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Pregnant Sow Behavior When Housed in Groups and Singly[1]

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Pregnant sow housing varies considerably from area to area in Australia. Thus, group housing amounts to less than 10% in Queensland, but probably exceeds 50% in Victoria. Confinement of pregnant sows in individual stalls is the most common alternative to group housing, but sows on some farms are separated from each other by tethers. When group housing is replaced by individual stalls or tethers, piggery managers ofter cite "bullying" of subordinate sows by dominant ones, especially during feeding, as a major problem leading to the change. Nevertheless, animal welfare proponents object to physical isolation of pregnant sows. McBride proposes that sows deprived of ability to control recurring aversive events in their environment may suffer from "learned helplessness" and are therefore less able to cope. Close confinement of sows in relatively barren surroundings, whether in individual or group housing, may increase the risk of "learned helplessness" and associated symptoms of stress.

We made preliminary observations of pregnant sow behavior when kept in groups and on tethers. This report deals with social interactions and effects of social status on feeding behavior and other general activities of grouped sows, and with the amount of time spent in various activities for both tethered and grouped animals. In addition, an experimental pen containing novel features was evaluated in terms of sow behavior and weight gains.

Grouped Sows in a Commercial Piggery

Two groups of 4 randomly selected sows were observed when they were one-month pregnant. One group was observed immediately after being assembled ("New" group), but the other group had been together from the beginning of pregnancy ("Stable" group).

Pens were approximately 8 ft wide and 9 ft deep with the front 40% in concrete and the rear 60% in hard-wood slat flooring. A recessed trough extended along the front of the pens and a low level of water flowed slowly in the trough. Feed was distributed in the trough and some was deliberately scattered on the adjacent solid floor. A single nipple-type waterer was at the center of the rear side of each pen.

Agonistic and Feeding Behavior

Observations of video tapes for the periods before, during, and following ingestion of feed revealed the following pattern. As a feed cart is pushed through the house, sows become active, in anticipation of being fed. They crowd into the feeding area and mill about with heads thrown high and with rapid back-and-forth movements of the head and forequarters. Much loud squealing is present and noise levels above 125 decibels (damaging to the human ear) have been recorded in other studies. Social status appears to be ignored as sows' attention is directed to the forthcoming feeding. The same situation prevails

[1] Studies conducted with Glen McBride at the University of Queensland, Brisbane, Australia (January-June, 1982).

during the period of rapid ingestion when feed is well distributed. Direct observations indicated that the bulk of the feed was consumed rapidly and without notable agonistic activity. The morning feed ration (4/5ths of the total daily feed) was eaten in 5 to 10 min, and the noon ration in 1 to 2 min.

As feed becomes scarce, social status effects become evident. Subordinate sows are subjected to aggression as more dominant ones move about searching for remaining particles. Trough and floor nosing continues for periods of 30 to 60 min or longer after all feed appears to have been eaten. Most aggressive and submissive acts occur during the hour-long periods following feed delivery. Subsequently, sows are likely to lie down for several hours, with only occasional and brief bouts of activity. Individual differences in persistence of nosing the trough and floor were evident. Subordinate sows usually come to the front of the pen (to the feeding area) as dominant ones lie down and lose interest. Further aggression is likely if subordinates disturb the resting, dominant animals.

Total frequencies of agonistic acts are shown in Table 1 for the 2 hour-long periods after feeding. It was expected that agonistic activity would decrease as the newly formed group "settled in" to established dominance relationships. No such trend is evident from the results. In similar fashion no clear difference was seen between the "new" and "stable" groups. When morning and afternoon postfeeding periods were combined, total interactions were found to be 61, 68 and 58 for the first 3 days of the newly assembled group and 77 for one day's observation of the stable group.

Table 1. Total frequencies of agonistic acts for 2 one-hour periods after feeding

		Agonistic acts						
Group	Day	Fight	Head thrust	Bite	Threat	Displace-ment	Avoid-ance	Total
New	1st	5	7	1	10	18	20	61
	2nd	0	12	4	7	16	29	68
	3rd	1	8	11	12	13	13	58
Stable	---	0	9	12	4	39	13	77

Although total agonistic activity did not change much over the first few days for the newly assembled group, the number of fights did. Total fights observed daily were 6, 2 and 1 for days 1, 2 and 3, respectively. Subordinate sows showed more avoidance of dominant sows in the new group, whereas displacements of subordinate sows in the feeding area were more common for the stable group.

The social order for the newly assembled group developed rapidly. During the first half day (the group was established at noon), those animals that ultimately achieved dominance over particular subordinates were seen to behave aggressively towards them 63 times, while only 9 violations of the ultimate dominance order occurred (12.5% violations). By the morning of the third day,

comparable figures were 77 and 5 (6% violations). The so-called stable group had 63 aggressive acts from dominant sows to their subordinates and 3 dominance-order violations (5%).

Figure 1 portrays the social system which existed, as indicated by agonistic acts, during the 2 half-day periods described above for the new pen and during a single full-day observation of the stable group. The stable group included a "pecking triangle" in which each of the animals designated as X, Y and Z was dominant to one of the others and submissive to the second. In the newly assembled group, a linear hierarchy was present with descending status in the order F, T, C and R.

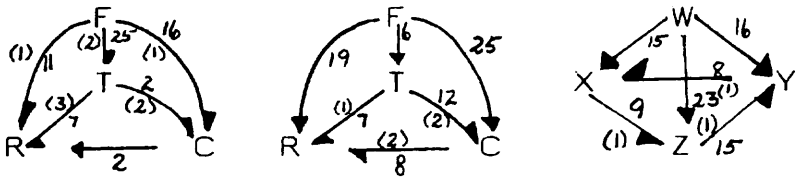

Fig. 1. Aggressive acts among group members and dominance relationships. Full-headed arrows point from dominant to subordinate sows where no dominance-order violations were seen. Half-headed arrows also indicate direction of dominance, but in these pairs violations were seen with frequencies indicated by numbers in parentheses. Total aggressive acts by dominant sows to each subordinate are indicated by numbers adjacent to arrows.

Table 2. Daytime activities of pregnant sows kept in groups

Sow	Social status	Time Spent (%) Head in trough + nosing floor	Standing, walking + active	Sitting	Lying
			New Group		
F	Highest	29.3%	5.0%	0%	65.7%
T	2nd	21.6	13.0	0	65.4
C	3rd	35.4	21.2	0.3	43.2
R	Lowest	16.5	10.8	0	72.7
Av		25.7%	12.5%	0.1%	61.8%
			Stable Group		
W	Highest	19.6%	8.1%	0.6%	71.6%
X	Equal	7.3	5.5	0.4	86.8
Y	Within	14.4	8.7	0.7	76.2
Z	X,Y & Z	33.3	6.1	0.1	60.5
Av		18.7%	7.1%	0.5%	73.8%

Daytime Activities

Daytime activities were recorded for both groups from time-lapse video tapes which were available for most daylight hours between 6AM and 6PM. The results presented in Table 2 fail to show any apparent association of within-group social status with total time spent in feeding and apparent searching for food (head in trough and nosing floor), in standing, walking and other miscellaneous activities, in sitting, or in lying down.

The newly assembled group as a whole was more active than the stable group. They were seen to be lying about 62% of the time as compared to 74% for the stable group. These observations suggest that new groups require more than a few days to adjust to their new surroundings and to settle into the daily routine of group living.

Experimental Pen

An experimental pen, designed by Glen McBride, was constructed in the Psychology Department at the University of Queensland and placed in the Veterinary Science piggery at Pinjarra Hills, Brisbane. The general plan of the pen is shown in Figure 2. Pen modifications were made from time to time, but it had the features shown for most of the 6-week period during which a group of 6 sows were studied. Approximately 13 sq ft (1.2 sq m) of area was available per sow, but that included feed trough space. Partitions separating feeders and one separating the dunging area from the remaining area decreased mobility of the sows. Significant features of the pen, for this report, consisted of the feeders, dividers between feed troughs, and push-bar mechanisms by which sows obtained their feed.

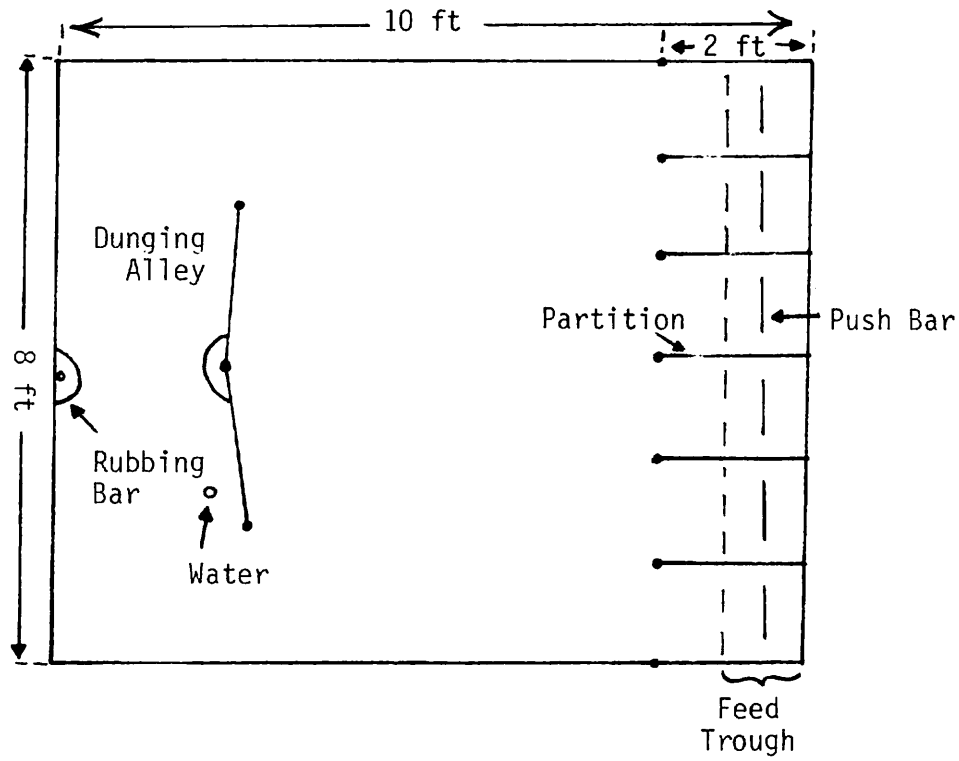

Fig. 2. Bird's-eye view of experimental pen constructed at University of Queensland (Australia).

Feed hoppers were constructed so that feed funneled into a vertical hole in a piston at the base. The piston was encased in a cylinder and could be moved by a vigorous push of the sow's snout against a flat metal push bar attached to the end of the piston. When the bar was pushed far enough, the hole containing a small portion of feed was moved beyond the end of the cylinder and the feed dropped into a trough below. The device was spring loaded so that the piston returned to its original position when pressure was released from the push bar. A small "pocket", not connected to the feed hopper, was present in the center of the push bar. The pocket could be loaded manually with feed pellets and attracted hungry sows' attention to the push bar.

It was intended that the feeding devices would provide the means by which sows could obtain their daily ration by working for it over a period of several hours. Bridging of feed over the hole in the piston and packing of feed in the opening occurred and frequent attempts at unclogging the mechanism were only partially effective. On the third day after sows were placed in the pen, the diameter of the hole in each piston was increased. Thereafter, clogging was infrequent and sows were usually capable of dislodging feed which bridged over the opening by vigorous bar pushing. Unfortunately, after modification of the feeding devices, they could be emptied of 1 kg of feed (quantity added twice a day) in about 15 to 25 min.

Conditioning Sows to Operate Feeding Devices

The first group of 6 randomly selected sows were weighed, marked and driven into the pen at 1240 on April 13, 1982. Two kg (4.4 lb) of feed had previously been placed in each of the 6 hoppers and the pockets in the push bars contained feed to attract the sows' attention. Sows soon located the feeders and push bars and there was considerable investigatory behavior and milling about in the feeder area. After 35 min the first sow had succeeded in obtaining feed by her own efforts. Three other sows were observed to operate the mechanisms after intervals of 50, 100 and 195 min.

Two sows, after ineffective exploratory attempts to obtain feed, wandered away from the feeders although the other 4 sows continued to feed. By mid afternoon we attempted to "shape" the behavior of those 2 sows by dropping feed into troughs when they approached and as they made closer and closer approximations of the desired bar-pushing movements. We did not achieve the desired final result in 2 hours of attempted shaping on that day, but both sows began bar pushing the following morning with an additional half-hour of shaping. Thereafter, all 6 sows were able to feed rapidly by bar pushing when feed was available. With the continuous reinforcement schedule used, sows showed relatively rapid extinction of bar pushing as the supply of feed was exhausted or when clogging of the mechanism occurred; pushing usually ceased within about a minute in those situations.

In retrospect it seems likely that sows would learn bar pushing more rapidly if the initial task was made easier and if feed was more consistently delivered. Weaker springs on the push bars could achieve the first objective and larger diameter openings in the piston the second. With the first group of 6 sows, competition effects were not important during the learning phase and they used whatever feeding compartment was most readily available.

After the first group of sows was removed, partitions between 3 adjacent feeding troughs were decreased to about 1½ ft instead of the original 2 ft. A

set of springs was also replaced on one feeder and those were later found to be so strong that a second group of 6 sows was unable to operate that feeder. Four second-set sows obtained feed by their own efforts within 5 hours. Nevertheless, 2 of the 6 encountered difficulties because of low social status and because only 5 of the 6 feeding devices were operating properly. Serious "bullying" behavior by the top ranking sow soon developed and the 2 low-ranking sows did not remain at the feeding devices long enough to learn the required behavior. After 72 hours the 2 subordinate sows, having obtained essentially no feed, were returned to their tethers and no further observations were made.

Feeding Strategies

Casual observations of the first group during the first few days suggested that sows differed in the number of bar presses given between periods of lowering the head to eat. Therefore, we counted frequencies of bar pressing by observing each sow in turn for timed intervals. This was done for four consecutive feedings 1 week after sows were placed in the pen and for two consecutive morning feedings 6 weeks later. Table 3 presents the results.

Table 3. Frequency of bar pressing between feeding bouts

Sow	Week after group was assembled	
	2nd	6th
0	4.4	0.0
1	4.5	3.4
2	17.6	11.7
3	1.8	4.4
X	5.8	11.8
L	1.9	1.0

Highly repeatable rates of bar pressing were obtained for individual sows within each period. Remarkable ranges in mean frequencies were obtained; those for the 2nd wk were 1.8 to 17.6 and in the 6th wk were from 0.0 to 11.8. These differences among sows are surely significant. Although there is fair consistency in ranking the sows as to frequency of bar pressing for the two periods, sow 0 showed a startling change between the two periods. In April she pressed an average of 4.4 times between feeding bouts, but in May she failed to press the bar at all. Nevertheless, she was feeding throughout the period when feed was available to the group. Sow 0 was the most dominant sow in the entire group and obtained all her feed in the second observation period by forcibly displacing other sows after they had caused feed to be delivered by working for it.

Rate of Feeding while Working

Rate of feed intake was estimated for each sow. Results are given in Table 4. The feed consumption rates shown involve not only ingestion but also efficiency of bar pushing so as to deliver feed into the trough. They also represent feeding in the absence of displacement of subordinates from the trough by more dominant sows. Such displacements were relatively uncommon during the second week after the group was assembled, when these data were gathered.

Table 4. Rate of feed intake of sows required to push a bar to obtain feed

Sow	Rate of feed consumption, gm per minute		
	April 20 a.m.	April 20 p.m.	Av
0	39.5	71.4	55.5
1	62.5	76.9	69.7
2	91.7	100.0	95.9
3	54.2	71.5	62.9
X	40.5	47.6	44.1
L	37.5	50.0	43.8

Sow 2 consumed feed at more than twice the rate achieved by X and L and more than half again as fast as 0, 1 and 3. Equal time spent feeding did not indicate equal intake. Close observation of sows 2 and L revealed very different feeding techniques. Sow 2 would push the bar very rapidly and frequently while feed accumulated. She would then lower her head and scoop up feed rapidly, not bothering to consume every bit before returning to rapid bar pressing. On the other hand, sow L would press her bar 1 to 3 times and then lower her head and eat every particle which had dropped into the trough before returning to bar press again.

An attempt was made to estimate rates of feed intake during the week of May 21. This effort failed because sow 0 was rapidly displacing one sow after another during feeding periods. As noted earlier, she was the top-ranking sow and obtained all her feed during this week by driving sows out of their compartments and then consuming whatever feed they had worked to obtain.

Social Status and Weight Gains

Time-lapse video tapes were examined to determine social status. Table 5 presents data on the dominance order (diagrammatically), total aggressive acts shown by each sow, number of other sows dominated and gains in body weight by 3-week periods.

Table 5. Social status of sows and body weight changes over a 6-wk period in the experimental pen

Dominance-order diagram*	Sow**	Aggressive acts, no.	Sows dominated, no.	Body wt change, by wks, kg. 1-3	3-6	1-6
0	0	62	5	14	15	29
↓	2	40	3	10	11	21
2 ↔ X	X	38	3	17	1	18
↓	3	13	1	17	-11	6
3 ↔ 1	1	8	1	8	-4	4
↓	L	2	0	3	3	6

*Arrows point from dominants to subordinates. Double-headed arrows indicate essentially equal status.

**In descending order according to total aggressive acts.

Social status was closely associated with well being of the sows as reflected by their changes in body weight over the first 6 weeks after they were assembled in the experimental pen. Further modifications in feeding arrangements are needed if sows are to be fed over a prolonged period and social competition effects avoided.

Time Spent in General Activities

General activities were recorded, using time-lapse video tapes, over a 24-hour period for the experimental pen and a 12-hour period for 6 tethered sows. Because 97½% of the overnight period (6PM to 6AM) was spent lying down, only the 12-hour period from 6AM to 6PM is shown in Table 6 for pregnant sows housed in the 2 environments.

Table 6. Time spent (%) in various general activities from 6AM to 6PM

Environment	Feeding, drinking + nosing floor	Standing, walking + active	Sitting	Lying
Experimental pen of 6 sows	9.5%	15.5%	10.4%	64.6%
Individually tethered				
1st set of 4 sows	40.6	2.8	8.3	48.3
2nd set of 4 sows	49.3	5.7	8.5	36.7

The six sows in the experimental pen averaged less than 10% of the day in feeding, drinking and nosing the floor (as if searching for food). In addition, about 16% of the day was spent in standing, walking or miscellaneous activities, 10% in sitting, and 65% lying down. As compared with the two groups observed in the commercial piggery (Table 2), the sows in the experimental pen spent less time in ingestive and searching behavior, but a roughly equivalent amount of time lying down.

Far more variation was seen among individually tethered sows than in sows kept in groups. Tethered sows spent a much larger portion of the day with the head in or above the feeder (where water was also available) and in nosing the floor. Thus tethered sows, on the average, were standing and engaged in feeding and drinking, or appeared to be searching for food for about 40 to 50% of the day, whereas comparable figures for the commercial and experimental sows kept in groups averaged about 22 and 10%, respectively. It is clear, even with the small number of sows observed, that different kinds of pregnant sow housing are associated with very different amounts of time being spent on daytime activities. Also, individual sows showed much greater variation in activities when kept in tethers than when grouped.

Some Tentative Conclusions

1. When feed is scattered in a pen, sows feed rapidly and with a minimum of social interactions until most of the feed has been consumed.

2. As feed becomes scarce, dominant sows drive subordinates from the feeding area and continue to search for remaining traces for 30 to 60 min.

3. Subordinate sows return to the feeding area after dominant ones lie down and search for any remaining feed particles for an additional 30 to 60 min.

4. Sows continue to show considerable agonistic activity (aggressive and submissive) for at least a month after groups are assembled. However, the incidence of fighting decreases rapidly over the first few days.

5. Social hierarchies form within the first day of assembly and are stable.

6. Grouped sows spend considerably less time feeding and searching for food than do individually tethered sows. Grouped sows also spend more time lying down during the day than tethered sows.

7. Sows in an experimental pen learned to "work" for their feed and were observed to use very different strategies in feeding. Feed intake in this situation varied greatly among sows.

8. Social status has major effects on well being and weight gains in groups when feed is placed at specific locations which can be controlled by dominant sows.

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