

Researches on Rumination Behavior in Six Months of Age Calves from Romanian Black and White Breed Fed Using Different Feed Space Allowance

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Abstract

The aim of this paper was to measure the main aspects that characterize the rumination behavior in six months old calves fed using three different feed spaces allowance. During the experiments the following rumination behavior aspects were determined: number of rumination periods, the length of rumination periods and the total length of rumination periods. Results showed that calves spent ruminating, on average, only 96.4 minutes in the morning, 176 minutes in the afternoon and 262.6 minutes during the night when the length of feeding space was 0.6 m per calf. Calves spent ruminating 124.2 minutes during the morning, 173.6 minutes during the afternoon and 243.4 minutes during the night when the length of the feeding space was 0.32 m per calf. Calves spent ruminating 106.2 minutes during the morning, 134.2 minutes during the afternoon and 286.4 minutes during the night when the length of the feeding space was 0.28 m per calf. The total time spent ruminating by calves was 535 minutes when the length of feeding space was 0.6 m per calf, 541 minutes when the length of feeding space was 0.32 per calf and 527 minutes when the length of the feeding space was 0.28 per calf. There were no significant differences ($p>0.05$) for total time spent ruminating by calves between the three experimental variants.

Keywords: calves, rumination behavior, Romanian Black and White breed.

1. Introduction

The behavior of young cattle as well as the behavior of all domestic and wild animals is one of the most interesting biological processes that involve a large amount of endogenous and exogenous factors: the nervous system, sense organs and glands with internal secretion, microclimate factors, motivational factors, genetically factors, technological and social factors [1, 3, 4].

Rumination behavior is also very important especially for young ruminants. Farmers are interested in having calves that ruminates as soon as possible [2, 5].

This paper presents a study of rumination behavior in six months old calves from Romanian Black and White breed.

2. Materials and methods

Researches were carried out during the autumn season in November 2010 at the university research farm, on a number of 5 six-month old calves from Romanian Black and White breed. Calves were housed in 5.0 x 5.0 m pens bedded with straw.

The behavior of calves was video recorded continuously for 24 hours for each experiment. To record the behavior of calves a surveillance video system was used. The system consisted in 4 CCTV (CC9622BIR) cameras with a 720 x 480 video resolution connected to a PC unit which had the capacity to store images at 125 frames per

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second. The video system recorded in a digital format and had software that allowed editing the recordings. The video system permitted to record the date and hours in a mode that included minutes and seconds, which helped the timing process.

Calves were fed using three different feed spaces allowance 0.6 m per calf, 0.32 m per calf and 0.28 m per calf.

Calves were fed with 1 kg of concentrates mixture, 10 kg of corn silage and 3 kg of alfalfa hay per head per day.

For a better interpretation the recorded material was divided in three periods for every 24 hours of surveillance: 07:00 to 15:00 (morning), 15:00 to 23:00 (afternoon) and 23:00 to 07:00 (night).

In the processing of recorded data, the feeding behavior was observed for calves by counting and timing the periods.

3. Results and discussion

The length of the rumination periods increased from 26.6 minutes in the morning to 47.5 minutes in the afternoon and to 51.1 minutes during the night when the maximum feeding space allowance was provided to calves (Table 1).

The number of ruminating periods also increased starting with 3.6 in the morning to 3.8 in the afternoon and 5.8 during the night. There were significant differences ($p < 0.01$) between morning and night and between afternoon and night for the number of feeding periods.

The total time spent ruminating by calves increased from 96.4 minutes in the morning to 176 minutes in the afternoon and to 262.6 minutes during the night.

There were significant differences ($p < 0.05$) between all three day periods for the total length of rumination periods.

Calves ruminate 535 minutes per day during 12.6 rumination periods with an average length of 42.8 minutes when the maximum feeding space allowance was provided (0.6 m per calf).

The length of the ruminating periods increased from 39.5 minutes in the morning to 39.4 minutes in the afternoon and to 44.5 minutes during the night when the intermediate feeding space allowance was provided to calves (Table 2).

The number of ruminating periods increased starting with 3.2 in the morning to 4.0 in the afternoon and 5.6 during the night.

The total time spent ruminating by calves increased from 124.2 minutes in the morning to 173.6 minutes in the afternoon and to 243.4 minutes during the night.

There were significant differences ($p < 0.05$) between all three day periods for the total length of rumination periods.

Calves ruminate 541.2 minutes per day during 12.8 rumination periods with an average length of 42.6 minutes when the intermediate feeding space allowance was provided (0.32 m per calf).

The length of the rumination periods decreased from 42.1 minutes in the morning to 34.8 minutes in the afternoon and increased to 46.1 minutes during the night when the minimum feeding space allowance was provided to calves (Table 3).

The number of rumination periods increased starting with 2.6 in the morning to 3.8 in the afternoon and to 6.2 during the night.

The total time spent ruminating by calves increased from 106.2 minutes in the morning to 134.2 minutes in the afternoon and to 286.4 minutes during the night.

There were significant differences between morning and night ($p < 0.05$) and between afternoon and night ($p < 0.05$) for the total length of rumination periods.

Calves ruminate 526.8 minutes per day during 12.6 rumination periods with an average length of 41.9 minutes when the minimum feeding space allowance was provided (0.28 m per calf).

Table 4 presents the differences and their significance for the rumination behavior of calves when the three feeding space allowances were used.

There were no significant differences ($p > 0.05$) between the experimental variants for the number of rumination periods, the average length of a rumination period and the total time spent ruminating by calves in 24 hours.

Table 1. Rumination behavior of calves when the feeding space was maximal (0.6 m per calf)

Day period		07:00-15:00	15:00-23:00	23:00-07:00	In 24 hours
Rumination periods	X±SEM	3.6±0.24	3.8±0.2	5.2±0.2	12.6±0.4
	SD	0.55	0.45	0.45	0.89
	v%	15.2	11.8	8.6	7.1
	min.	3.0	3.0	5.0	12.0
	max.	4.0	4.0	6.0	14.0
Total length of rumination periods (min.)	X±SEM	96.4±12.5	176.0±10.6	262.6±19.8	535.0±38.4
	SD	28.0	23.7	44.2	85.8
	v%	29.0	13.4	16.8	16.1
	min.	55.0	150.0	220.0	466.0
	max.	130.0	211.0	337.0	678.0
Length of a rumination period (min./period)	X±SEM	26.6±2.7	47.5±5.9	51.1±4.9	42.8±3.8
	SD	6.1	13.2	10.9	8.6
	v%	23.0	27.7	21.4	20.1
	min.	18.3	37.5	36.7	33.6
	max.	32.5	70.3	67.4	56.5
Differences and their significance		I1 - I2	I1 - I3	I2 - I3	
Rumination periods		-0.2 ^{ns}	-1.6 ^{**}	-1.4 ^{**}	
Total length of rumination periods (min.)		-79.6 [*]	-166.2 [*]	-86.6 [*]	
Length of a rumination period (min./period)		-20.9 [*]	-24.5 [*]	-3.6 ^{ns}	

*-% from possible time (8 or 24 hours)

- I1 – time frame between 07:00-15:00, I2 – time frame between 15:00-23:00, I3 - time frame between 23:00-07:00

- ns = p>0.05, * = p<0.05, ** = p<0.01, *** = p<0.001

- positive values are in the advantage of the first compared segment and the negative values are in the advantage of the second segment

Table 2. Rumination behavior of calves when the feeding space was intermediate (0.32 m per calf)

Day period		07:00-15:00	15:00-23:00	23:00-07:00	In 24 hours
Rumination periods	X±SEM	3.2±0.2	4.0±0.0	5.6±0.4	12.8±0.5
	SD	0.45	0.0	0.89	1.1
	v%	14.0	0.0	16.0	8.6
	min.	3.0	4.0	4.0	11.0
	max.	4.0	4.0	6.0	14.0
Total length of rumination periods (min.)	X±SEM	124.2±3.4	173.6±10.7	243.4±4.6	541.2±9.9
	SD	7.6	24.0	10.3	22.2
	v%	6.1	13.8	4.2	4.1
	min.	117.0	144.0	233.0	508.0
	max.	136.0	207.0	258.0	567.0
Length of a rumination period (min./period)	X±SEM	39.5±2.7	43.4±2.7	44.5±3.6	42.6±2.1
	SD	6.1	6.0	8.0	4.8
	v%	15.4	13.8	18.0	11.2
	min.	29.3	36.0	38.8	38.1
	max.	45.3	51.8	58.5	51.1
Differences and their significance		I1 - I2	I1 - I3	I2 - I3	
Rumination periods		-0.8 [*]	-2.4 [*]	-1.6 [*]	
Total length of rumination periods (min.)		-49.4 [*]	-119.2 [*]	-69.8 [*]	
Length of a rumination period (min./period)		-3.9 ^{ns}	-5.0 ^{ns}	-1.1 ^{ns}	

*-% from possible time (8 or 24 hours)

- I1 – time frame between 07:00-15:00, I2 – time frame between 15:00-23:00, I3 - time frame between 23:00-07:00

- ns = p>0.05, * = p<0.05, ** = p<0.01, *** = p<0.001

- positive values are in the advantage of the first compared segment and the negative values are in the advantage of the second segment

Table 3. Rumination behavior of calves when the feeding space was minimal (0.28 m per calf)

Day period		07:00-15:00	15:00-23:00	23:00-07:00	In 24 hours
Rumination periods	X±SEM	2.6±0.2	3.8±0.2	6.2±0.2	12.6±0.2
	SD	0.55	0.45	0.45	0.55
	v%	21.1	11.8	7.2	4.4
	min.	2.0	3.0	6.0	12.0
	max.	3.0	4.0	7.0	13.0
Total length of rumination periods (min.)	X±SEM	106.2±6.7	134.2±17.6	286.4±22.5	526.8±9.1
	SD	15.3	39.4	50.4	20.2
	v%	14.4	29.3	17.6	3.8
	min.	86.0	77.0	233.0	503.0
	max.	126.0	175.0	348.0	551.0
Length of a rumination period (min./period)	X±SEM	42.1±4.4	34.8±3.4	46.1±2.9	41.9±1.3
	SD	9.9	7.7	6.5	2.9
	v%	23.5	22.1	14.0	6.8
	min.	33.7	25.7	38.8	38.7
	max.	58.0	43.8	55.2	45.1
Differences and their significance		I1 - I2	I1 - I3	I2 - I3	
Rumination periods		-1.2*	-3.6**	-2.4**	
Total length of rumination periods (min.)		-28.0 ^{ns}	-180.2*	-152.2*	
Length of a rumination period (min./period)		7.3 ^{ns}	-4.0 ^{ns}	-11.3 ^{ns}	

*-% from possible time (8 or 24 hours)

- I1 – time frame between 07:00-15:00, I2 – time frame between 15:00-23:00, I3 - time frame between 23:00-07:00

- ns = p>0.05, * = p<0.05, ** = p<0.01, *** = p<0.001

- positive values are in the advantage of the first compared segment and the negative values are in the advantage of the second segment

Table 4. Differences and their significance for rumination behavior

Day period	Specification	MFS	IFS	MinFS	Differences		
					MFS-IFS	MFS-MinFS	IFS-MinFS
I1	Rumination periods	3.6	3.2	2.6	0.4 ^{ns}	1.0*	0.6 ^{ns}
	Total length of rumination periods (min.)	96.4	124.2	106.2	-27.8 ^{ns}	-9.8 ^{ns}	18.0 ^{ns}
	Length of a rumination period (min./period)	26.6	39.5	42.1	-12.9*	-15.5*	-2.6 ^{ns}
I2	Rumination periods	3.8	4.0	3.8	-0.2 ^{ns}	0.0 ^{ns}	0.2 ^{ns}
	Total length of rumination periods (min.)	176.0	173.6	134.2	2.4 ^{ns}	41.8 ^{ns}	39.4 ^{ns}
	Length of a rumination period (min./period)	47.5	43.4	34.8	4.1 ^{ns}	12.7 ^{ns}	8.6 ^{ns}
I3	Rumination periods	5.2	5.6	6.2	-0.4 ^{ns}	-1.0*	-0.6 ^{ns}
	Total length of rumination periods (min.)	262.6	243.4	286.4	19.2 ^{ns}	-23.8 ^{ns}	-43.0 ^{ns}
	Length of a rumination period (min./period)	51.1	44.5	46.1	6.6 ^{ns}	5.0 ^{ns}	-1.6 ^{ns}
In 24 hours	Rumination periods	12.6	12.8	12.6	-0.2 ^{ns}	0.0 ^{ns}	0.2 ^{ns}
	Total length of rumination periods (min.)	535.0	541.2	526.8	-6.2 ^{ns}	8.2 ^{ns}	14.4 ^{ns}
	Length of a rumination period (min./period)	42.8	42.6	41.9	0.2 ^{ns}	0.9 ^{ns}	0.7 ^{ns}

- I1 – time frame between 07:00-15:00, I2 – time frame between 15:00-23:00, I3 - time frame between 23:00-07:00

- ns = p>0.05, * = p<0.05, ** = p<0.01, *** = p<0.001

- Positive values are in the advantage of the first compared segment and the negative values are in the advantage of the second segment

- MFS – maximum feeding space, IFS – intermediate feeding space, MinFS – minimum feeding space

4. Conclusions

Calves ruminate 535 minutes per day during 12.6 rumination periods with an average length of 42.8 minutes when the maximum feeding space allowance was provided (0.6 m per calf).

Calves ruminate 541.2 minutes per day during 12.8 rumination periods with an average length of 42.6 minutes when the intermediate feeding space allowance was provided (0.32 m per calf).

Calves ruminate 526.8 minutes per day during 12.6 rumination periods with an average length of 41.9 minutes when the minimum feeding space allowance was provided (0.28 m per calf).

There were no significant differences ($p>0.05$) between the experimental variants for the number of rumination periods, the average length of a rumination period and the total time spent ruminating by calves in 24 hours.

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