33%	
OM intake (%BW)	4.1ᵃ	4.5ᵃ	3.9ᵃ	4.3ᵃ	4.3ᵃ	4.6ᵃ	0.127
OM intake (g kg^{-1} $BW^{0.75}$)	86.3ᵃ	94.0ᵃ	83.6ᵃ	87.8ᵃ	92.6ᵃ	96.8ᵃ	2.413
Digestible OM intake (g kg^{-1} $BW^{0.75}$)	52.5ᵃ	58.6ᵃ	56.0ᵃ	56.7ᵃ	55.0ᵃ	54.5ᵃ	1.501
**CTTAD of OM	0.62ᵃ	0.62ᵃ	0.67ᵃ	0.65ᵃ	0.59ᵃᵇ	0.56ᵇ	1.251

*Different subscripts indicate significant differences between treatments through SNK test (p < 0.05). **CTTAD - Coefficient of total tract apparent digestibility. ***SEM = Standard error of the mean.

Table 5. Means of crude protein (CP) daily intake as a percentage of body weight (% BW) and grams per unit of metabolic size (g kg^{-1} $BW^{0.75}$), of digestible CP (g kg^{-1} $BW^{0.75}$) and coefficient of apparent CP digestibility of diets containing increasing levels of dehydrated cashew apple to sheep (n=24).*

Variables	Grinding Size		Inclusion Levels of DCA				***SEM
	3 mm	19 mm	11%	21%	28%	33%	
CP intake (%BW)	0.8ᵃ	0.9ᵃ	0.8ᵃ	0.8ᵃ	0.8ᵃ	0.9ᵃ	0.025
CP intake (g kg^{-1} $BW^{0.75}$)	16.4ᵃ	18.1ᵃ	16.0ᵃ	16.7ᵃ	17.8ᵃ	18.7ᵃ	0.481
Digestible CP intake (g kg^{-1} $BW^{0.75}$)	7.9ᵃ	8.8ᵃ	8.9ᵃ	7.9ᵃ	8.2ᵃ	8.5ᵃ	0,317
**CTTAD of CP	0.49ᵃ	0.48ᵃ	0.56ᵃ	0.47ᵃ	0.46ᵃ	0.46ᵃ	1.528

*Different subscripts indicate significant differences between treatments through SNK test (p < 0.05). **CTTAD – Coefficient of total tract apparent digestibility. ***SEM = Standard error of the mean.

Table 6. Means of NDF daily intake as a percentage of body weight (% BW) and grams per unit of metabolic size (g kg^{-1} $BW^{0.75}$) of digestible NDF (g kg^{-1} $BW^{0.75}$) and coefficient of apparent NDF digestibility of diets containing dehydrated cashew apple provided to sheep (n=24)*.

Variables	Grinding Size		Inclusion Levels of DCA				***SEM
	3 mm	19 mm	11%	21%	28%	33%	
NDF intake (%BW)	2.3ᵃ	2.6ᵃ	2.3ᵃ	2.5ᵃ	2.4ᵃ	2.6ᵃ	0.073
NDF intake (g kg^{-1} $BW^{0.75}$)	48.7ᵃ	54.2ᵃ	49.5ᵃ	50.2ᵃ	51.9ᵃ	54.3ᵃ	1.369
Digestible NDF intake (g kg^{-1} $BW^{0.75}$)	18.7ᵃ	22.8ᵃ	24.6ᵃ	21.2ᵃ	19.6ᵃ	17.7ᵃ	1.022
**CTTAD of NDF	0.39ᵃ	0.42ᵃ	0.50ᵃ	0.42ᵃᵇ	0.38ᵇᶜ	0.32ᶜ	1.921

*Different subscripts indicate significant differences between treatments through SNK test (p < 0.05). **CTTAD - Coefficient of total tract apparent digestibility. ***SEM = Standard error of the mean.

For the ADF, the inclusion of dehydrated cashew apple had an observed increase in the consumption of this nutrient ($p < 0.05$). For the ADF intake (% BW), the lambs fed diets with 33% had a higher intake than those fed the diet containing 11% of dehydrated cashew apple ($p <0.05$), and, to (g kg^{-1} $BW^{0.75}$), the diet with 33% provided higher ADF intake compared to 11 and 21% ($p < 0.05$) (Table 7). There was a negative ADF digestibility influenced by increasing the inclusion of by-product, in which the diet with 11% showed higher values than the other treatments ($p < 0.05$).

For nitrogen balance, neither grinding at different particle sizes nor inclusion levels used had differences between treatments ($p > 0.05$), which both exhibited positive nitrogen balance (Table 8).

Table 7. Means of ADF daily intake as a percentage of body weight (% BW) and grams per unit of metabolic size (g kg^{-1} $BW^{0.75}$) of digestible ADF (g kg^{-1} $BW^{0.75}$) and coefficient of apparent ADF digestibility of diets containing dehydrated cashew apple provided to sheep (n=24)*.

Variables	Grinding Size		Inclusion Levels of DCA				***SEM
	3 mm	19 mm	11%	21%	28%	33%	
ADF intake (%BW)	0.8^{a}	0.9^{a}	1.1^{b}	1.2^{ab}	1.3^{ab}	1.5^{a}	0.045
ADF intake (g kg^{-1} $BW^{0.75}$)	26.5^{a}	28.1^{a}	24.3^{b}	25.5^{b}	28.4^{ab}	30.9^{a}	0.855
Digestible ADF intake (g kg^{-1} $BW^{0.75}$)	6.0^{a}	6.8^{a}	7.4^{a}	5.3^{a}	6.0^{a}	6.8^{a}	0.403
**CTTAD of ADF	0.23^{a}	0.24^{a}	0.31^{a}	0.22^{b}	0.21^{b}	0.21^{b}	1.584

*Different subscripts indicate significant differences between treatments through SNK test (p < 0.05). **CTTAD – Coefficient of total tract apparent digestibility. ***SEM = Standard error of the mean.

Table 8. Means of nitrogen intake (NI), faecal nitrogen (FN), urinary nitrogen (UN) (g d^{-1}), retention nitrogen (RN) as percentage of NI (RN/NI), and nitrogen balance (NB) of diets containing increasing levels of dehydrated cashew apple to sheep (n=24)*.

Variables	Grinding Size		Inclusion Levels of DCA				***SEM
	3 mm	19 mm	11%	21%	28%	33%	
NI (g d^{-1})	24.9^{a}	27.8^{a}	25.6^{a}	23.4^{a}	28.5^{a}	27.9^{a}	1.184
FN (g d^{-1})	12.8^{a}	14.2^{a}	11.2^{a}	12.4^{a}	15.4^{a}	15.3^{a}	0.733
UN (g d^{-1})	2.0^{a}	2.1^{a}	2.5^{a}	1.7^{a}	2.4^{a}	1.7^{a}	0.180
RN/NI (%)	40.8^{a}	40.7^{a}	46.0^{a}	39.9^{a}	37.6^{a}	39.6^{a}	1.451
NB (g d^{-1})	10.0^{a}	11.4^{a}	12.0^{a}	9.3^{a}	10.7^{a}	10.9^{a}	0.633

*Different subscripts indicate significant differences between treatments through SNK test (p < 0.05). **CTTAD - Coefficient of total tract apparent digestibility. ***SEM = Standard error of the mean.

Discussion

The average daily DM intake was 105.5 grams BW0.75. The nutritional requirements of lambs at four months old, 30 kg of body weight in early maturity, and weight gain of 200 g day^{-1} is 93.6 grams of DM $BW^{0.75}$ day^{-1} (NRC, 2007). For this recommendation, as presented in Table 3 that the averages of all treatments were superior. For the inclusion of dehydrated cashew apple in diets to sheep, Dantas Filho et al. (2007) observed average DM intake 106.1 g $BW^{0.75}$ when considering levels of 10-40% of inclusion.

Evaluating agro-industrial by-products as the only food for sheep (Lousada Junior, Neiva, Rodriguez, Pimentel, & Lôbo, 2005), reported values lesser than observed here, concerning DM digestibility of pineapple, Barbados cherry, guava and melon by-products (47.5, 22.8, 30.8 and 47.7%, respectively).

The high levels of lignin, in both dehydrated cashew apple and cottonseed meal (Table 1), may have been responsible for compromising the processes of rumen OM degradation. The inclusion of dehydrated cashew apple increases the lignin content of diet and thus particularly compromising, reducing voluntary feed intake. According to Adesogan et al. (2019), plant cell wall associated with lignin is a great barrier to complete digestion of feeds, particularly forages and by-products, and for utilization of the nutrients and energy they contain. High cell-wall concentration in diets, mainly rich lignin, decreases the voluntary intake present in diets once cell-walls contribute to ruminal fill (Jung & Allen, 1995). Only aerobic systems (mainly formed by fungi) degrade polyphenolic substrates, including lignin and condensed tannins.

The presence of polyphenolic substrates in anaerobic environments promotes deposition and protection of associated nutrients for a long time (Van Soest, 1994). This author recommended that feeds as that should be evaluated regarding protein availability, analysing nitrogen present on acid detergent fiber. In Table 2, it was shown that the values of ADICP ranged from 4.6 to 7.1%, in contents of dietary CP between 16.1 and 16.4%, representing 28.0 to 43.0% of the total CP. Despite that, this did not result in a reduction of CP digestibility.

The fiber composition (NDF and ADF) increased with the growing inclusion of dehydrated cashew apple. The average values of intake of NDF found in this study were 2.5% of BW and 51.4 g BW0.75, corroborating Dantas Filho et al. (2007), who observed 2.2% for NDF intake as a percentage of BW and 53.6 grams of NDF kg $BW^{0.75}$. Higher values of NDF intake for guava by-product (3.3% BW and 78.8 g BW0.75) was observed by Lousada Junior et al. (2005), elucidated by its higher fiber content.

Macedo Júnior et al. (2009) recommended a minimum of 28.1% of NDF content in the diet to sheep. All diets offered presented NDF content above this value. Unfortunately, the NDF digestibility observed for dehydrated cashew apple diets was lower than observed for Tifton 85 hay (64.0%) and sugar cane bagasse (55.4%) (Valadares Filho, Magalhães, Rocha Júnior, Cappelle, 2006), indicating that dehydrated cashew apple may be better characterized a fibrous food as forages. The average value found in this study for the intake of ADF as g $BW^{0.75}$ was 27.3. It is noteworthy that studies evaluating the physical effects of the fiber of fruits by-products of diets for small ruminants will be important for properly evaluating this service.

The digestibility of ADF was highly correlated with NDF (r = 0.8135, p < 0.0001), and this was reflected in the observed outcomes, particularly for levels including larger amounts of dehydrated cashew apple. The digestibility of ADF was inferior to that of disintegrated corn with straw and cob (53.4%) and orange bagasse silage with additives (69.9%) (Valadares Filho et al., 2006). Therefore, the use of dehydrated cashew apple by-product under fine grinding (3 mm) requires caution regarding the inclusion at levels higher than 11%. The treatment of low-quality fibrous foods may be an alternative to improve the availability of nutrients. However, Ribeiro et al. (2009), evaluating the influence of ammonisation with urea of the dehydrated cashew apple on the digestibility of fibrous contents, observed no improvement with ammonisation for the NDF and ADF digestibility.

The nitrogen balance remained positive even with the increased unavailability of the N in diets containing dehydrated cashew apple, even with the average CP digestibility under 50.0%. Leite et al. (2013) observed CP digestibility of 40.0% when evaluated the nutritive value of dehydrated cashew apple by-product associated with different concentrates. The authors associated the less CP digestibility to high ADIN content as well as the tannin present in diets with cashew apple. This suggests that the chemical composition of dehydrated cashew apple may vary depending on the source and form of manure the cashew apple. Due to the low availability of nitrogen contained in the dehydrated cashew apple, its supply must consider it being used mainly as a source of fiber supplementation, and not as a protein or energetic supplement.

Conclusion

For total mixed diet to sheep, the dehydrated cashew apple can be used finely or coarsely milled. The inclusion of dehydrated cashew apple up to 33% of the total diet does not affect sheep intake. However, when included at levels above 21%, it may cause a reduction in the digestibility of EE and NDF diet. The high fiber content in the dehydrated cashew apple suggests its use as a fibrous supplement to sheep.

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