Original Article

INGESTIVE BEHAVIOR OF SHEEP IN *Panicum* AND *Brachiaria* PASTURES IN DRY SEASON

COMPORTAMENTO INGESTIVO DE OVINOS EM PASTOS DE Panicum *E* Brachiaria *NA ÉPOCA SECA*

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ABSTRACT: The ingestive behavior of sheep supplemented with concentrate in *Brachiaria brizantha* and *Panicum maximum* pastures were evaluated during the dry season. Twenty four male sheep of ½ Santa Inês x ½ undefined breed genotypes were used. The treatments were four feeds of cultivar grasses: *B. brizantha* cvs. Marandu and Piatã, *P. maximum* cvs. Massai and Aruana. The ingestive behavior of the animals was recorded during two periods of 24 hours. The grazing time, rumination, idleness (minutes day^{-1}), bite rate (bites minute^{-1}), and the frequency of the animals activities in relation to defecation, urination and search for water, concentrated and mineral salt were observed. There was interaction between time of the day and evaluated cultivars based on the grazing time and bite rate response. Sheep grazing on marandu-grass showed higher grazing time between 11 am to 4 pm (257 minutes), compared to animals grazing on aruana-grass (217 minutes). The bite rate was higher for sheep on massai-grass between 11 am to 4 pm (34.32 bits minute^{-1}). There was no grass effect for idleness and rumination, which can highlight the similarity of chemistry characterization and high percentage of structural components in evaluated pastures. The structural limitations and feed mass composition in the dry season caused effects on the ingestive behavior of idleness and bite rate of supplemented sheep in *Brachiaria* and *Panicum* pastures.

KEYWORDS: Bite rate. Forage crops. Grazing. Livestock. Supplementation.

INTRODUCTION

The pasture is the main food source for ruminant animals in Brazil. These production systems enable Brazilian competitiveness in the livestock sector, serving the global demand for food, in addition to allowing for raising livestock in a sustainable manner from an environmental and economic point of view. Thus, the need to maximize pasture consumption becomes the main goal to reduce production costs, as well as the fact that studies have proven that feed intake is highly correlated with weight gain (PAULINO, 2001; BARROS et al., 2004; DIFANTE et al., 2009a).

However, in order to carry out the potential benefits of this feed alternative for ruminants, it is necessary to understand the factors related to their grazing environment and the relationship between plants and animals, since different structures for canopy determine different patterns of behavior and animal performance (PEDREIRA et al., 2009).

Feed intake under grazing conditions is related to the animal's behavior described by variables such as grazing time, bite rate and bite mass (ALLDEN; MCWHITTAKER, 1970). Thus, voluntary consumption in these conditions can be influenced by the combination of factors relating to the animal, to the plant, to the environment, and management practices (SANTANA et al., 2010).

The analysis of feeding behavior of animals in grazing is an important way to know the factors that influence and/or limit their consumption. Thus, identifying how grazing conditions interfere in the feeding behavior of ruminants and their performance enables designing suitable management conditions for the animal category and the adopted production system (JOCHIMS et al., 2010).

Pasture areas cultivated in Brazil are predominantly formed by *Brachiaria* and *Panicum* genus. According to Da Silva (2004), the plants of *Brachiaria* genus show greater use and management flexibility than the plants of *Panicum* genus, therefore, the adequate monitoring of these swards based on the balance between growth processes, senescence, and animal consumption enables larger

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productive and qualitative indexes of herbage production feed and livestock. Pasture handling based on structural characteristics of plants, along with environmental factors, allows for greater efficiency in forage production (DIFANTE et al., 2009b).

Therefore, this study aimed to evaluate the ingestive behavior of sheep in *Brachiaria brizantha* and *Panicum maximum* pastures, with concentrated supplementation during the dry season.

MATERIAL AND METHODS

The experiment was performed at the Academic Unit Specialized in Agricultural Sciences (UAECA), located in the Agricultural School of Jundiaí, Macaíba Campus of Federal University of Rio Grande do Norte – UFRN, in Macaíba-RN, in the experimental area of the Study Group on Forage Crops (GEFOR) of UFRN, with geographical coordinates 5° 53' 34'' south latitude, 35° 21' 50'' west longitude, and at 50 meters of altitude.

The climate, according to the climatic classification of THORNTHWAITE (1948), is sub-humid dry with water surplus from May to August.

The experiment lasted 84 days in the dry season (October 24, 2011 to January 16, 2012), and the collection period was divided into two periods of 24 hours. The temperature data were obtained from the database of the National Institute of Meteorology - INMET, and a *Ville de Paris* stainless steel rain gauge installed on site was used for precipitation data (Figure 1).

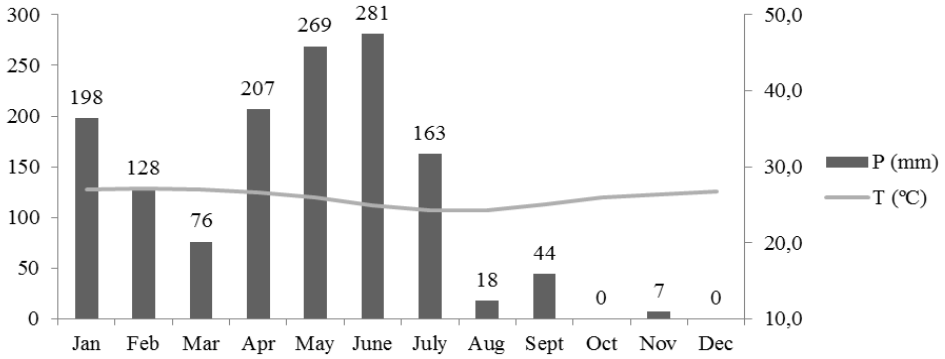

Figure 1. Precipitation (P) and temperature (T) in the experimental area in 2011.

The experimental area was composed of eight modules (six paddocks in each), planted with two cultivars of *Brachiaria brizantha* (Marandu and Piatã), and two cultivars of *Panicum maximum* (Massai and Aruana). Each cultivar corresponded to one treatment with two area repetitions. The animals had unrestricted access to drink water and mineral supplement in all modules. The used grazing method was the intermittent stocking and variable stocking rate with occupation and rest periods of 7 and 35 days, respectively.

Twenty four male sheep of ½ Santa Inês (SI) vs. ½ undefined breed (SPRD) genotypes were used with an average weight of 29.6±4.0kg, divided into eight groups of three animals. The period for pasture access was from 7 am to 4 pm. At 4 pm, the animals were brought to a collective stall, but were maintained in the same group and the same division per treatment for concentrate supply (1.5% of live weight, based on natural matter). The concentrate was made in accordance with NRC (1985) recommendations for gains of 150 g.day-1, however the quantity was adjusted weekly according to the animal's weight.

The ingestive behavior of the animals was evaluated from ongoing activities of grazing, rumination, idleness, and bite rate, obtained through visual observations every five minutes. The times were grouped into four-hour intervals in order to verify the possible environment effects. According to the methodology of Hodgson (1985), the bite rate was recorded in minutes within 20 bites, and converging to bites/minute unit. Defecation and urination were also recorded, as well as the search for water, concentrate, and mineral supplement, expressed in turn day^{-1}.

The canopy height, total herbage mass (THM) and the percentage of participation of morphological constituents were used to determine the agronomic characterization of pasture (Table 1). The height was obtained by measuring 40 random points in each paddock. The direct method was used for THM estimate, with cuts close to the ground by using a square frame of 0.25 m² in four points of the paddock. The percentage of morphological constituents was determined from the manual separation of forage samples in a leaf blade, stem (stem + leaf sheath) and dead material.

Laboratory tests for chemical composition of the samples (Table 2) were performed at the Animal Nutrition Laboratory of the Federal University of Rio Grande do Norte, determining the dry matter (DM) content, crude protein (CP), and mineral matter (MM), according to procedures described by Silva & Queiroz (2002); and neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) with techniques described by Van Soest (1965).

Table 1. Canopy height, forage mass, morphological, and chemical composition of grass cultivars and concentrate.

Characteristics	Massai	Aruana	Marandu	Piatã	Concentrate
Canopy height (cm)	35.1	27.8	32.4	28.5	-
Forage mass (kg.ha^{-1} of DM)	2898.0	1844.0	2047.0	2790.0	-
---------- Morphological composition (%) ----------					
Leaf blades	15.9	-	-	-	-
Stem	13.2	40.4	17.1	14.8	-
Dead material	70.8	59.6	82.8	81.0	-
Undesired species	-	-	-	4.2	-
---------- Chemical composition (g.kg^{-1} of DM) ----------					
Dry matter	55.3	59.7	55.0	53.3	91.7
Crude protein	2. 7	4.9	2.9	2.5	38.7
Acid detergent fiber	48.1	47.4	47.7	49.1	12.8
Neutral detergent fiber	82.1	78.5	79.6	83.2	20.5
Lignin in acid detergent	6.8	10.8	9.1	8.9	0.4
Mineral matter	5.5	6.7	6.3	5.2	5.6
Ether extract	-	-	-	-	7.2

The experimental design was random block, with treatments arranged in subplots, where cultivars were allocated in plots and the times of day in sub-plots. The data were submitted to variance analysis, significant case by F-test, and the sources of variations or interactions were compared by Tukey test, both at 5% of significance level.

RESULTS AND DISCUSSION

There was interaction between daytime and cultivars for grazing time and bite rate (Table 2). Between 7 am to 11 am, there was no difference in grazing time of animals maintained in pastures of different cultivars. Between 11 am to 4 pm, there was a higher grazing time of animals maintained in marandu-grass in relation to animals maintained in aruana-grass, with no difference among the others. This occurred because the animals maintained in marandu-grass had greater difficulty in selecting and capturing the grass, which required higher grazing time. A higher percentage of dead material on marandu-grass when compared to aruana-grass was observed (Table 1) and according to Euclides et al. (2000), there is a positive correlation between grazing time and percentage of dead material. These conditions in pasture structures for these cultivars were also observed by Emerenciano Neto et al. (2013), even during the rainy season.

Table 2. Grazing time and bite rate of sheep grazing during two periods of the day.

Cultivar	Period of the day			
	7 am to 11 am	11 am to 4 pm	7 am to 11 am	11 am to 4 pm
	Grazing time (min)		Bite rate (bites min^{-1})	
Massai	219.^{Aa*}	234^{ABa}	28. 6^{Ab}	34.3^{Aa}
Aruana	232^{Aa}	217^{Bb}	20.2^{Ba}	21.3^{Ba}
Marandu	236^{Aa}	257^{Aa}	27.7^{Aa}	19.4^{Bb}
Piatã	220^{Aa}	238^{ABa}	21.0^{Ba}	20.6^{Ba}

*Different lowercase letters in the line and uppercase letters in the column differ from each other by Tukey test at 5% of significance level.

Grazing animals use strategies that minimize the qualitative effects of the pasture. There is an increase in grazing time motivated by food restriction conditions conditioned by pasture structure (CARVALHO et al., 2007). Therefore, the animals probably have food restriction effects caused by the dead material percentage of this cultivar; this makes them spend more time in searching for more nutritious parts of the plants, resulting in an increase in grazing time.

In general, the bite rate is related to grazing time; moreover, the inherent factors of the forage canopy are also associated to this variable due to association with the animal's facility to capture the food (HODGSON, 1990). This study showed that the bite rate of animals maintained in aruana-grass and piatã-grass presented lower values in the morning graze (Table 2).

Animals maintained in massai-grass showed higher bite rate from 11 am to 4 pm (Tabela 2). However, the increase in bite rate may be provided by the pasture restriction in relation to the availability and morphological composition. The animals increase their bite rate by a higher competition in feed consumption, when there is a large concentration of grazing animals (PEDROSO et al., 2004), which is a fact not observed in this study, since grazing in massai-grass showed a higher bite rate, and the structure of this cultivar showed higher percentage of leaf blades and forage mass. Between 11 am to 4 pm, the animals grazing in aruana-grass decreased their bite rate, which leads us to associate this effect with the structural limitation of the pasture. The stem quantity of this cultivar probably provided a physical limitation to the animals at chewing and during capture.

The period in which the animals looked for concentrate was higher between 4 pm to 7 pm (60.1 minutes) for all treatments, which is explained because the period is characterized by the arrival of the animals to the stalls, when the concentrate was provided. Animals grazing on aruana-grass showed less feeding time for concentrate (45.8 minutes day^{-1}). This result may be associated with structural and chemical characteristics of this grass during the experiment. The stem and lignin percentage of this cultivar were 40.4% and 10.8% in DM, respectively (Table 1), in addition to lower forage mass. Thus, aruana-grass did not meet the animal's nutritional needs, leading them to consume the concentrate in less time. Supplementation modifies the way that sheep interact with grazing (JOCHIMS et al., 2010).

The cultivars showed no effect for rumination and idleness variables, which showed average values of 397.8 and 552.0 minutes, respectively. This result is associated with pasture canopy structure, which showed a high percentage of structural plant components. The chemical composition and the NDF percentage in DM were similar among cultivars (Table 1). As for feed, NDF value is linked to the cell wall thickness, which influences the rumination time, since the animals will spend more time performing the process of reducing food particles (VAN SOEST, 1994). This activity allows regurgitation, chewing, salivation, and the passage of the previously ingested food into the rumen (LIMA et al., 2014). While idleness time is a reflection of the other activities, the behavior is the opposite for rumination, meaning that when there is more time consumed by grazing and rumination, idleness time was reduced. According to Ribeiro et al. (2014), in situations of reduced forage quality and availability, animals have food compensatory strategies, prioritizing grazing time to maintain forage intake.

The animals maintained in marandu-grass showed higher searching for drinking water, while animals maintained in aruana-grass showed less demand for water (Table 3). The DM quantity used is related to water intake (POMPEU et al., 2009). This fact may be related to the animal's grazing time in both cultivars, since, in this study, the largest grazing time may have led to a greater feed intake, and the search for water is positively correlated with the consumption of DM (NEIVA et al., 2004).

Table 3. Specific activities (turn day^{-1}) carried out by animals during the behavioral evaluation period.

Specific activities	*Massai*	*Aruana*	*Marandu*	*Piatã*
Searching for salt	5.3^{a*}	3.1^{a}	3.2^{a}	6.0^{a}
Searching for water	3.4^{bc}	2.6^{c}	5.9^{a}	5.0^{ab}
Defecation	7.1^{a}	6.8^{ab}	9.3^{a}	4.3^{b}
Urination	7.7^{a}	3.5^{b}	6.7^{ab}	4.6^{ab}

*Values followed by different letters in the line differ from each other by Tukey test at 5% of significance level.

The number of defecations per day was lower in animals grazing piatã-grass when compared to animals grazing marandu and massai grasses. Pompeu et al. (2009) associated the higher number of defecations to the higher intake of DM and water, which led to a rapid filling of the gastrointestinal

tract, which, in turn, would have to be eliminated quickly to avoid compromising the animals' daily intake of DM.

Animals maintained in aruana-grass did not differ from the others for this variable. Animals maintained in aruana-grass showed lower frequency of urination per day than animals grazed on massai-grass. This fact is associated with the lower water intake, reducing the frequency of urination. The frequency of urination observed by the animals in aruana-grass pasture were significantly lower than the 6.9 times day^{-1} described by Vieira et al. (2011), for sheep in confinement, where the authors only verified alterations regarding the periods of the day, with higher frequency in the beginning of the morning and at the end of the afternoon.

CONCLUSIONS

The ingestive behavior of sheep supplemented in pasture is influenced by chemical and physical characteristics of the canopy in the dry season.

The structural limitations and feed mass composition in dry season caused effects on ingestive behavior variables of supplemented sheep grazing in *Brachiaria* and *Panicum* pastures.

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RESUMO: Avaliou-se o comportamento ingestivo de ovinos, suplementados com concentrado, em pastos de *Brachiaria brizantha* e *Panicum maximum* durante a época seca. Foram utilizados 24 animais, machos inteiros do genótipo ½Santa Inês x ½ sem padrão racial definido. Os tratamentos corresponderam a quatro cultivares de gramíneas forrageiras, sendo *B. brizantha* cultivares. Marandu e Piatã e *P. maximum* cultivares. Massai e Aruana. O comportamento ingestivo dos animais foi registrado durante dois períodos de 24 horas. Observou-se o tempo de pastejo, ruminação, ócio (minutos/dia), taxa de bocados (bocados/minuto) e a frequência dos animais em relação à defecação, micção e busca pela água, concentrado e suplemento mineral. Houve interação entre o período do dia e as cultivares avaliadas sobre as respostas de tempo de pastejo e taxa de bocado. Os animais sob pastejo no capim-marandu apresentaram maior tempo de pastejo no período de 11-16h (257 minutos) em relação aos animais do capim-aruana (217 minutos). A taxa de bocados foi maior para os animais do grupo do capim-massai no período 11-16h (34,32 bocados/minuto). Não houve efeito de tratamento para as variáveis de ócio e ruminação, o que pode evidenciar a semelhança da caracterização química e elevada porcentagem de constituintes estruturais nos pastos avaliados. As limitações estruturais, de composição e massa de forragem na época seca provocam efeitos sobre as variáveis de comportamento ingestivo de ovinos suplementados em pastos de *Brachiaria* e *Panicum*.

PALAVRAS-CHAVE: Bocado. Forragicultura. Pastejo. Produção animal. Suplementação.

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