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Urea and Tannin in multiple supplements: Ingestive behavior of grazing beef cattle

Hellen Patricia de Oliveira Araújo[1*], Nelcino Francisco de Paula[1], Hariany Ferreira Martello[1], Ronyatta Weich Teobaldo[2], Luana Barros Pereira[1], Lays Martins Mora[1], Jean Kaique Valentim[3] and Hellen Cristina Ferreira Antunes[4]

[1]Universidade Federal de Mato Grosso, Av. Fernando Corrêa da Costa, 2367, Boa Esperança, Cuiabá, Mato Grosso, Brasil. [2]Universidade Estadual Paulista "Julio de Mesquita Filho", Jaboticabal, São Paulo, Brasil. [3]Universidade Federal da Grande Dourados, Dourados, Mato Grosso do Sul, Brasil. [4]Universidade Federal de Lavras, Lavras, Minas Gerais, Brasil. *Author for correspondence. E-mail: holiveira@outlook.com

ABSTRACT. This work was carried out to evaluate the inclusion of urea and tannin in multiple supplements on ingestive behavior of cattle in pasture. The experiment was taken in the Cattle Nutrition pasture of the Experimental Farm of the Federal University of Mato Grosso, in 4 x 4 Latin square design with a factorial arrangement 2 x 2 (with and without urea and with and without tannin). Four Nellore bulls were used, with average weight of 470 kg and an average age of 20 months, randomly divided in: Supplement without urea and without tannin, Supplement without urea and with tannin, supplement with urea and without tannin, and supplement with urea and with tannin. The level of supplementation used was 1% of body weight during the dry period of the year. The experiment lasted 80 days in total, divided into four periods of 20 days each and every where, the 14 first days were intended for the adaptation of animals to the add-in and the 6 days left to collect samples. Bulls were visually observed for two days during 12 consecutive hours, morning and evening shifts recital. The variables studied were: grazing time, idle time, time of rumination, length of stay in the trough and length of stay at a watering hole.The inclusion of urea to cattle supplement in grazing reduced the grazing time and increased time spent in the trough. The addition of tannin did not influence ingestive behavior.

Keywords: natural additives; forage; supplementation; urea; tannins.

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Introduction

The forage grasses for Brazilian beef cattle herd are the main source of nutrients for the animals throughout the year (Moreira et al., 2004b; Paula et al., 2010). However, productivity and quality of these grasses undergo seasonal variation throughout the year due to meteorological conditions (Moreira, Prado, Cecato, Wada, & Mizubuti, 2004a), not allowing constant performance of the animals throughout the year, especially during the dry season , resulting in low zootechnical indexes (Gurgel, Difante, Roberto, & Dantas, 2017).

In order to overcome forage protein deficiency during the annual dry period, according Possamai et al. (2017) it requires the use of technologies that aims to strengthen beef cattle raising by intensifying meat production, developing strategies that goes from breeding termination, improving zootechnical indexes of this sector. Several methods intensify live stock production: confinement, semi-confinement and supplementation, seeking a short production cycle and better finishing of carcasses (Goes et al., 2019).

In order to intensify and toughen livestock sector, the use of alternative sources of protein in ruminant feeding hs great importance. Urea is a source of non-protein nitrogen, being an alternative mainly in the dry period of the year, and can be supplied associated with mineral salt, multiple mixtures and concentrate (Neumann et al., 2018). It is a simple technology and accessible to the producer, being a source of low cost nitrogen implantation. Resulting in reduction of weight losses of the animals in the dry period. The urea, as well as the source of ammoniacal nitrogen for the microorganisms present in the rumen, can also act as a supplementing agent controlling due to its palatability (Malafaia, Cabral, Vieira, Costa, & Carvalho, 2003). In addition to the use of alternative protein sources, the use of food additives has been one of the methods used to reduce feed costs. Rumen manipulation via substances introduced into feed, or naturally present in feeds, has offered alternatives to increase the efficiency of diets consumed by ruminants (Fugita et al., 2018; Valero et al., 2016; Valero et al., 2014).

Additives are substances added to the diet in order to intensify, preserve or even modify its properties, as long as it does not affect the nutritional value of the food. Secondary plant compounds constitute natural possibilities for modifying ruminal fermentation (Costa et al., 2017; Monteschio et al., 2017; Monteschio et al., 2019; Ornaghi et al., 2017). Several plants contain secondary compounds that protect them from fungi, bacteria, herbivores and insects attacks. Saponins and tannins present in some tropical plants may act in this process (Furtado, Carneiro, Pereira, Moreira Filho, & Silva, 2016), when supplied at high levels, these compounds may have adverse effects on the ruminal microbial population and animal health, while at low levels it presents potential to improve ruminal fermentation (Santos, 2018).

The objective of this work was to evaluate the effects of urea and tannin inclusion in multiple supplements on ingestive behavior of beef cattle during grazing during the dry period of the year.

Material and methods

The experiment took place in the Cattle Nutrition sector at the Experimental Farm of the Federal University of Mato Grosso, located in the county of Santo Antônio de Leverger-MT, between July and September 2017, during the dry season. Four non-neutered male Nellore bulls, cannulated in the rumen, with a mean age of 20 months and an initial mean body weight of 470 kg ± 8 kg were used. The animals were randomly distributed in a 4 x 4 Latin square with a 2 x 2 factorial arrangement (supplement with and without urea, supplement with and without inclusion of tannin) according to table 1.

Table 1. Supplements composition.

	Without Urea		With Urea	
Ingredients (NM base %)	Without Tannin	With Tannin	Without Tannin	With Tannin
Ground corn	68.0	68.0	80.0	80.0
Soybean meal	30.0	30.0	16.0	16.0
Ureia:AS	0	0	2.0	2.0
Nucleous	2.0	2.0	2.0	2.0
Tanino[1]	0	0.10	0	0.10
Total	100	100	100	100

Isoproteic suplement. NM: Natural matter. [1]g kg^{-1} de DM total consumed.

The experimental area for the animals was formed of Brachiaria brizantha cv. Marandu and the animals remained in individual pickets of 0.25 ha each, with drinking fountains and covered troughs to supply the supplement. The experiment had a total duration of 80 days, divided into four periods of 20 days each, where the first 14 days were destined to adapt the animals to the supplement and the remaining six days for the evaluations. The supplement was offered daily at 10:00 am in the amount of 1.0% of body weight/animal, and the tannin was a commercial blend containing 70% of tannin extract condensed and hydrolysable (Silvafeed-Bypro®, Silvateam-Inudor SA, Argentina) it was mixed at the time of delivery.

Forage sample collection was carried out at the different pickets by cutting close to the ground of two areas delimited by a 0.5 x 0.5 m metal square, chosen at the average height of the forage (20 points on each diagonal of the picket) . After collection, the samples from each were weighted and homogenized, from those evaluations it was possible to estimate the available content of forage ha^{-1} (Moraes, Paulino, Zervoudakis, Valadares Filho, & Moraes, 2005).

Evaluations of the ingestive behavior of the animals were performed in two days, on the 13th and 14th day of each experimental period for 12 consecutive hours (6:00 to 18:00 hours) during daylight. It was considered a morning shift between 6:00 and 11:59 hours, and the afternoon shift comprised between 12:00 and 18:00 hours, being therefore 24 hours of evaluation in each experimental period, totaling 96 hours throughout the experiment, according to methodology adapted by (Silva et al., 2005a). For the observations, three people took turns between shifts. The observers were at a sufficient distance from the pickets so that their presence did not interfere with any animal habits, with the aid of a binocular, making the annotations of the start and end times of the behavioral activities (Silva et al., 2005b).

The variables studied were the residence times of the animals in the following activities: grazing, rumination, leisure, feeder and drinking fountain. All the activities were recorded in spreadsheets and identified individually whenever there was an activity change. For the time of grazing, the time of forage selection by the animals was considered, including the moment of apprehension and chewing.

Rumination time was stipulated during regurgitation activities, remastigation of portions of feed that returned from the rumen to the mouth (Cabral, Bauer, Cabral, Souza, & Benez, 2011). For the leisure time, the period of inactivity of the animals was considered. The period that the animals remained in the trough for supplement consumption was counted as trough time. The time when the animals remained consuming water was recorded as drinking time. The variables studied were analyzed in a 2 x 2 factorial arrangement (supplement with and without urea and with and without tannin) using the MIXED procedure of SAS, version 9.3. Initially the daytime effect was tested, due to the absence of significant difference, this factor was disregarded. The effects of urea, tannin and urea/tannin interaction were considered as fixed effect, and animal and period as random effects.

The degrees of freedom and tests were adjusted using the Kenward-Roger option. The LSMEANS option was used to generate the individual averages for treatment effect. Effects were declared significant when $p < 0.10$.

Results and discussion

Total dry matter availability of Marandu grass was above 4 tons ha^{-1}, therefore, it was understood that there was no limitation for the animals to exercise selective grazing according to recommendations of (Euclides, Cardoso, Macedo, & Oliveira, 2000) of 2, 7 and 3.2 t ha^{-1}, respectively, for drought and water periods.

Rumination time, leisure time and the time of stay in the feeder was higher ($p < 0.10$) for supplements with urea compared to those supplements without urea. The addition of urea to the supplement reduced grazing time ($p < 0.10$; Table 2).

Table 2. Diurnal ingestion behavior of grazing cattle receiving supplementation with or without urea and tannin.

Item	Without Urea		With Urea			P Value		
	Without Tannin	With Tannin	Without Tannin	With Tannin	SEM	Urea	Tannin	U*T
Grazzing	302.50	299.87	264.75	273.56	15.13	0.042	0.833	0.707
Rumination	57.90	76.25	94.56	87.37	14.50	0.065	0.634	0.311
Leisure	291.25	284.38	319.00	338.03	18.03	0.010	0.661	0.384
Trough	28.87	33.52	40.37	42.30	6.26	0.029	0.432	0.759
Drinker	6.25	7.68	19 .62	8.20	4.37	0.139	0.269	0.170

EPM: Standard error of the mean. U * T: interaction urea vs. tannin.

There was interaction effect of urea x tannin x period ($p < 0.10$; Table 3) for leisure time and grazing time.

Table 3. P-value for main effects and interactions of ingestive behavior of beef cattle receiving supplements with or without urea and tannin.

Item	EPM	P value for main effects			Interactios			
		Urea	Tannin	Period	U*T	U*P	T*P	U*T*P
Grazzing	12.62	0.083	0.864	<.0001	0.750	0.014	0.937	0.004
Rumination	8.53	0.025	0.569	<.0001	0.214	0.980	0.030	0.774
Leisure	15.91	0.080	0.791	<.0001	0.574	0.915	0.607	0.061
Trough	4.15	0.097	0.554	<.0001	0.695	0.001	0.379	0.557
Drinker	3.23	0.142	0.288	0.8301	0.171	0.624	0.852	0.642

SEM: Standart Error of the Means. U*T: ureia x tanin. U*P: ureia x período. T*P: tanin x period. U*T*P: ureia x tanin x period.

The time in which animals remained idle was higher in the morning compared to the afternoon period for all treatments (Table 4). There was no difference ($p > 0.05$) between morning periods for the different combinations of treatments (Table 4). There was interaction ($p < 0.10$) urea x period for the dwell time in the trough, there was no effect of the treatments ($p > 0.10$) for residence time in the drinker (Table 4).

Table 4. Means of ingestive behavior of beef cattle receiving supplement with and without urea and tannin in relation to shifts.

	Morning				Afternoon			
	With urea		Without urea		With Urea		Without Urea	
Item	With tannin	Without tannin	With tannin	Without tannin	With tannin	Without tannin	With tannin	Without tannin
Grazzing	76.33	99.25	93.20	68.62	197.33	165.50	206.60	233.88
Rumination	50.89	50.75	71.18	54.75	6.21	25.50	23.88	32.62
Leisure	213.67	188.25	163.80	195.00	124.33	130.75	120.60	96.25
Trough	25.40	21.12	29.27	25.88	15.90	19.25	4.87	3.00
Drinker	3.00	10.25	5.00	3.62	5.17	9.38	2.70	2.62

Grazing time was higher in the afternoon period compared to the morning for all treatments (Figure 1). There was no difference ($p > 0.05$) for the morning and evening periods when analyzed between treatments (Figure 1).

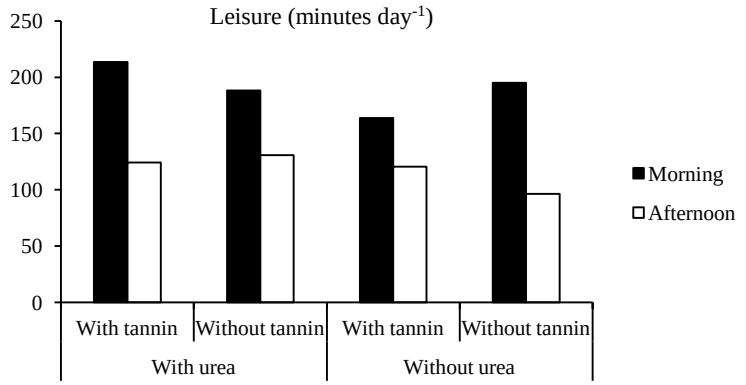

Figure 1. Leisure time of beef cattle in the morning and afternoon shifts according to experimental treatments. Capital letters compare periods within urea and tannin. Lowercase letters compare each period within urea and among tannin.

There was interaction ($p < 0.10$) tannin x period for time in rumination (Table 3). The rumination time was higher in the morning compared to evening, both in the supplements with and without tannin. There were no differences for the morning and evening periods when compared between supplements with and without tannin for rumination time (Figure 2).

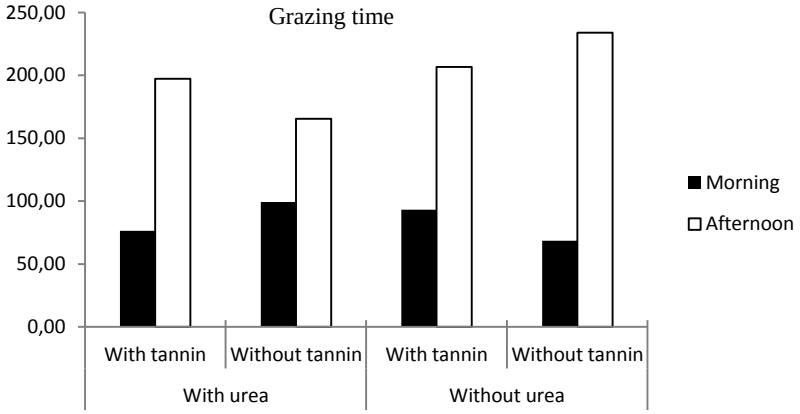

Figure 2. Grazing time of beef cattle in the morning and afternoon shifts in function of experimental treatments. Capital letters compare periods within urea and tannin. Lowercase letters compare each period within urea and among tannin.

Animals that received supplementation with urea spent more time on rumination when compared to those who did not receive urea (Figure 3).

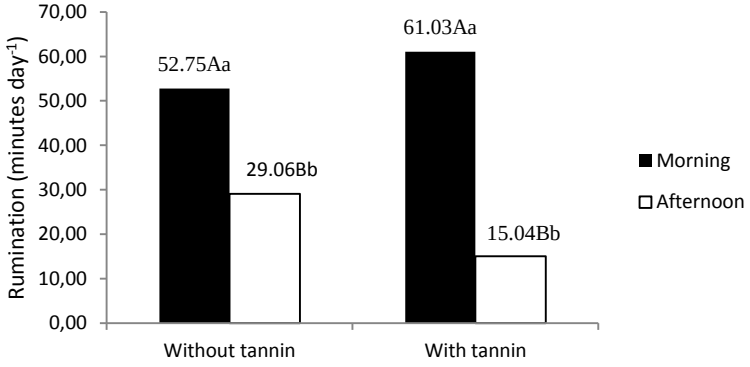

Figure 3. Ruminating time of beef cattle in the morning and afternoon shifts due to the inclusion or not of tannin. Capital letters compare the periods within urea and tannin. Lowercase letters compare each period within urea and among tannin.

Animals that received supplementation without urea remained longer in the trough in the morning. Animals that received supplementation with urea spent more time on rumination when compared to those who did not receive urea (Figure 4).

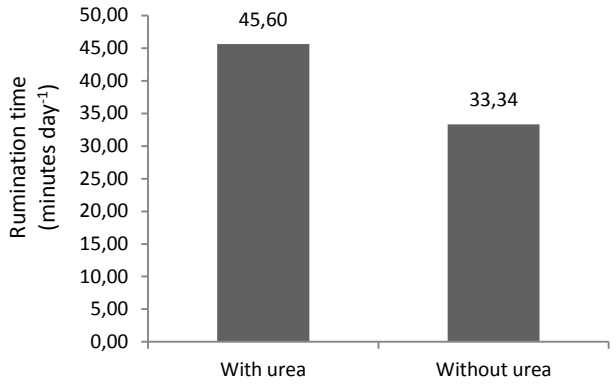

Figure 4. Ruminating time of beef cattle as a function of the inclusion or not of urea. Capital letters compare the periods within urea and tannin. Lowercase letters compare each period within urea and among tannin.

Animals that received supplementation without urea remained longer in the trough in the morning. Animals receiving urea supplementation did not show differences between morning and evening periods (Figure 5).

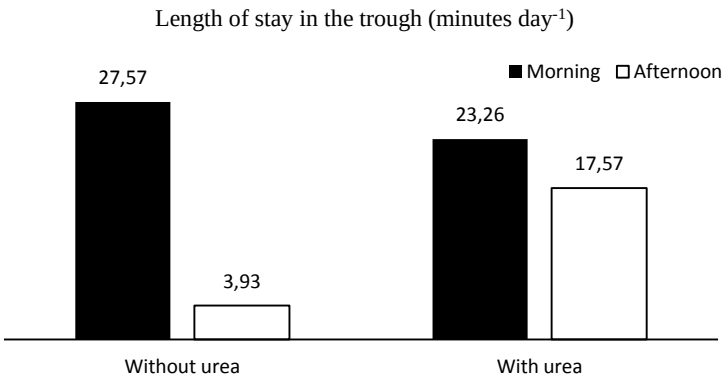

Figure 5. Length of stay in the trough of beef cattle in the morning and afternoon shifts due to the inclusion or not of urea. Capital letters compare the periods within urea and tannin. Lowercase letters compare each period within urea and among tannin.

Animals that received urea supplements remained longer in the trough than animals that did not receive urea (Figure 6).

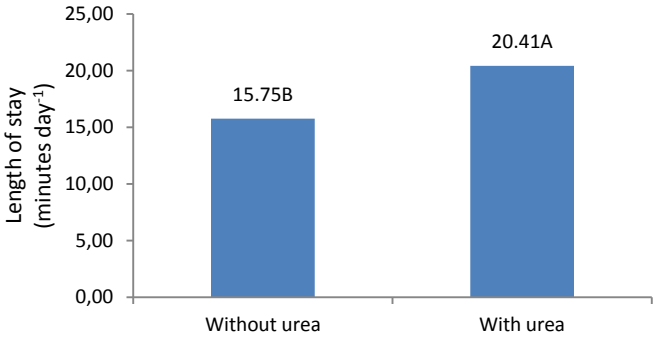

Figure 6. Length of stay in the trough of beef cattle due to the inclusion or not of urea. Capital letters compare the periods within urea and tannin. Lowercase letters compare each period within urea and among tannin.

The cattle do not perform their behavioral activities at the same time, they perform one activity at a time, in this way, when individuals spend more time performing one activity, decreases the time of others.

In this case, as the animals spent more time chewing, idling and lingering longer in the trough, they eventually reduced their grazing time.

The presence of urea caused the animals to present interruptions in concentrate consumption due to the decrease of palatability of the supplement (Silva et al., 2010) or the association made by the animals to the discomfort caused by the excess of ammonia formed. Animals receiving urea were likely to visit the trough several times a day, slowly consuming the supplement, while the animals that received the urea-free treatment consumed everything at once in the morning.

These results may have been influenced by the amount of supplements that were given to 1% animals of the BW. Supplementation levels above 0.7% CP/day generally provides a reduction in forage intake (Palma, Barra, Herling, Gomide, & Saran Netto, 2015). However, in some cases this effect is verified even at lower levels (Quadros et al., 2016).

There is greater rumination activity in the morning period, since the animals prefers to ruminate in periods that are not amid the hottest hours of the day (Damasceno, Baccari Júnior, & Targa, 1999). According to Cabral et al. (2011), rumination activity is more consistent at dawn, around 75% and the average time of daily rumination is seven to eight hours. Thus explaining the low total time of rumination in analyzes of ingestive behavior, in addition, the animals occupy a large part of the day to ingest food, which shows that they use the diurnal stage for grazing.

The animals that were treated with urea spent more time in the trough compared to the animals that did not receive this additive. Therefore, it occurs when the animals receives supplementation, the animals that did not receive urea consumes all the supplement supplied in the morning period, whereas the animals that receives urea have their consumption regulated, visiting the trough several times of the day.

Conclusion

Urea inclusion to grazing beef cattle supplements reduces grazing time and increases time in the trough. Addition of tannin does not influence ingestive behavior.

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