# Heifers grazing pattern on natural grassland over 24 hours

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***Resumo.*** *O objetivo do presente trabalho foi avaliar a dinâmica do comportamento em pastejo de novilhas de carne manejadas em uma pastagem natural por 3 anos. Ao todo foram utilizados dados de 15 avaliações de comportamento ingestivo, realizadas visualmente e por períodos de 24 horas, cada, quando avaliou-se o comportamento dos animais. Bovinos apresentam padrões de comportamento ingestivo que se repetem nos dias, distribuindo as atividades ao longo do dia e de acordo com as condições da pastagem, em especial a quantidade de alimento, mas também de acordo com as características climáticas, como a luminosidade e a temperatura. Os animais apresentam três picos de pastejo por dia. Um no inicio da manhã, um ao final da tarde e um pastejo noturno, independentemente da estação do ano. Ao que tudo indica, o que estimula os animais a iniciarem a atividade de pastejo pela manhã é a luminosidade.*

***Palavras-chave.*** *Comportamento ingestivo, pastejo, distribuição*

***Title*** Heifers grazing pattern on natural grassland over 24 hours

***Abstract.*** *The objective of the present work was to evaluate the dynamics of heifers grazing behavior managed under rotative management in natural grassland over three years. Were used data from 15 behavior assessments, performed visually over 24 hour periods. Heifers present patterns of grazing behavior that repeat over the days, distributing they grazing activities according the sward conditions, specially the herbage mass quantity, but all so according climatic characteristics, mostly luminosity and temperature. Animals presented three intense grazing peaks over the day. One in early morning, one before darkness and one by night. It seems that what make the animals start to graze is the light in the morning.*

***Key-words.*** *Grazing behavior, grazing, distribution*

## Introduction

Grazing behavior evaluations can be an important issue when establishing management goals, because animals' behavior on pasture gives clues to judge if pasture management decisions are suitable or not (GONÇALVES et al., 2009) and whether animals are expressing their natural behavior, a good indication of animal welfare in pasture-based production systems. Furthermore, the behavior of animals in controlled situations, such as grazing trials, can give insights into the production data collected.

Among behavior variables, time spent grazing and ruminating were the main measured indicatives and key variables to use as indicator of management efficiency and welfare. For

example, ruminants commonly have grazing times between 450 to 600 min/day in temperate pastures and rarely forage less than 360 min/day up to intervals that may exceed 760 min/day under subtropical and tropical pastures (CARVALHO et al., 1999). In the Southern Brazil Campos Grasslands, without limitations to inhibit potential intake (*e.g.* sward height or herbage mass), the time spent grazing commonly range between 500 – 650 min/day (MEZZALIRA et al., 2012), regardless the grazing method used. This variation in grazing time already indicates a wide possible situations and challenges that animal can face, even in situations with abundant forage allowance, showing the complex interaction of animals with plants and sward structure. However, observed grazing times out of this "standard times" are indicative that something is wrong with animal management, which even harms welfare by forcing an unusual behavior of animals, as grazing in hot periods of the day.

In this way, understand the grazing distribution over the day length (24 hours) became important to avoid management mistakes all so the check if the animals were presenting they natural behavior, which indicates that the sward management are well done. Therefore, the main objective of this work is to describe the grazing dynamics of heifers over periods of 24 hours in the four seasons of the year.

## Material and Methods

The experimental area is located in Southern part of Brazil, Rio Grande do Sul state, with the center of the experimental area at approximately 29º43'30" S, 53º45'33" W. This area belongs to Federal University of Santa Maria (UFSM). Local climate is classified as subtropical humid, with a mean ambient annual temperature of 19.2ºC and mean annual rainfall of 1770 mm and 95m above sea level. The experimental area of 22.5 ha that was divided into six rectangular paddocks of 3.5 ha. Each of these six areas was then subdivided into 7 smaller sub-paddocks and managed with rotational grazing method.

In this area were collected 15 experimental evaluations of beef heifers grazing behavior. All assessments were performed with visual observations during 24 consecutive hours. In each year, a variable number between 24 and 36 beef heifers (at least four heifers *per* paddock) were evaluated with variable body weights (177 to 215 kg) and age (12 to 24 months). hen, those data were clustered by year, generating four evaluations in the first year (4 × 6 paddocks = 24 replicates); six evaluations over second year (6 × 6 = 36 replicates); and five evaluations in third year (5 × 6 = 30 replicates) and than separated by climatic seasons. To this analysis, year was used as block in the statistical model to remove possible climatic differences among the years. After the clustered the data, were generated 12 replicates to summer; 24 replicates to autumn; 36 replicates to winter; and 18 replicates to spring. Each replicate evaluates, at least, four heifers. All 15 grazing behavior evaluations began on the second day of occupation of the sub-paddocks,

Total grazing activity time were visually recorded, every ten minutes, over 24 consecutive hours, and results were expressed in min/day. The recording frequency was chosen based on previous data reported by MEZZALIRA et al. (2012). Grazing was defined including time spent searching, selecting and gathering (eating) forage.

The analysis of grazing time (minutes *per* hour during 24 hours) was performed using the mean values of grazing time from all replicates of the database. For this analysis, data were separated by climatic seasons and, using mean values of all replicates in each climatic

season, it was calculated the grazing time (minutes *per* hour) in each hour of the day. From this, it was compared the grazing time in each hour between climatic seasons.

Data were submitted to a Bartlett test followed by a Shapiro-Wilk test to check the variance homogeneity and normality of residuals, respectively, at P<0.05. After, data were submitted to variance analysis and F test, again at P<0.05. Means comparison analyzes were made using PROC MIXED (Tukey test at P<0.05) from SAS 9.2 software, including in the model the effects of blocks (years) and treatments (evaluation periods).

**Results and Discussion**

Grazing time distribution over 24 hours presented some similarities among seasons, mainly when comparing warm seasons (summer and spring) cooler seasons (autumn and winter) among them (Figure 1).

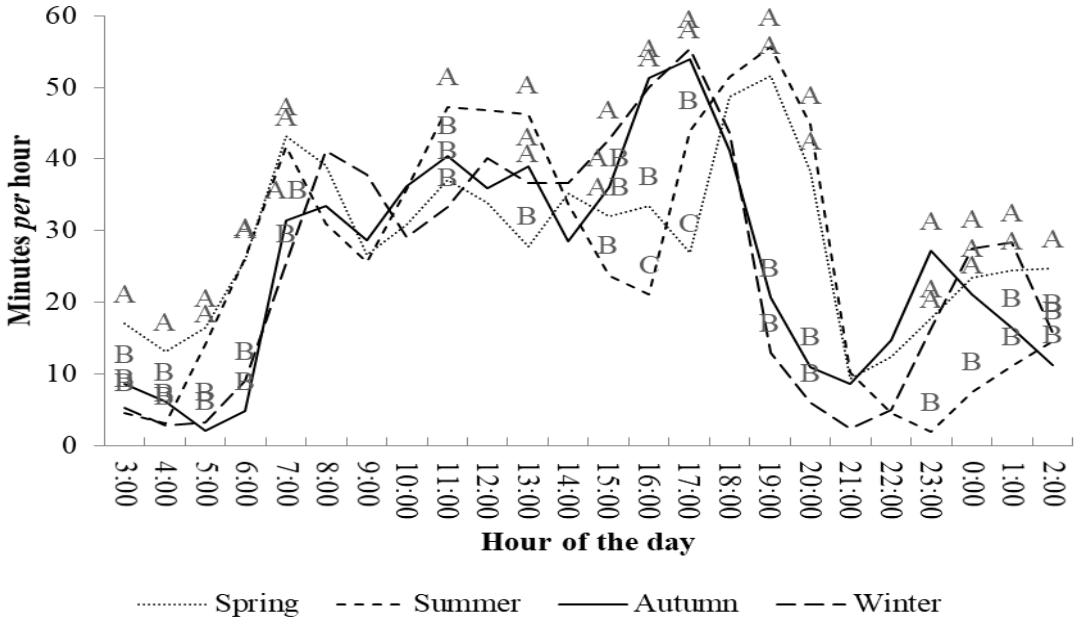


**Figure 1**. Mean foraging time (minutes per hour) of beef heifers, over 24 hours, managed in natural grassland under rotational grazing method among the four climatic seasons over the years of 2010 to 2012 (*Different capital letters in column differs among them by Tukey test at 5%)

During warm seasons, the first intense grazing cycle (or peak) occurred earlier than in cooler seasons, around 4:00 in the morning. At 5:00, grazing activity was more intense on warm seasons than during cool seasons (P<0.05). In cooler seasons, the first grazing peak started around 6:00 hours. The difference (P<0.05) on grazing intensity (time spent grazing *per* hour) between warm and cool seasons was observed until 8:00. In all seasons, after this intense activity, grazing activity was reduced until 10:00 hours.

The extent of grazing taking place at daylight in summer and spring (higher temperatures) compared to autumn and winter (lower temperatures) were not highly variable,

even though the peaks in this behavior occur during different periods of the day. In summer and spring, grazing begins earlier in the day compared to the autumn and winter seasons. In the same way, grazing peak during the morning is more intense on warm seasons than cool seasons. This fact is probably due to the larger photoperiod encouraging the animals to start foraging earlier (GREGORINI et al., 2006; 2008) and, in this way, it would reduce the need for foraging during the hottest period of the day (late-morning/early afternoon). After animal´s first meal (morning grazing peak), animals decrease the time spent grazing, probably due to the rumen filling (DEMMENT et al., 1995).

During late morning, around 11:00, a second intense peak of grazing activity occurred in the summer and it was different from other seasons ($P<0.05$). In this same part of the day (late morning and early afternoon), cool seasons and spring had a low intensity and more constant grazing distribution. Regardless the season, during late afternoon and in the beginning of the night (16:00 – 20:00 hours), a second intense grazing peak was observed. This peak in the grazing activity started earlier in the cool season when comparing to warm seasons. In winter and autumn, this intense grazing activity started around 15:00 to 16:00 hours. This grazing peak had, approximately, a duration of three hours, one hour less than the duration of the grazing peak observed during the warm season. In summer and spring, the intense foraging activity happened between 17:00 – 21:00 hours. After this grazing peak in late afternoon, grazing activity was reduced during the early evening. In cool seasons, this grazing activity reduction ranged from 19:00 - 22:00 hours. During spring, this reduction was shorter, and ranged from 21:00 to 22:00 hours and, in the summer, grazing activity was evident from 21:00 - 0:00 hours. Furthermore, in spring, autumn and winter, heifers had another short grazing peak during the night (between 23:00 to 1:00 hours). Only during summer, heifers presented a low foraging activity during the night.

Our data support, in a tropical climate situation, the affirmation that sunlight (including dawn and dusk) has a strong influence in the animal activity, even in warm environments. Besides, another important fact is that grazing events, which occur after sunset, should not be underestimated (KRYSL and HESS, 1993). Clearly, grazing activity occurs mainly during day light and the influence of day length changes the animal's foraging pattern. Moreover, the different grazing peaks, during different seasons, demonstrate the animal's ability to adapt their ingestive activity to variations in daylight, reserving most rumination and rest activities for periods of darkness in order to keep their welfare. Besides, there are other factors to determine this pattern as the difficulty of food selection in dark periods, defense mechanisms and hormonal factors (GREGORINI, 2012).

Another important fact supported by our data is related to the use of feeding supplements: in production systems, when the use of supplementary source of feeding is necessary, supplements should be offered between the grazing peaks. In our environment, this means offering it from 8:30 to 9:30 (spring-summer) and from 9:30 to 10:30 (autumn-winter). Thus, using this information it is possible to reduce herbage substitution by supplement. Furthermore, when energetic supplements are used, this management schedule allows a better use of herbage nitrogen (POPPI and MCLENNAN, 1995).

Grazing peak during earlier afternoon, during the autumn and winter compared to summer and spring, may be a consequence of the interaction of photoperiod and environmental temperatures. The first are related to the light period, when animals can

distribute better their grazing activity, avoiding the high temperature periods of the day. Secondly, animals start grazing when temperatures are milder (afternoon end). In seasons with high environmental temperatures, this grazing peak [mainly in summer (GREGORINI et al., 2006; 2008)] is slightly longer than in other seasons.

The longer duration and later start of the afternoon grazing peak, probably, influence the latter onset of grazing over the night period, during the summer. Only during the summer, animals did not present a meal during night between 22:00 to 1:00h. Grazing events over the night are also necessary for the animals to maintain their metabolic heat production (by rumen fermentation), during cool seasons. Furthermore, our data of nighttime behavior observations contradict the assumption that heifers do not forage for significant periods at night (Krysl and Hess, 1993). Therefore, if one of the experimental goals is to measure the length of foraging events and represent the natural grazing activity, it would be necessary to accurately evaluate periods of night time grazing, especially under subtropical and tropical climate conditions.

## Conclusion

Beef heifers managed in natural grassland have a diurnal pattern of grazing. However, there are significant grazing events in dark periods and there are also significant changes between seasons in the moments that animals perform these events.

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