Eliminative and Reposing Behavior of Dairy Cows in the Stanchion Stall Barn

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(Received June 2, 1989)

Abstract In order to obtain detailed information on eliminative and lying behavior, observations on nine Holstein cows housed in total confinement in stanchion stalls were made. Behaviors observed included defecation, urination, and lying, and the records were collected by visual observations for 24 consecutive hours on each of the 3 occasions. Average values of the behavioral observations were summarized as follows: frequency of defecations and urinations were 9.0 ± 2.5 and 4.3 ± 2.2 times with ranges of 5.3 to 12.0 and of 2.3 to 8.0, respectively. The times required for elimination by defecation and by urination were 7.6 ± 2.6 and 11.7 ± 5.5 min, with ranges of 6.1 to 10.5 and 7.7 to 19.8 min, respectively. The frequency of periods lying down, total duration of lying, and duration per lying were 11.8 ± 6.5 (range 2 to 21), 625.6 ± 166.4 min, (range 398 to 807) and 53.5 ± 51.5 min, (range 24.3 to 212.3), respectively. The average intervals between defecations, between urinations and between lyings were 160.8 ± 99.6 min, 335.2 ± 245.3 min, and 69.6 ± 12.1 min, respectively. Significant differences were found between the day-time (8:00-20:00) and the night-time (20:00-8:00) in all recorded behavioral data except the time required for defecation and the interval between defecations.

Jpn. J. Zootech. Sci., 61 (3) : 249-254, 1990

About half of the management time spent for dairy cows in the barns is for the milking routine. Therefore, milking efficiency holds the key to the rationalization of management. Cleanliness of the udder contributes greatly in reducing the length of time for milking chores because the time required to wash the udder before milking is determined by the degree of udder contamination. In fact, it has been reported that the design of the stall structure, including gutter structure, affects the time spent for udder preparation¹⁾.

To rationalize dairy herd management so

that it ensures that the cow keeps the udder clean requires detailed information on the eliminative and lying behavior of dairy cattle. This paper deals with eliminative behavior, including defecation and urination and with lying behavior of dairy cattle housed in stanchion stalls.

Materials and Methods

Nine Holstein cows in dry stage were housed in stanchion stalls, each with a floor length of 1,600 mm. The cows averaged 8.8 years of age and 601 kg of weight. All cows were fed twice

each day (concentrate of 2 kg, timothy grass hay of 2 kg, potato of 2 kg, and green maize of 17 kg per head per meal). Water was provided *ad libitum* by water cups. Records of defecation, urination, and lying were collected by visual observation. The nine cows were observed for 24 consecutive hr, on each of the 3 occasions during September and August of 1988 resulting in a total of 27 animal-observations. The mean values of data were compared by the *t*-test for significant differences between data of the day-time (8:00-20:00) and the night-time (20:00-8:00).

Results and Discussion

1. Frequency of elimination

The cows averaged 9.0 ± 2.5 defecations, with a range of 5.3 to 12.0 times, and 4.3 ± 2.2 urinations, with a range of 2.3 to 8.0 times, and the average intervals between defecations and between urinations were 160.8 ± 99.6 min, and 335.2 ± 245.3 min, respectively (Table 1).

There had been several reports on frequency of cow elimination. Defecation of 13.6 times per day was recorded by MITSUMATA *et al.*²⁾, using three Holstein milking cows, and 13.9 times by SUZUKI *et al.*³⁾, using 16 Holstein milking cows, both under housing conditions. On the other hand, the number of 8.13 defeca-

tions was found by GRAY *et al.*⁴⁾ under grazing condition with Charolais cows.

It is apparent that feeding conditions influence the frequency of defecation; our values, however, were between those of the two different conditions. Differences between ours (housed) and the former two (housed) may be due to whether the cattle used were dry cows or milking cows which might influence the amount of feed intake and the state of feed, mainly moisture content. SUZUKI *et al.*³⁾ observed defecation of 5.1 times when cows received only concentrate mixture and hay during their dry period, but defecation of 11.3 times was recorded when they were fed on green grass during their lactation period. In our observations, cows averaged 9.0 defecations of which 5.2 (58%) were during the day-time and 3.8 (42%) were during the night-time, respectively, and the difference was statistically significant ($P < 0.01$).

The average interval between defecations was 160.8 ± 99.6 min, and there was no significant difference between the day-time interval and the night-time interval.

The values of $2.3^{2)}$, 5.1 (with a range of 2-10⁵⁾, 6.4 (with a range of 2-20³⁾, and $6.2^{4)}$ of urination have been reported.

In our data, the average frequency of urina-

Table 1. Average values of eliminative behavior

		Frequency (No.)	Time required (sec)	Interval (min)
Defecation	Average	9.0 ± 2.5	7.6 ± 2.6	160.8 ± 99.6
	Range	5.3~12.0	6.1~10.5	104.0~381.8
	Day-time	5.2 ± 1.6	7.5 ± 2.7	145.4 ± 96.0
	Night-time	3.8 ± 1.5	7.7 ± 2.4	181.9 ± 100.6
	Difference between day-time and night-time	1.4**	-0.2	-36.5
Urination	Average	4.3 ± 2.2	11.7 ± 5.5	335.2 ± 245.3
	Range	2.3~8.0	7.7~19.8	127.6~900.5
	Day-time	2.9 ± 1.8	9.8 ± 3.8	276.7 ± 218.1
	Night-time	1.4 ± 0.8	15.5 ± 6.4	450.6 ± 257.7
	Difference between day-time and night-time	1.5**	-5.7***	-173.9*

*** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$

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tion was 4.3, of which 2.9 times (67%) occurred during the day-time and 1.4 times (33%) occurred during the night time, respectively, and the difference was again statistically significant ($P < 0.01$).

The average interval between urinations was 335.2 ± 245.3 min, and the difference between the day-time and the night-time was also statistically significant ($P < 0.05$).

Fig. 1 and 2 show the hourly distribution of defecation and urination, respectively, during

24 hr.. It is likely that defecation had no special influence on the pattern of behavior, however, the most intense periods of urination occurred immediately after the AM and PM feeding times. And low frequencies of both defecation and urination were recorded between 3:00 and 5:00 in the morning. It was clear that cows have significantly less defecation and urination during the night-time than during the day-time, and the interval between urinations during the night-time was longer than that during the day-time.

2. Time required to eliminate

Times required for defecation and urination also appear in Table 1. The average times required for defecation and urination were 7.6 ± 2.6 sec, and 11.7 ± 5.5 sec., with ranges of 6.1 to 10.5 sec, and of 7.7 to 19.8 sec, respectively. There was no special tendency according to time of day of defecation, but cows seemed to spend relatively longer times for urination during the period from mid-night to early morning (Fig. 3 and 4). This may be related to the fact that frequency of urination was relatively low, compared with defecation, during the same hour period.

The average time of 15.5 sec, for the night-time was significantly ($P < 0.001$) longer than that of 9.8 sec, for the day-time.

3. Lying behavior

Fig. 1. Hourly distribution of number of defecations (Average of 27 cows)

Fig. 2. Hourly distribution of number of urinations (Average of 27 cows)

Fig. 3. Hourly distribution of time (sec) spent on defecation (Average of 27 cows)

Table 2. Average values of lying behavior

	Frequency of periods (No.)	Total time per 24h (min)	Duration per period (min)	Interval (min)
Average	11.8 ± 6.5	625.6 ± 166.4	53.5 ± 51.5	69.6 ± 12.1
Range	2.0~20.7	398.0~806.7	24.3~212.3	14.2~507.7
Day time	4.4 ± 3.2	154.6 ± 93.3	35.4 ± 34.1	106.2 ± 126.8
Night time	7.3 ± 3.8	471.1 ± 123.3	64.2 ± 57.0	46.0 ± 128.4
Difference between day-time and night-time	-2.9***	-316.5***	-28.8***	60.2***

***P<0.001

Fig. 4. Hourly distribution of time (sec) spent on urination (Average of 27 cows)

Table 2 shows that the average frequency of periods of lying, total time of lying per 24 hr, and average duration of lying were 11.8 ± 6.5 times (range 2 to 21), 625.6 ± 166.4 min, (398.0 to 806.7) and 53.5 ± 51.5 min, (24.3 to 212.3), respectively.

There was an apparent disproportion between the data of the day-time and of the night-time: cows were usually recumbent a shorter duration of 2.57 hr, (21.7%) during the day-time, while they rested a longer duration of 7.85 hr, (65.4%) during the night-time. The same disproportion was found in frequencies of lying: out of an average number of 11.8 periods of lying during 24 hr, about 38% was recorded during the day-time, and 62% occurred during the night-time. Average durations per lying also were disproportionate: 35.4 ± 34.1 min, was recorded during the day-time; on the other hand 64.2 ± 57.0 min, during the

Fig. 5. Hourly distribution of number of lying (Average of 27 cows)

night-time.

The average interval between lyings was 69.6 ± 12.1 min, (range 14.2 to 507.7 min), and the same disproportion was found: 106.2 min, for the day-time and 46.0 min, for the night-time.

All the above differences between the day-time and the night-time were statistically significant ($P < 0.001$).

HEDLUND *et al.*⁶⁾ reported that stanchion-stalled cows lay an average of 10.3 hr/24 hr day (range 4.8 to 15.0 hr). Several other reports indicated that cows spent 8.7 hr, (range 9 to 13 hr) lying in pasture⁴⁾, but 11 to 11.5 hr in loose or free stall housing^{7,8)}. HEDLUND *et al.*⁹⁾ also found that during the day-time cows averaged about nine periods of recumbency and an equal number of rest periods at

Fig. 6. Hourly distribution of time (min) spent on lying (Average of 27 cows)

night to give an average total of 18 to 20 rest periods per 24 hr, day, and that the cows were recumbent an average of 5.5 of 9 hr, of darkness and 6.6 of 15 hr, of light. Our data, however, showed that the average frequency of periods and total duration of lying during the day-time (12 hr) was less than that during the night-time (12 hr.), i.e., 4.4 ± 3.2 vs 7.3 ± 3.8 times, and 21.7% vs 65.4% of each 12 hr. And as shown in Fig. 5 and 6 frequent lying and standing actions of cows were recorded during 19:00 and 6:00, and periods of lying were relatively longer during the same hours.

It is assumed that the cow's udder is more easily soiled during night-time because the longer time of recumbency and more frequent lying are obvious from our results. It is expected that our findings give farmers, advisers and engineers useful information to

rationalize dairy herd, management to ensure keeping the udder cleaner.

Acknowledgment

The assistance of the staffmembers of the farm, The Agricultural and Forestry Research Center, University of Tsukuba is gratefully acknowledged.

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スタンション式牛舎の乳牛の排せつならびに横臥行動

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乳牛の乳房を出来るだけ汚さない合理的な乳牛の管理法を確立するために, 9頭の非搾乳牛を用いて, 舎飼時の排せつおよび横臥行動を調べた。観察は24時間にわたって行ない, これを3回繰り返し実施した。のべ27頭の測定値の平均と範囲は以下のとおりであった。排糞および排尿回数(範囲)は, 1日当たりそれぞれ 9.0 ± 2.5 回(5.3~12.0)および 4.3 ± 2.2 回(2.2~8.0)で, 両者とも夜間は昼間より回数が有意に少なかった。また, 1回当たりに要した時間は, それぞれ 7.6 ± 2.6 秒(6.1~10.5)および 11.8 ± 5.5 秒(7.7~19.8)で, 排尿は排糞より明らかに所要時間が長かった。また, 夜間は昼間より有意に長い傾向が認められた。一方, 1日当たりの横臥回数およびのべ横臥時間は 11.8 ± 6.5 回(2~21)および 625.6 ± 166.4 分(398.0~806.7)であった。また, 横臥1回当たりの時間は 53.5 ± 51.5 分(24.3~212.3)であった。横臥は, 回数, 延べ時間および1回当たりの時間ともに夜間は昼間よりその値が有意に大きく, また横臥と横臥との間隔は平均 69.6 ± 12.1 分で, 昼間のそれは夜間より有意に長かった。これらのことが朝夕の搾乳時の乳房の汚れ程度に大きく関与しているものと思われた。

日畜会報, 61 (3) : 249-254, 1990