BEHAVIORAL PATTERNS OF FEEDLOT STEERS

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Story in Brief

Ninety three crossbred yearling steers were observed at 30-minute intervals for 24 hours on day 40 of a 138 day feeding trial to examine the diurnal patterns and individual differences in eating, ruminating and lying times. These steers spent 6.6, 15.5 and 54.4% of their time eating, ruminating, and lying, respectively. Peak eating times occurred at 0650 (47.3% of steers eating) and 1700 (36.8% eating) which corresponds to times of addition of fresh feed with another small peak at 2100 (17.9% eating). Ruminating and lying peaks during the day occurred at times inverse to eating. Individual animals with highest eating times had highest rumination and lying times. Steers which spent more time eating or ruminating tended to gain more rapidly. Daily gains increased by .02 lb/day for each 1% increase in lying time. Results of this trial suggest that the frequencies of eating, ruminating and lying are correlated with animal performance.

(Key Words: Feedlot Cattle, Behavior Pattern, Diurnal Patterns.)

Introduction

The pattern of feeding behavior by cattle is highly repeatable. A review by Hancock (1953) reported that grazing peaks occur at dawn and dusk with the majority of grazing occurring during the day. Diurnal activity patterns of feedlot cattle also have been reported in several studies. Stricklin (1987) in a review of feeding patterns of feedlot cattle in Saskatchewan, Canada (Gonyou and Stricklin, 1981 and 1984) reported that cattle exhibited three periods of eating activity during a 24-hour day. Major peaks occurred during the morning and afternoon which were associated closely with time of sunrise and sunset. A third period occurred in the middle of the night. Stricklin suggested that cattle divide their day into three 8-hour periods of eating. Ray and Roubicek (1971) reported on the diurnal behavior of feedlot steers in an Arizona feedlot during winter and summer and noted that in both seasons

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eating activity was greatest immediately following sunrise and prior to sunset. Similar eating patterns were noted in Iowa feedlot trials (Hoffman and Self, 1973), Maryland studies (Putnam and Davis, 1963; Putnam et al., 1967 and 1968) and Oklahoma feedlot trials (Arp et al., 1983; Doran, 1985). The objective of this study was to examine the diurnal behavior of feedlot steers and to determine if time spent eating, ruminating and lying down were correlated with performance of individual animals.

Materials and Methods

Ninety six crossbred (primarily British crosses) yearling steers which had been wintered on wheat pasture near Dalhart, Texas were trucked to Goodwell, Oklahoma on June 3, 1987. On arrival, all cattle were individually weighed, ear tagged, implanted with Synovex-S, and injected with ivermectin and a BRSV vaccine. These steers were predominantly Herefords (78 head) of small to medium frame size. The steers were divided into twelve pens of eight head each and four feed treatments were assigned randomly to the pens. Steers were fed a cracked corn high concentrate ration twice daily (approximately 0700 and 1600) for the 138-day trial. The ration was 80% cracked corn, 11% chopped alfalfa, 3.9% cane molasses and 5.1% pelleted supplement.

On days 40 and 41 of the trial (July 13 and 14), the behavior of each steer was noted and recorded at 30-minute intervals for 24 hours (2000 to 1950 hours, 48 observations per steer) to monitor the amount of time each animal spent eating, standing, lying, standing and ruminating, or lying and ruminating. Ambient temperature peaked at 78°F, on July 14 which is low for July. A thunderstorm occurred at 1550 hour (day 41) which altered normal behavioral patterns. These data were used to examine the diurnal patterns of eating, ruminating and lying. Because eating and ruminating behavior may alter performance (Owens and Ferrell, 1983), performance measurements were regressed against the frequency of eating, ruminating, and lying to examine these relationships.

Results and Discussion

The eating time pattern for these steers is illustrated in Figure 1. Between 2200 and 0600, less than 3.2% of the steers were eating. Eating peaked from 0650 to 0750 with 47.3% of the steers eating at 0650, and again from 1650 to 1700 with 36.8% eating at 1700. These peak eating times coincided with the feeding times (0700 and 1600); the presence of fresh feed

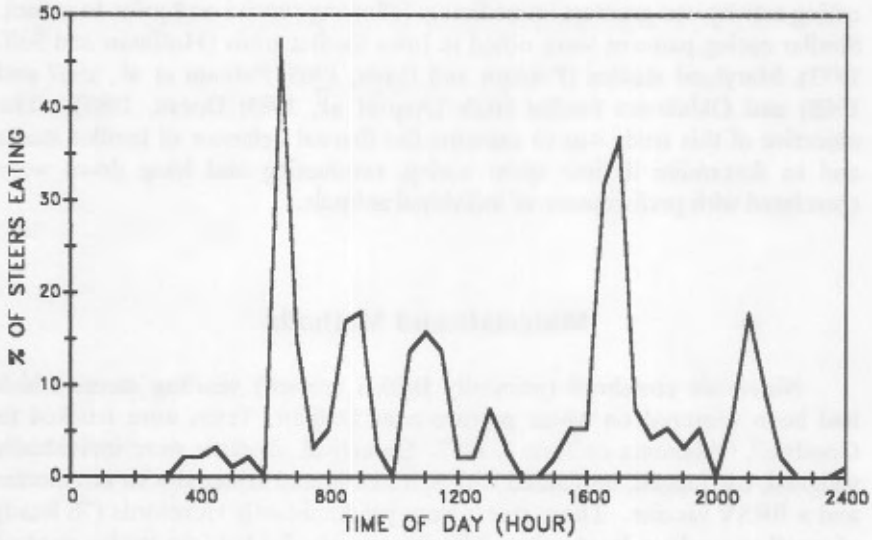

Figure 1. Eating pattern of feedlot steers.

stimulated eating. Gonyou and Stricklin (1981) also observed that peak eating times coincided with feeding times. In the period of time between feedings, the percentage of steers eating oscillated between 0 and 17.9%. Another peak in eating occurred at 2100 (sunset) with 17.9% of the steers eating. Similar diurnal eating behavior has been reported by several workers previously (Putnam and Davis, 1963; Putnam et al., 1967, 1968; Ray and Roubicek, 1971; Hoffman and Self, 1973; Arp et al., 1983; Doran, 1985; Stricklin, 1987).

Ruminating incidence (Figure 2) tended to be the inverse of eating. Between 2200 to 0600, 13.7 to 33.7% of the steers were ruminating. Lowest rumination incidence times occurred at 0650 (3.2%), 1700 (0%) and 2150 (2.1%) which correspond with the peak eating times. Doran (1985) noted similar ruminating patterns in feedlot steers.

Lying time (Figure 3) also varied inversely to eating time as was previously noted by Doran (1985). From 2250 to 0600, 56.8 to 100% of the steers were lying down. During the day (0750 to 1500) 31.6 to 88.4% of the steers were lying down which may reflect the warm temperature. From 1550 to 1800, most of the steers were standing; this corresponds to feeding time and occurrence of the thunderstorm. The steers generally were more active during the hours of 1550 to 2150 as temperature decreased.

Correlations between time spent eating, ruminating and lying and steer performance are presented in Table 1. Behavior of the steers grouped by

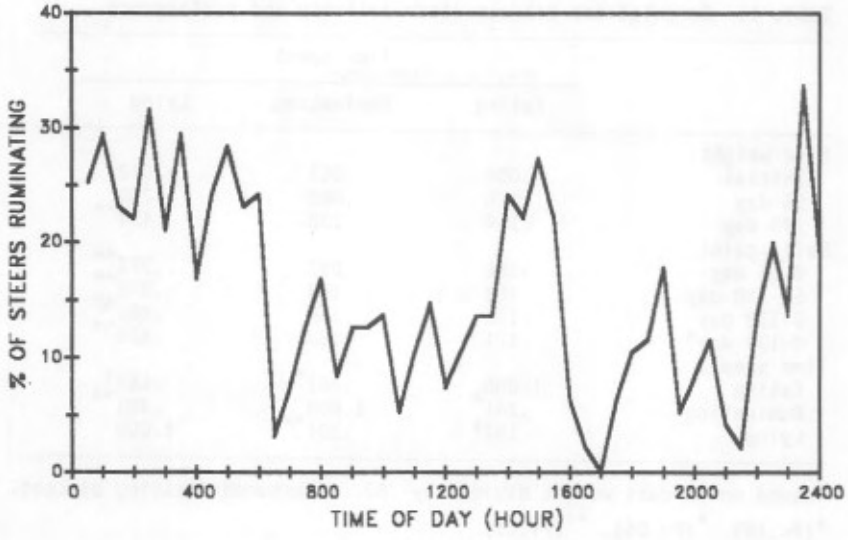

Figure 2. Ruminating pattern of feedlot steers.

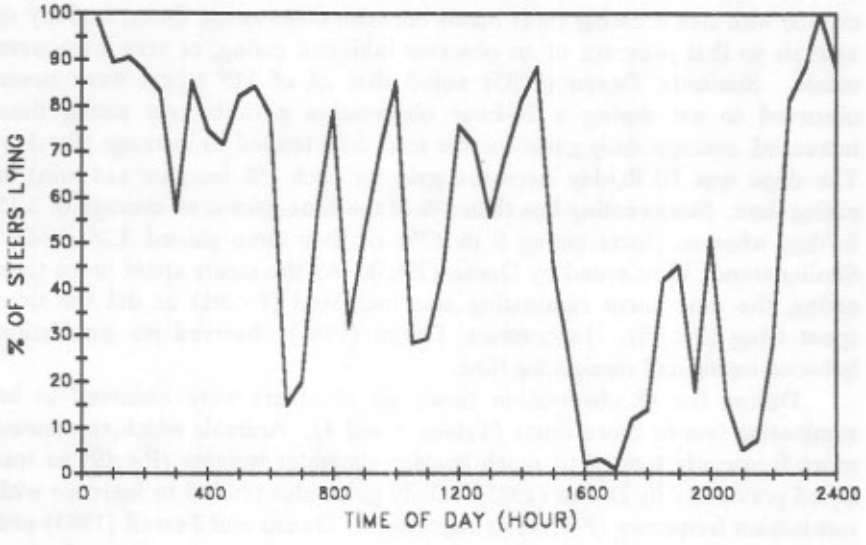

Figure 3. Lying pattern of feedlot steers.

Table 1. Correlations between steer activity and performance.

	Time spent		
	Eating	Ruminating	Lying
Live weight:			
Initial	.004	-.013	-.012
56 day	.126	.068	.290**
138 day	.154	.138	.434**
Daily gain:			
0-56 day	.156	.097	.377**
57-138 day	.102	.153	.376**
0-138 day	.166	.158	.481**
0-139 day[a]	.171	.168	.419**
Time spent:			
Eating	1.000	.261*	.187+
Ruminating	.261*	1.000	.301**
Lying	.187+	.301**	1.000

[a]Based on carcass weight divided by .62, an assumed dressing percent.
+(P<.10), *(P<.05), **(P<.01)

fraction of time spent eating is presented in Table 2. During the 24-hour observation, 82% of the steers spent between 2 and 10% of their time eating. Seven of the steers (7.5%) were never observed to eat; this may be due to chance with steers eating short meals between observation times, timidity of animals so that presence of an observer inhibited eating, or very infrequent meals. Similarly, Doran (1985) noted that 24 of 118 steers were never observed to eat during a 24-hour observation period. As eating time increased, average daily gains for the total trial tended to increase (P<.11). The slope was .02 lb/day increased gain for each 1% increase (14 min) in eating time. Steers eating less than 8% of the time gained an average of 3.15 lb/day, whereas steers eating 8 to 17% of their time gained 3.28 lb/day. Similar trends were noted by Doran (1985). As the steers spent more time eating, the time spent ruminating also increased (P<.01) as did the time spent lying (P<.08). In contrast, Doran (1985) observed no correlation between eating and ruminating time.

During the 48 observation times, all 93 steers were observed to be ruminating two or more times (Tables 3 and 4). Animals which ruminated more frequently tended to reach heavier slaughter weights (P<.19) as was noted previously by Doran (1985). Daily gains also tended to increase with rumination frequency (P<.11) as reported by Owens and Ferrell (1983) and Doran (1985). In this trial, daily gains appeared to plateau once rumination exceeded 17% of the time. As steers spent more time ruminating, time spent lying also increased (P<.003).

Table 2. Performance of steers versus percentage of time spent eating.

Item	Percentage of time spent eating									Linear slope	Prob.
	0	2	3	6	8	10	13	15	17		
No. of steers	7	14	11	17	22	12	7	2	1		
Live wt, lb:											
Initial	647	638	640	649	656	638	638	625	671	0	.970
56 day	818	821	825	840	845	854	816	803	878	1.5	.228
138 day	1041	1034	1045	1082	1076	1087	1027	1065	1098	2.6	.140
Daily gain, lb:											
0-56 day	2.46	2.66	2.71	2.84	2.77	3.26	2.60	2.60	3.08	.026	.136
57-138 day	2.60	2.51	2.55	2.82	2.68	2.73	2.46	3.08	2.57	.011	.328
0-138 day	2.55	2.57	2.62	2.84	2.73	2.95	2.53	2.88	2.77	.017	.112
0-139 day[a]	3.06	3.04	3.10	3.30	3.23	3.50	2.95	3.32	3.52	.022	.101
Time spent, %:											
Ruminating	13.4	12.4	16.3	14.2	17.6	16.0	19.3	17.7	20.8	.461	.012
Lying	47.6	49.4	59.5	54.0	55.5	58.5	52.7	55.2	52.1	.470	.073

[a]Based on carcass weight divided by .62, an assumed dressing percent.

Table 3. Performance of steers versus percentage of time spent ruminating (Part 1).

Item	Percentage of time spent ruminating										
	4	6	8	10	13	15	17	19	21	23	25
No. of steers	4	2	10	13	11	10	12	7	9	2	6
Live wt, lb:											
Initial	625	671	658	651	623	651	638	638	656	671	667
56 day	794	843	840	836	818	851	845	794	851	880	840
138 day	1012	1023	1060	1060	1067	1065	1074	1008	1089	1098	1074
Daily gain, lb:											
0-56 day	2.49	2.44	2.64	2.71	2.90	2.95	3.10	2.20	2.88	3.12	2.51
57-138 day	2.53	2.11	2.60	2.62	2.93	2.51	2.68	2.51	2.77	2.53	2.75
0-138 day	2.51	2.24	2.62	2.66	2.93	2.68	2.86	2.38	2.82	2.77	2.64
0-139 day[a]	2.99	2.75	3.08	3.12	3.32	3.30	3.37	2.79	3.34	3.43	3.08
Time spent, %:											
Eating	5.2	1.0	5.6	6.4	5.3	7.5	7.6	6.5	9.0	2.1	6.9
Lying	46.4	52.1	50.2	54.0	52.8	53.5	56.2	53.9	55.6	57.3	57.3

[a]Based on carcass weight divided by.62, an assumed dressing percent.

Table 4. Performance of steers versus percentage of time spent ruminating (Part 2).

Item	Percentage of time spent ruminating				Linear slope	Prob.
	27	29	33	38		
No. of steers	4	3	1	1		
Live wt, lb:						
Initial	636	620	678	583	0	.902
56 day	834	832	849	805	.4	.519
138 day	1074	1076	1091	1056	1.3	.186
Daily gain, lb:						
0-56 day	2.93	3.17	2.44	3.41	.011	3.55
57-138 day	2.82	2.84	2.84	2.93	.011	.144
0-138 day	2.86	2.97	2.68	3.12	.011	.130
0-139 day[a]	3.26	3.48	3.30	3.78	.011	.108
Time spent, %:						
Eating	9.4	7.6	8.3	12.5	.148	.012
Lying	58.3	63.9	60.4	62.5	.431	.003

[a]Based on carcass weight divided by .62, an assumed dressing percent.

Table 5. Performance of steers versus percentage of time spent lying (Part 1).

Item	Percentage of time spent lying										
	19	21	25	33	38	42	44	46	48	50	52
No. of steers	1	1	1	2	1	4	1	4	7	3	8
Live wt, lb:											
Initial	620	636	581	660	697	636	618	662	656	623	660
56 day	724	777	708	849	832	821	779	836	838	796	847
138 day	920	1012	849	1049	1034	1025	986	1045	1063	1034	1060
Daily gain, lb:											
0-56 day	1.34	1.96	1.76	2.77	1.78	2.71	2.31	2.53	2.66	2.53	2.75
57-138 day	2.29	2.77	1.65	2.31	2.40	2.40	2.42	2.42	2.64	2.75	2.51
0-138 day	1.91	2.44	1.69	2.51	2.13	2.53	2.38	2.46	2.64	2.66	2.60
0-139 day[a]	2.46	2.97	2.11	3.10	2.51	3.01	2.97	2.97	3.08	3.08	3.08
Time spent, %:											
Eating	2.1	0.0	6.3	1.0	6.3	8.9	2.1	6.8	6.5	8.3	7.6
Ruminating	4.2	12.5	10.4	9.4	8.3	13.5	14.6	16.7	11.9	14.6	18.8

[a]Based on carcass weight divided by .62, an assumed dressing percent.

Table 6. Performance of steers versus percentage of time spent lying (Part 2).

Item	Performance of time spent lying								Linear slope	Prob.
	54	56	58	60	63	65	67	77		
No. of steers	6	14	13	8	5	11	2	1		
Live wt, lb:										
Initial	631	660	642	656	605	638	649	645	0	.907
56 day	818	836	847	851	838	845	854	801	1.5	.005
138 day	1034	1065	1085	1067	1096	1102	1080	1049	2.9	.0001
Daily gain, lb:										
0-56 day	2.75	2.55	3.04	2.90	3.56	3.10	3.04	2.22	.026	.0002
57-138 day	2.53	2.66	2.77	2.51	2.99	3.04	2.66	2.90	.018	.0002
0-138 day	2.62	2.64	2.88	2.66	3.23	3.06	2.82	2.64	.022	.0001
0-139 day[a]	3.12	3.08	3.39	3.21	3.85	3.52	3.37	2.90	.020	.0001
Time spent, %:										
Eating	7.6	6.5	5.8	6.3	8.8	7.6	8.3	4.2	.074	.073
Ruminating	12.2	15.9	14.7	18.2	22.1	19.1	13.5	10.4	.211	.003

[a]Based on carcass weight divided by .62, an assumed dressing percent.

Over 83% of the steers spent more than 46% of their time lying down (Tables 5 and 6). Time spent lying was positively correlated with live weight at 56 and 138 days ($P<.01$). Daily gains for the first half of the trial, last half of the trial and total trial all increased as time spent lying increased ($P<.001$). Similarly, the NRC (1981) reported that mud, rain or storms (conditions causing lack of suitable bedding area) decrease feed intake by cattle which in turn should decrease performance. Those steers spending less than 57% of their time lying (53 head) gained 3.04 lb/day while those spending greater than 57% of the time lying (40 head) gained 3.43 lb/day. Doran (1985) reported that gains tended to increase as lying time increased up to 71% of the time ($P<.10$).

In summary, these feedlot steers exhibited diurnal behavior as has been noted by other workers. Results also suggest that the frequencies of eating, ruminating and lying were correlated with animal performance, but the mechanisms of the relationships remain to be defined. As frequency of eating, ruminating and lying increased, daily gains also increased. Presumably, increased feed intake would increase all of these factors whereas timidity or nervousness should decrease all three. Altering roughage level or source would be expected to alter eating and rumination time. If greater eating and ruminating times increase both particle size reduction and salivary flow to buffer the rumen and increase ruminal outflow, increases in rumination and eating times may improve efficiency of feed utilization and reduce acidosis. No information on efficiency of feed use of individual animals was available from this study. Selection for rapid eating, as practiced with dairy cattle, would reduce chewing time and potentially decrease digestibility of poorly processed grains. This could explain why shelled corn diets are often poorly utilized by Holstein steers. Whether feed supply, roughage level, feeding frequency or feed additives alter patterns or total time spent feeding and ruminating time needs study. No effect of limit feeding on these measurements was apparent here though Doran (1985) suggested that supplemental potassium tended to increase rumination time.

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