

Phytogenic additive Noni (*Morinda citrifolia*) in feed of confined lambs

Aditivo fitogênico Noni (*Morinda citrifolia*) em rações de cordeiros confinados

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Abstract

The objective of this study was to evaluate the inclusion of different levels of 0.0%; 0.7%; 1.4% and 2.1% of Noni (*Morinda citrifolia*) in the feeding of lambs regarding ingestive behavior and physiological variables. The experiment was carried out in a double Latin (4x4) experimental design with eight animals, consisting of four periods and four experimental rations. Eight lambs with no defined racial pattern were used, with mean initial body weight (BW) of 23.74 ± 1.00 kg. The ingestive behavior was performed during 24 hours, always on the last day of each experimental period. The physiological variables and the environmental variables were measured during three days of each period. Data were submitted for analysis of variance and, when significant, regression equation was applied at 5% of probability. Statistical analysis was performed considering the subdivision of the plot, which consisted of the diurnal and nocturnal evaluation times for the ingestive behavior and the morning and afternoon periods for the physiological variables. The inclusion of Noni in fed lambs did not change ($p > 0.05$) the time spent with ingestive behaviors for dry matter intake (DMI), rumination (RUM), idleness (IDL), water intake (WIN) and other activity (OAC). However, the daytime During the period there was gr eater ($p < 0.05$) time use for DMI, WIN and OAC. Inclusion of Noni to diets provided higher ($p > 0.05$) time use during the night time for RUM and IDL. The physiological variables were not influenced ($p > 0.05$) by the inclusion of Noni in the diets of lambs. However, higher mean ($p < 0.05$) body temperature of the front and rear, rectal temperature and respiratory rate of the lambs were observed during the afternoon. The inclusion of up to 2.1% of Noni in lamb feed does not alter ingestive behavior and physiological variables. However, the consumption of dry matter and water is higher during the diurnal period, while rumination and idleness are more active during the night period.

Key words: Body temperature. Idleness. Respiratory rate. Rumination.

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Resumo

Objetivou-se avaliar a inclusão de diferentes teores 0,0%; 0,7%; 1,4% e 2,1% de Noni (*Morinda citrifolia*) na alimentação de cordeiros quanto ao comportamento ingestivo e às variáveis fisiológicas. Adotou-se o delineamento experimental em quadrado latino duplo (4 x 4) com oito animais, consistindo de quatro períodos e quatro rações experimentais. Foram utilizados 8 cordeiros sem padrão racial definido, com peso corporal (PC) inicial médio de $23,74 \pm 1,00$ kg. O comportamento ingestivo foi realizado durante 24 horas, sempre no último dia de cada período experimental. As variáveis fisiológicas e as variáveis ambientais foram mensurados durante três dias de cada período. Os dados foram submetidos à análise de variância e, quando significativos, aplicou-se equação de regressão a 5% de probabilidade. A análise estatística foi procedida considerando a subdivisão da parcela, as quais consistiram dos tempos de avaliação diurno e noturno para o comportamento ingestivo e períodos manhã e tarde para as variáveis fisiológicas. A inclusão de Noni na alimentação de cordeiros não alterou ($p > 0,05$) o tempo despendido com as atividades dos comportamentos ingestivo, quanto ao consumo de matéria seca (CMS), ruminação (RUM), ócio (OCI), consumo de água (CAG) e outras atividade (OAT). Porém, durante o período diurno houve maior ($p < 0,05$) utilização do tempo para as atividades de CMS; CAG e OAT. A inclusão do Noni às dietas proporcionou maior ($p > 0,05$) utilização do tempo durante o período noturno para RUM e OCI. As variáveis fisiológicas não foram influenciadas ($p > 0,05$) pela inclusão do Noni às dietas dos cordeiros. Contudo foram observadas maiores médias ($p < 0,05$) de temperatura corporal do dianteiro e traseiro, temperatura retal e frequência respiratória dos cordeiros durante o período da tarde. A inclusão de até 2,1% de Noni na alimentação de cordeiros não altera o comportamento ingestivo e as variáveis fisiológicas. Porém, o consumo de matéria seca e de água é maior durante o período diurno, enquanto a ruminação e o ócio se apresentar mais ativos durante o período noturno.

Palavras-chave: Comportamento ingestivo. Frequência respiratória. Temperatura corporal.

Introduction

The search s with natural products phytogetic animals are poorly explored the (CATALAN et al., 2013), therefore, studies that prove their effectiveness are scarce, but the sector is growing and jobs are the most varied (WANG et al., 2002; GERON et al., 2019) mainly in increasing the resistance of the animal organism against diseases, intoxications or environmental problems, mode of action that these natural foods act on the consumption and digestion, avoiding immunosuppression, stress and, consequently, reduced animal performance.

According to Bontempo (2007), functional foods are part of an elite group of nutrients. Besides having nutrients, functional foods also have components of protective, medicinal, therapeutic and special curative action, all these characteristics make functional foods beneficial to human and animal health.

In recent years research on medicinal plants has increased considerably (RODRIGUEZ-PRADO et al., 2011; PINTO et al., 2013). Some traditional species have been the starting point for the manufacture of important medicines Tagliati et al. (2008).

The Noni (*Morinda citrifolia*) has a low protein content and lipids, consisting pre dominantly of carbohydrates, sugars and fibers (CUNHA et al., 2012). In addition, Noni contains large amounts of vitamin C, and substantial amounts of niacin (vitamin B3), potassium and iron. Noni fruit usually has a concentration of 216.67 mg Golic acid equivalent - EAG of total phenolics 100^{-1} g, which is a natural antioxidant (CORREIA et al., 2011). Phenolic compounds act as antioxidants not only for their ability to donate hydrogen or metal chelating electrons, but also because of their stable intermediate radicals, which prevent the oxidation of various food constituents, particularly fatty acids and oils (SOARES et al., 2008).

Phenolic compounds have been widely studied for their influence on food quality and their constitution that has antioxidant properties (SOARES, 2002). In addition, some gallic acid derivatives, the gallates, have been shown to inhibit the respiratory chain of the *Trypanosoma cruzi* parasite (LETÉLIER et al., 1990), antimicrobial activity against *Escherichia coli* (BOYD; BEVERIDGE, 1981) and rat hepatocyte toxicity, contributing to mitochondrial dysfunction (NAGAKAWA; TAYAMA, 1995). Thus, there is a possibility that the use of functional foods with phytogenic origin may alter the rumen fermentative activity and consequently the ingestive behavior of ruminants.

The result of Noni is presented as phytogenic potential additive in animal feed, since this is expanded in Brazil, and has the ability to adapt to any soil, besides presenting a considered quantity of gallic acid (CORREIA et al., 2011). In general, antioxidants are substances capable of inhibiting or retarding the oxidation of sensitive structures when present in minute concentrations (ANGELLA, 2014). In organism lives, the existence of an imbalance in favor excessive generation of radicals, or instead of removal rate of this species reactive known as oxidative stress in the long term, this stress in the cellular environment, can cause severe problems metabolic and be wrapped into degenerative diseases (SHAMI; MOREIRA, 2004).

Evaluation of pulp extract, noni seed and bark as an additive natural was conducted by Costa et al. (2013) indicated that acetic pulp extract, quantified 109.81 mg / 100g of total phenolics, followed by acetone extracts of the shell (76.01 mg/100g) of seeds (28.75 mg/100g). Thus, the authors concluded that all the fractions of Noni fruit have antioxidant activity *in vitro*, due to the presence of phenolic compounds and gallic acid.

Review performed by Wang et al. (2002), to verify the antimicrobial action of Noni extract indicated that this activity is mainly related to the presence of anthraquinones and phenolic

compounds present in their chemical composition of the fruit. These compounds are responsible for preventing the attack of infectious bacterial strains.

Search with different levels of Noni (0, 8, 16 and 24%) as an alternative food source of protein to ruminants were subjected to fermentation *in vitro* by Geron et al. (2019). The authors observed a range of variation of 6% between 0% Noni and 24% Noni diets. They suggested that new study s should be carried out are, to verify that the use of Noni can act phytogenic additive for ruminants.

The feeding behavior of animal knowledge provides for better air feeding management and, consequently, the change so positive results production (BREMM et al., 2008). The feedlot sheep exhibit ingestive behavior as a function of roughage nutritive value, acceptability, particle size and physical form. The first factor that affects this activity is neutral detergent fiber (NDF), since they intervene directly in the ruminal kinetics (YANG et al., 2001).

The animal may alter its ingestive behavior when there is a change in food or the addition of food additives (GONÇALVES et al., 2000). Also, in situations where the animal is outside its comfort zone, it suffers from what we call stress. This way, if the animal is under stress, it can pass by situations that depend on several factors (leakage, curious, alert, fear, etc.), which can be evidenced by evaluation of animal ethology and dietary behavior (DADO; ALLEN, 1994).

The objective of this study was to evaluate the inclusion of Noni (*Morinda citrifolia*) in lambs feeding, ingestive behavior and physiological variables.

Material and Methods

The experiment was conducted in Setor de Metabolismo Animal (SeMA) of the Universidade do Estado de Mato Grosso (UNEMAT) and the chemical analysis of ingredients and feed were

carried out in Laboratório de Análise de Alimentos e Nutrição Animal (LAANA).

The experimental design was double Latin square (4X4) with eight animals (lambs), consisting of four periods and four experimental rations with 0.0%; 0.7%; 1.4% and 2.1% of Noni to lamb's feedlot. Eight crossbred lambs with average initial body weight (BW) of 23.74 ± 1 kg were used in the test of total nutrient digestibility and ingestive behavior. The lambs were housed in individual pens (metabolism cages), each cage contained a feeder and an individual polyethylene drinker.

For evaluates ingestive behavior and the physiological variables were considered are two periods as subplots, and day (7:00 a.m. to 18h59) and evening (19:00 pm to 6h59) for ingestive behavior variables (GERON et al., 2018) and the time the morning (7:00 a.m to 11h00) and late (13:00 a.m. to 17h00) for physiological variables lambs (GERON et al., 2018).

The fruit of the Noni was harvested on plantations not trade in the southwest of the State of Mato Grosso, in the municipality of Pontes e Lacerda,

during the months from May to June 2015. The fruits of Noni *in natura* were processed in crusher with sieve the screens 10 mm and, in sequence, was dried in the sun for approximately 96H00 layered approximately 5 cm above a plastic sheet.

The diets with inclusion of Noni were balanced second requirements NRC (2007) for lambs, aiming average daily gain of 150 g pet^{-1} , to be isonitrogenous and isoenergetic using the ingredients concentrated corn ground grain, soybean and Noni dried and the roughage was corn silage (Tables 1 and 2), in the ratio 35:65, respectively. The water and the salt mineral were available in individual troughs at ease. The rations were provided twice a day (at 8:00 am and 4:00 pm), so that there were approximately 10% of leftovers daily.

The experiment lasted 84 days, divided into four experimental periods of 21 days each, 14 days for adaptation of animals and 7 days of data collection (behavioral and physiological), food samples and leftovers. During the experimental period, management was performed as described by Geron et al. (2018).

Table 1. Chemical composition of the experimental feed ingredients.

Variables	Experimental foods (g kg ⁻¹)			
	CS ¹	CG ²	SM ³	Noni ⁴
Dry matter (DM)	346.60	910.00	926.80	900.90
Organic matter (OM)	932.00	983.60	933.70	905.00
Crude protein (CP)	72.50	89.80	491.60	57.20
Ethereal Extract (EE)	30.90	38.50	17.30	13.30
Neutral detergent fiber (NDF)	552.20	142.70	153.50	7.30
Acid Detergent Fiber (FDA)	311.30	42.30	96.30	194.70
Crude Fiber (CF)	249.00	33.80	77.00	155.80
Non Nitrogen Extractive (NNE)	597.30	821.40	350.20	688.20
Total Carbohydrates (TC)	829.60	855.30	424.70	834.80
Non-fibrous Carbohydrate (NFC)	276.90	713.10	271.20	827.50
Mineral Matter (MM)	50.30	16.40	63.80	85.60
Total Digestible Nutrients (TDN)	631.20	860.30	807.20	750.00
Equivalent gallic acid mg 100 ⁻¹ g*	-	-	-	216.67

¹ corn silage, ² ground corn grain, ³ soybean meal, ⁴ dehydrated noni, *values obtained by Correia et al. (2011).

The samples of food and remains were dried at 55 °C for 72h00, and processed in a mill type Willey, using sieve 1 sieves, 0 mm, then mixed in equal amounts, separately, based on dry weight, to form samples composed of animal food and leftovers experimental period⁻¹ ration⁻¹.

The nitrogen content, with consequent estimate of crude protein (CP) and determining the mineral

matter (MM) and ether extract (EE) of the food and the remains as well as the estimate of organic matter (OM) were obtained are second methodologies described by Silva and Queiroz (2002). The estimate of the content of neutral detergent fiber (NDF) and acid detergent fiber (ADF) of the food remnants and faeces were performed according to Van Soest et al. (1991).

Table 2. Percentage and chemical composition of Noni- containing experimental diets fed to lambs.

Foods	Noni inclusion levels in experimental diets			
	0,0	0,7	1,4	2,1
Corn Silage (CS)	65.00	65.00	65.00	65.00
Corn grain (CG)	21.00	21.00	20.30	19.90
Soybean meal (SM)	14.00	13.30	13.30	13.00
Noni	0.00	0.70	1.40	2.10
Total	100.00	100.00	100.00	100.00
Bromatological composition		g kg ⁻¹		
Dry Matter (DM)	546.10	545.90	545.90	545.80
Organic Matter (OM)	943.10	926.40	926.40	926.30
Crude Protein (CP)	134.80	131.80	131.50	130.10
Ethereal Extract (EE)	30.60	30.60	20.80	20.70
Neutral detergent fiber (NDF)	410.40	409.40	408.40	407.40
Acid Detergent Fiber (ADF)	224.70	225.40	226.50	227.40
Total Carbohydrate (TC)	778.00	780.80	780.70	781.80
Non-fibrous Carbohydrate (NFC)	367.70	371.60	372.40	374.50
Total Digestible Nutrients (TDN)	704.00	703.60	702.80	702.20
Equivalent gallic acid mg 100 ⁻¹ g	0.00	1.52	3.03	4.55

The estimated total carbohydrate (TC) content of food, leftovers and feces was obtained by the equation: $TC = OM - [EE + CP]$ (SNIFFEN et al., 1992). The non-fibrous carbohydrate (NFC) content of food, leftovers and feces was estimated by the equation: $NFC = 100 - (CP + NDF + EE + MM)$ according to Sniffen et al. (1992).

The ingestive behavior of the animals was performed on the first day of each collection period. Throughout the experimental period, artificial lighting was maintained at night so that animals could adapt to the environment to collect ingestive

behavior data (GERON et al., 2018).

The sheep were subjected to visual observation to evaluate the ingestive behavior variables, and were observed every five minutes for 24h00 to determine the time spent for dry matter intake (DMI), rumination (RUM), idleness (IDL), water consumption (WC) and other activities (OAT), the latter is related to activities that do not fit in with any other described above (eg playing, scratching, mineral salt consumption, etc.). which were measured for four non-consecutive days (JOHNSON; COMBS, 1991).

The total time of each activity observed in the different periods (day and night) was obtained by summing the total number of times each sheep was in a given state following the recommendations of Souza (2007).

As for the physiological parameters, evaluate u is the respiratory frequency (RF), rectal temperature (RTH), the front body temperature (FBT), the rear body temperature (RBT) measured over three days in each period experimental at the times of 7:00 a.m. and 11h00 (morning) and 13h00 and 17h00 (afternoon), as described by (SILVA et al., 2015).

The RTH was measured with a clinical thermometer introduced into the animal's rectum for two minutes, and the RF by visual observation for 15 seconds, of how many times the animal's flank inspires and expires, and the result multiplied by four, thus obtaining the frequency min^{-1} . The FBT and RBT obtained using a digital infrared thermometer, obtaining the FBT in the palette region of the animal's thigh.

The environmental variables recorded were the ambient temperature (AmT) by means of a tacho thermometer; the dry bulb (DBT) and wet bulb (WBT) temperature by the analog dry bulb and wet

bulb thermometer, respectively; and maximum and minimum temperature, the temperature thermometer analog maximum and minimum, respectively (VERÍSSIMO et al., 2009).

The physiological data were collected during three days of each experimental period, from the second to the fourth day of each collection period. The relative humidity (%) was obtained by using the SD (saturation deficit) = $T_h - T_u$, where T_s is the dry bulb temperature unless the temperature of the bulb wet (BSCS, 1970). The wet bulb temperature and saturation deficit (ΔT) data were interpolated in the saturated vapor pressure table as a function of the temperature to obtain the relative humidity (RH) of the air (%).

Lambs fed diets containing 0.0% inclusion; 0.7%; Noni 1.4% and 2.1% were housed in metabolism cages located in an area covered by fiber cement, which presented a range of variation for air temperature (AT); dry bulb (DB) and wet bulb (WB) and relative humidity (RH) as described in Table 3. The ambient temperature values were higher in the afternoon than in the morning. Relative humidity values ranged from 43% to 56%, and a lower RH was observed for the afternoon (Table 3).

Table 3. Medium variable climate in the region Southwest d the state of Mato Grosso.

Climate Variables	Morning	Evening
AmT (°C)	26.9	32.3
DBT (°C)	28.1	33.1
WBT (°C)	21.3	24.1
RH (%)	53.0	46.0

Ambient Temperature (AmT), Dry Bulb (DBT), Wet Bulb (WBT) and Relative Humidity (RH).

Data were analyzed by analysis of variance using the System of Statistical and Genetic Analysis - SAEG (UFV, 2007). For feeding behavior data and physiological variables statistical analysis was preceded considering the subdivision of the plot, considering the periods of day and night rating for

feeding behavior and the times of the morning and the afternoon to the physiological variables. When significant, the mean subplots were compared by the test of Tukey and for Noni inclusion levels, applied equations regression, considering 5% probability.

Results and Discussion

The addition of Noni in dieting of the lambs not changed ($P>0.05$) the parameters of the behavior intake, as the time taken for dry matter intake (DMI), rumination (RUM), idleness (IDL), water consumption (WC) and other activity (OAT) for the total period of 24h00, with average values of 252; 484; 550; 13 and 141 min day⁻¹, respectively (Table 4). This small variation in the NDF and NFC levels of the experimental diets, with average values of 40.89% and 37.16%, respectively, may

have corroborated the data on the ingestive behavior of sheep fed with different Noni levels. Since the inclusion of Noni sought nutritional levels in the diet. Furthermore, the different levels Noni provided a gallic acid equivalent concentration ranging from 0 to 4.55 100 mg⁻¹ g, this fact indicated that the levels used Noni did not promote changes in the rumen environment, which could have changed the rate of passage and time of retention ration and therefore have changed the feeding behavior of sheep.

Table 4. Ingestive behavior (expressed in minutes) of lambs fed diets containing the inclusion of different Noni levels for the 24h00 period and coefficient of variation.

Activity	Levels of inclusion of Noni in experimental rations				Regression	%CV
	0,0	0,7	1,4	2,1		
DMI min. dia ⁻¹	246	256	252	253	$\hat{Y} = 252$	21.65
RUM min. dia ⁻¹	493	466	489	488	$\hat{Y} = 484$	13.21
IDL min. dia ⁻¹	560	562	556	524	$\hat{Y} = 550$	15.58
WC min. dia ⁻¹	14	12	12	14	$\hat{Y} = 13$	83.83
OAT min. dia ⁻¹	127	144	131	161	$\hat{Y} = 141$	29.34
Total min. dia ⁻¹	1.440	1.440	1.440	1.440	-	-

DMI = Feed intake, RUM = Rumination, WC: water consumption, IDL = Other Activities. Regression value equal to mean for values with $p>0.05$.

Study by Macedo et al. (2007), to evaluate the ingestive behavior of sheep receiving diets with different levels of orange pomace (0; 25; 50 and 75%) observed that the DMI presented an average undressing time of 405 min day⁻¹. However, the authors used diets with average levels of 8% CP and 68% TDN, which provided a longer time spent for feed intake.

A study to evaluate the inclusion of Noni in balanced diets for sheep submitted to *in vitro* fermentation was conducted by Geron et al. (2018). The authors indicated the pH content fermented after incubation for 24 hours showed a maximum point, and suggested that Noni could alter the environment brew will and consequently the production and

feeding behavior. However, the inclusion of up to 2.1% Noni as phytogetic additive feed for lambs provided a level of 4.55 mg equivalent gallic acid 100⁻¹ g, and this not been satisfactory and / or facilitated changes in behavior ingestive.

Time spent on DMI, RUM, IDL, WC and OAT was influenced ($P<0.05$) by day and night periods (Table 5). The effect of these activities observed over periods of ingestive behavior is correlated with the environmental variables, which corroborated the data obtained, since temperature milder next track thermal comfort were obtained at the beginning of the period morning (26.9 the C), however the end the afternoon and early evening at room temperature was 32.3 the C (Table 3).

Table 5. Ingestive behavior (expressed in minutes) of lambs fed different levels of Noni for the day and night periods.

Activity	Period	Noni inclusion levels in experimental diets				Regression	% CV
		0,0	0,7	1,4	2,1		
DMI min.	Daytime	166	180	169	178	$\hat{Y} = 173a$	32.70
	Night	66	66	77	70	$\hat{Y} = 71b$	
RUM min.	Daytime	189	179	189	192	$\hat{Y} = 187b$	23.51
	Night	304	287	301	296	$\hat{Y} = 297a$	
IDL min.	Daytime	256	234	243	249	$\hat{Y} = 246b$	51.71
	Night	304	328	313	276	$\hat{Y} = 305a$	
WC min.	Daytime	13	11	12	12	$\hat{Y} = 12a$	49.23
	Night	1	1	1	1	$\hat{Y} = 1b$	
OAT min.	Daytime	84	89	73	96	$\hat{Y} = 86a$	21.71
	Night	43	55	58	64	$\hat{Y} = 55b$	

Period (day and night) within ration; DMI = Feed Consumption, RUM = Ruminando, IDL: idleness; WC: water consumption, OAT = Other activities. Min.: minutes. Regression value equal to mean for values with $p > 0.05$. Different lowercase letters in the column differ from each other ($p < 0.05$).

The more time spent ($P < 0.05$) for the activities of DMI, WA and OAT in daytime with mean values of 173; 12 and 86 min day⁻¹, respectively in relation to the night period with 71; 1 and 55 min day⁻¹, respectively, are related to the sheep ethology itself, which present larger activities in general for the daytime and, consequently, longer time used for feed and water consumption. Another factor, which may help to understand these values, is correlated with the roaring, which occurred at 8h00 and 16h00, during the daytime, which stimulates feed intake. The higher feed intake during day time and high ambient temperature of 32.3 The C during the afternoon, were factors which contributed to the greatest WA during this period, in relation to night.

The activity DMI has May relevance during the daytime, in ovine and, consequently, the higher dry matter intake provides a greater stimulus to WC, which facilitates the swallowing of food and processes digestive and metabolic the food and nutrients (ARAÚJO et al., 2011).

Observed is the sheep fed diets containing Noni presented May time ($P < 0.05$) spent on the activity of RUM and IDL during the night period (Table 5).

These results are correlated with the gregarious habit and protection of sheep against predators, the which might m reduces the activity are physically s during the night (BERCHIELLI et al., 2006). In addition, the daytime feeding hours favored the longer time spent for RUM and IDL during the night time.

A study by Michailoff et al. (2015), to evaluate the ingestive behavior of sheep confined those in the northeastern semiarid, obtained average 300 minutes to the time taken for the IDL activity during the period day, value above that found in 246 minutes this study.

The inclusion of Noni in the sheep diet did not change ($P > 0.05$) the front body temperature (FBT), the rear body temperature (RBT), rectal temperature (RT) and respiratory frequency (RF) regardless of the time evaluated morning or afternoon (Table 6). However, it was observed that the different times evaluated morning and afternoon influenced ($P < 0.05$) these variables. Highers ($P < 0.05$) FBT and RBT were observed during the afternoon, with a mean of 35.94 and 35.87 °C, respectively, in relation to the morning time, with mean values of 32.16 and 32.48 °C respectively (Table 6).

Table 6. Physiological variables of lambs fed different levels of Noni for the morning and afternoon hours.

Variables	Schedule	Levels of inclusion of Noni in experimental rations				Regression	% CV
		0,0	0,7	1,4	2,1		
FBT (°C)	Manhã	32.07	32.23	32.09	32.25	$\hat{Y} = 32.16b$	8.50
	Tarde	36.03	36.14	35.82	35.76	$\hat{Y} = 35.94a$	
RBT (°C)	Manhã	32.66	32.72	32.49	32.03	$\hat{Y} = 32.48b$	7.69
	Tarde	35.99	35.91	36.05	35.51	$\hat{Y} = 35.87a$	
RT (°C)	Manhã	37.86	38.94	38.97	38.40	$\hat{Y} = 38.54b$	2.71
	Tarde	39.27	39.31	39.27	38.77	$\hat{Y} = 39.16a$	
RF	Manhã	28.00	30.00	28.00	28.00	$\hat{Y} = 28.50b$	29.22
	Tarde	36.00	40.00	38.00	40.00	$\hat{Y} = 38.50a$	

FBT = Front body temperature, RBT = Rear body temperature, RT: Retal temperature, RF = Respiratory frequency, Quant. per min. = amount per minute. Regression value equal to mean for values with $p > 0.05$. Different lowercase letters in the column differ from each other ($p < 0.05$).

The addition of Noni in the feeding of sheep did not affect ($P > 0.05$) RT, however this one was influenced by the morning and afternoon, with greater ($P < 0.05$) (39.16°C) for the afternoon to the morning (38.34 °C). Despite the range of variation for RT observed at the evaluated times, these values are close to normal RT and 38.5 °C to 39.5 °C for sheep (CUNNINGHAM, 2008).

The RF is higher ($P < 0.05$) in time afternoon with Medi to the 28.5 and 38.5 movements min^{-1} for morning and afternoon, respectively. This result may have been influenced by the characteristics climate of the region tropical Wonderlands, a since the room temperature showed range of variation 26.9 °C in the morning to 32, 3 °C , in the afternoon , in which they can exert direct influence on the physiological variables of the animals, especially the RF (RASLAN, 2008).

The literature points out that the ambient temperature range, which constitutes the thermal comfort zone for sheep, is from 20 °C to 27 °C. This way it was observed that at the time morning AmT 26.9 °C was the recommended. However, during the hours later, RT 32.3°C remained above that recommends, second Baêta and Souza (2010). According to Reece (2007), the normal RF for

sheep is 16 to 34 min^{-1} movements. To the extent that the environment shown stressful to the animals, the physiologic system triggers m heat dissipation mechanisms.

The inclusion of Noni as a phytogetic additive in sheep diets does not influence the ingestive behavior and does not change the physiological parameters of finishing sheep. Up to 2.1% of Noni is recommended in the diet.

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