Asian-Aust. J. Anim. Sci.
Vol. 20, No. 9 : 1402 - 1406
September 2007

www.ajas.info

Feeding Behavior of Pregnant Dairy Heifers during Last Trimester under Loose Housing System

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ABSTRACT : Thirty pregnant heifers (Jersey, Holstein Friesian and Hariana) were divided into three groups (10 animals/group) according to their stage of pregnancy viz. seven-month (181-210 days) pregnancy (SMP), eight-month (211-240 days) pregnancy (EMP) and nine-month (241-280 days) pregnancy (NMP) group. Time spent in various feeding activities (eating fodder, eating concentrate, standing rumination, sitting rumination and drinking) by each animal in the three pregnant groups was recorded in four different sessions (each session of 24 h per week). The time spent eating concentrate, eating fodder, standing rumination, sitting rumination and drinking was 61.4, 271.3, 84.6, 367.6 and 10.6 min/day, respectively in the SMP group; 52.7, 289.5, 103.3, 345.8 and 9.2 min/day, respectively in the EMP group and 65.0, 277.7, 138.1, 291.0 and 9.8 min/day, respectively in the NMP group. The animals in the EMP group spent significantly ($p<0.01$) more time on eating fodder and concentrate compared to the animals in SMP and NMP groups. The pregnant heifers preferred rumination in standing posture in comparison to sitting posture. The time spent on standing rumination was significantly higher in the NMP group whereas the time spent on sitting rumination was significantly lower in this group. Except for the sitting rumination activity, all the other activities were predominant in daytime compared to night time; the diurnal variation was significant ($p<0.01$) for all the activities. (**Key Words :** Drinking, Heifer, Eating, Pregnant, Rumination, Time Budget)

INTRODUCTION

Successful self-maintenance, the basis of animal health and productivity, depends on the effective expression of maintenance and social behavior. Domestication of animal brings major changes in the time budget of maintenance behavior especially feeding behavior of animals that are now more dependent on cultivated feed and fodder than foraging. Feeding behavior of animal reared under intensive management system includes active intake of concentrate feed and fodder, rumination and drinking. The period varies according to species, utility of breed, husbandry system, quality of feed, environmental conditions, age and physical state of the animal etc. Research workers studied various aspects of feeding behavior of bovine like time spent eating (Thind and Gill, 1986; Hicks et al., 1989; Odyuo et al., 1991), time spent rumination (Dall and Gill, 1994; Odyuo et al., 1995) and time spent drinking (Hedlund and Rolls, 1977; Lainez and Hsia, 2004). Optimum feeding of pregnant heifers is essential because it influences the lifetime production of animal. Detailed knowledge about the feeding behavior of primiparous pregnant animals will help to chalk out suitable strategy for optimum feeding in these animals. But, literature related to the feeding behavior of primiparous dairy cows at late pregnancy is limited. Trnka (1980) and Rusev and Ignatov (1989) both recorded the behavior in dairy cows at different stages of pregnancy. The present study was undertaken to document the feeding behavior during late pregnancy (seventh to ninth month of pregnancy) in crossbred dairy heifers reared under loose housing system.

MATERIALS AND METHODS

The experiment was designed to see the effect of month of pregnancy on the feeding behavior of pregnant animals during last trimester. Feeding behavior (eating, rumination and drinking) was observed in 30 crossbred (Jersey, Holstein-Friesian and Hariana) heifers belonging to

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Received July 21, 2005; Accepted February 6, 2006

Table 1. Time budget (min/24 h) of feeding behavior in heifers during last trimester of pregnancy under loose housing system

Month of pregnancy	Eating		Rumination		Drinking mean±S.E.
	Concentrate mean±SE	Fodder mean±SE	Standing mean±SE	Sitting/lying mean±SE	
Seventh (SMP)	61.4±2.7^{A}	271.3±6.8^{A}	84.6±6.6^{A}	367.6±12.7^{A}	10.6±0.8
Eighth (EMP)	52.7±2.4^{B}	289.5±8.2^{B}	103.3±7.3^{A}	345.8±11.6^{A}	9.2±0.9
Ninth (NMP)	65.0±2.7^{A}	277.7±8.2^{B}	138.1±10.2^{B}	291.0±1.9^{B}	9.8±0.7
Overall	60.0±1.6	279.3±4.5	109.9±5.1	332.9±7.8	9.9±0.4

Values with different superscripts for each effect in a column differ significantly at 1% level ($p<0.01$).

different months of pregnancy (7 to 9 months of pregnancy). The animals were selected randomly from the Institute's Dairy Farm. The experimental animals were kept under loose housing system where each animal was provided 8 m^2 covered area and 16 m^2 opened area. The experimental site was at an altitude of 170 m above sea level at 28°22'N latitude and 79°24'E longitude. The relative humidity ranges from 20 to 70% at 0600 h and 35 to 85% at 1900 h. Maximum and minimum temperature during the experimental period varied from 25 to 45°C and 15 to 35°C, respectively. The experimental animals were offered green fodder (maize, oat, barseem) *ad lib.* along with concentrate mixture. The concentrate mixture was offered at 0900 h and green fodders at 1100, 1400 and 1600 h. Green fodders and water were always available to the animals throughout the 24 h period.

As estrous synchronization was not followed in the institute farm, the selected heifers were conceived at different months and that made difficulty in constituting a group of 10 animals having same month of pregnancy. However, the difficulty was tackled by constituting one experimental batch of 10 animals with different month of pregnancy (seventh, eighth or ninth month); three such experimental batches were constituted from the thirty selected pregnant heifers. Thereafter, for statistical analysis of the data, the experimental animals were divided into three pregnant groups (10 animals per group) according to the stage of pregnancy viz. Seven-Month Pregnancy (SMP), Eight-Month Pregnancy (EMP) and Nine-Month Pregnancy (NMP). The experimental period prolonged to four months (March to June)

The behavioral activities of 10 pregnant heifers under an experimental batch were noted continuously in one session of 24 h. Total 12 sessions of behavioral observation were carried out for the three experimental batches (4 sessions per batch) in a manner that each animal of the three experimental batches was studied once in a week in the respective month of pregnancy. Each session started at 0601 h and continued until 0600 h of the next day. Four observers worked at a shift and each was allotted randomly two or three animals at a time. The observation was taken from a point 4-5 m away from the animals without disturbing them. Observers were relieved from the job after 6 h. To minimize inter-observers error, all the observers in rotation noted the behaviour of each animal. To facilitate the data recording in night, the entire paddock was illuminated with fluorescent tube light, which might not influence the behaviour of experimental animals as they are accustomed to the similar light at the Institute's farm. The animals were also marked with glossy paint for easy recognition by the observer. Two days trial period was given to the observers to get familiar with the experimental procedures. Instantaneous point sample (Tyler, 1979) of ongoing activities of each pregnant heifers was recorded every 60 sec for 24 consecutive hours. Eating time was considered as the time when the animals were actively engaged in the ingestion (prehension and swallowing) of concentrate as well as green fodder. Rumination time was defined as the time spent by an animal either in standing or sitting posture when observed chewing cud. Drinking time was described as the time spent for drinking water. Information on eating, rumination and drinking behaviour were quantified in terms of activity time (min/day). As the activity times of behaviour were not normally distributed, the data were subjected to log transformation before analysis (Jensen et al., 1998). To see the effect of diurnal variation and month of pregnancy, analysis of variance with Duncun Multiple Range Test was performed as per standard statistical procedure (Snedecor and Cochran, 1967).

RESULTS

Time spent eating concentrate and fodder by the pregnant heifers during last trimester of pregnancy is presented in Table 1. The overall time spent eating concentrate was 60.0 min/day; it was significantly shorter ($p<0.01$) in the eight-month pregnancy (EMP) group (52.7 min/day) compared to the seven-month pregnancy (SMP) group (61.4 min/day) and nine-month pregnancy (NMP) group (65.0 min/day). The time spent eating fodder was 271.3, 289.5 and 277.7 min/day in the SMP, EMP and NMP group, respectively. Diurnal variation of eating concentrate

Table 2. Diurnal variation (min/12 h) of feeding behavior in heifers during last trimester of pregnancy under loose housing system

Month of pregnancy	Eating		Rumination		Drinking mean±SE
	Concentrate mean±SE	Fodder mean±SE	Standing mean±SE	Sitting/lying mean±SE	
Seventh (EMP)					
Day	61.4±2.7	165.7±5.8^{A}	51.7±5.5^{a}	107.3±6.8^{A}	7.9±0.7^{A}
Night	-	105.5±5.5^{B}	32.9±2.9^{b}	260.3±10.4^{B}	3.3±0.5^{B}
Eighth (EMP)					
Day	52.7±2.4	197.2±5.9^{A}	59.5±5.0^{a}	82.7±.1^{A}	7.5±0.9^{A}
Night	-	92.3±6.6^{B}	43.8±4.3^{b}	263.1±8.8^{B}	1.7±0.2^{B}
Ninth (NMP)					
Day	65.0±2.7	181.2±6.1^{A}	73.6±5.6	60.3±5.6^{A}	7.7±0.6^{A}
Night	-	96.5±7.3^{B}	64.4±7.7	230.7±10.4^{B}	2.1±0.3^{B}

Values with different superscripts for each effect in a column differ significantly (capital letters significant at 1% level ($p<0.01$) and small letters at 5% level ($p<0.05$)).

and fodder in heifers during last trimester of pregnancy has been shown in Table 2. Time spent eating fodder by the heifers at day time (0601 h to 1800 h) and night time (1801 h to 0600 h) was 165.74 and 105.52 min, respectively in the SMP group; 197.20 and 92.26 min, respectively in the EMP group and 181.15 and 96.53 min, respectively in the NMP group. Time spent fodder eating differed significantly ($p<0.01$) between the day time and night time in all the pregnant groups. Diurnal variation for eating concentrate could not be studied because animals were offered concentrate feed only at day time.

Time spent standing rumination and sitting rumination was 84.6 and 367.6 min, respectively in the SMP group; 103.3 and 345.8 min, respectively in the EMP group and 138.1 and 291.0 min, respectively in the NMP group (Table 1). Time spent rumination in both standing and sitting posture were significantly ($p<0.01$) higher in the NMP group compared to the SMP and EMP group. The diurnal variation of both the time spent standing and sitting rumination during last trimester of pregnancy has been presented in Table 2. The SMP, EMP and NMP groups spent 51.7, 59.5 and 73.6 min/12 h, respectively on standing rumination at the day time; the corresponding values at the night time were 32.87, 43.76 and 64.43 min/12 h, respectively. Time spent sitting rumination during the daytime at seventh, eighth and ninth month of pregnancy were recorded as 107.28, 82.68 and 60.32 min, respectively. The respective values during the night time were 260.33, 263.13 and 230.65 min. The diurnal variation in the time spent rumination was significant in both standing ($p<0.05$) and sitting ($p<0.01$) posture.

Heifers in the SMP, EMP and NMP group spent 10.6, 9.2 and 9.8 min/day, respectively on drinking water (Table 1). The time spent drinking at the day time and night time was 7.9 and 3.3 min, respectively in the SMP group; 7.5 and 1.7 min, respectively in the EMP group and 7.7 and 2.1 min, respectively in the NMP group (Table 2). The difference between time spent drinking at the day time and night time was found significant ($p<0.01$) in the three pregnant groups.

DISCUSSION

The total time spent eating green fodder and concentrate varied in between 23.10 to 23.79% of 24 h. The time spent eating increased slightly with the advancement of pregnancy from 7th to 8th month. Increased fodder might help the pregnant animal to fulfill the extra nutrient requirement for her normal body growth and maintenance and also for rapid growing fetus. The reference is limited in the literature on the time spent eating by pregnant heifers. Rusev and Ignatov (1989) observed in Black Pied pregnant cows that they spent 300 min/day in eating. The present study showed that month of pregnancy influenced both the time spent eating concentrate and green fodder by the crossbred heifers. Although the experimental animals were offered equal amount of concentrate per day in the last three months of pregnancy, but the time spent concentrate eating was significantly ($p<0.01$) less in the EMP group compared to the SMP and NMP group, implying that heifers in the EMP group consumed concentrate at faster rate than the other groups. The EMP group also spent more time on eating fodder than the other two groups. The discomfort that the animals generally experience due to enlarged abdomen in the nine-month of pregnancy could be the reason for sluggish intake of concentrate and green fodder by the NMP group.

Significant diurnal variation in the time spent eating fodder was observed in the present study. The animal spent more time eating fodder at the day time compared to the night time at the seventh (23.02 vs. 14.66% of 12 h), eighth (27.39 vs. 12.80% of 12 h) and ninth (25.16 vs. 13.41% of 12 h) month of pregnancy. Schake and Riggs (1969) reported the eating time of Hereford cows during day and night time as 173.2 and 28.8 min, respectively; the difference was significant. Similar finding in buffalo was also reported by Odyou et al. (1991). The daily pattern of

fodder eating was almost similar in the three pregnant groups. Two major peaks of eating were observed in between 1100 to 1300 h and 1600 to 1800 h; three minor peaks were in between 0500 to 0600 h, 1400 to 1500 h and 2300 to 2500 h. Eating activity was at low ebb during 0300 to 0500 h and 1900 to 2200 h. Chase et al. (1976) found that in early hours eating activity in Holstein steers was relatively low but increased between 0600 and 0800 h; thereafter it fluctuated with two major peaks at 1400 and 1900 h. Odyuo et al. (1991) observed that major period of eating in Murrah buffaloes occurred between 0400 and 0500 h, 0900 and 1000 h, 1300 and 1600 h and 1800 and 2000 h.

The total time spent rumination (in both standing and sitting posture) remained more or less same (450 min/day) in the SMP and EMP group but it declined significantly in the NMP group (429 min/day) which could be the sign of uneasiness/exhaustion that pregnant animals generally experience in the last month of pregnancy. This is supported by the findings that the pregnant heifers preferred rumination in standing posture in compare to sitting posture; time spent standing rumination increased from 84.6 min/day in the SMP group to 138.1 min/day in the NMP group. Whereas, time spent sitting rumination declined from 367.6 min/day in the SMP group to 291.0 min/day in the NMP group. The reference in the literature is limited to compare the present study. Trnka (1980) reported that the advanced pregnant cows spent 239.80 min/day for rumination.

The time spent standing rumination during day time was always higher compared to night time in all the pregnant groups whereas it was reverse for the time spent sitting rumination, which was found higher at night time. The total time spent rumination (in both standing and sitting posture) was always higher at night time than at day time. Schake and Riggs (1969) in lactating beef cows, Hedlund and Rolls (1977) in Holstein cows and Odyuo et al. (1995) in lactating buffaloes recorded that the animals spent more time rumination at night time compared to day time. Standing rumination periods at day time were intense between 0600-0700 h, 0800-0900 h and 1600-1700 h whereas at night time it was in between 0200-0300 h, 0500-0600 h, 1900-2000 h and 2300-2400 h. Hedlund and Rolls (1977) noted that maximum rumination occurred at 1000-1600 h and rumination was noted to cease during and about 2 h after feeding.

The pregnant heifers spent about 10 min/day on drinking water. Most of the total drinking episodes took place during day time. The results reported by Odyuo et al. (1995) also support the present findings. In the present study, peak drinking time was noted at 1100-1200 h, moderate at 0900-1100 and 1200-1800 h and lowest at 0400-0600 and 0700-0800 h. Fraser (1980) reported that cattle usually drank in the pre-noon, early afternoon and evening but rarely at night or dawn.

CONCLUSION

Month of pregnancy influenced both the time spent eating concentrate and green fodder in pregnant heifers. The time spent concentrate eating was significantly ($p<0.01$) less in the eight-month pregnant (EMP) group compared to the seven-month pregnant (SMP) and nine-month pregnant (NMP) group. The EMP group also spent more time on eating fodder than the other two groups. The total time spent rumination (in both standing and sitting posture) was remained more or less same (450 min/day) in the SMP and EMP group but it declined significantly in the NMP group (429 min/day) which could be the result of uneasiness/ exhaustion that pregnant animals generally experience in the last month of pregnancy. The pregnant animals preferred eating at the day time while rumination was predominant activity at the night time. The pregnant heifers spent about 10 min/day on drinking water. Most of the total drinking episodes took place during the day time.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. O. S. Tomer, Ex-Director, Indian Veterinary Research Institute, Izatnagar and Dr. H.N. Pandey, In-Charge, Livestock Production Research (Cattle& Buffalo), Indian Veterinary Research Institute for providing valuable suggestions and necessary facilities for conducting the study.

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