

# The Effect of Food Deprivation Length of Pair House Pigs on the Running Speed and Feeding Activity in Solitary and Social Conditions

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**ABSTRACT :** The purpose of this experiment was to study the feeding behavior and running speed under various feed deprivation lengths and social environments. Three trials were conducted. Trial 1: ten pigs were trained individually to run a course and eat their feed at the end of the course. The pigs were deprived feed for 1, 5, 10 or 20 h. Trial 2: 1. Two pigs ran and ate together. Both pigs had 5 h of feed deprivation before the run (D5). 2. Two pigs ran and ate alone, but both pigs had 5 h of feed deprivation before the run (S5). 3. Two pigs ran and ate together. Both had 1 h of feed deprivation before the run (D1). 4. Two pigs ran and ate alone and both pigs had 1 h of feed deprivation before the run (S1). 5. Two pigs ran together, one had 5 h of feed deprivation, and the other had 1 h of feed deprivation before the run (S1). Trial 3: 1. On the 1st day 5 pairs of pigs had 5 h feed deprivation and could eat feed together at (B) point (D1). 2. On the 2nd day the pigs ran and ate alone at (B) point after 5 h of feed deprivation. Feed was obtainable (D2). On the 3rd to 6th days, the pigs ran in pairs after 5 h of feed deprivation and only the dominant pig ate feed at point (B). The inferior pig was chased back to room and fed there. This stage was continued for four consecutive days, d 3 to 6. In trial 1, the running speed of pigs increased with the length of feed deprivation until 10 h, then being stable afterwards. Total feeding time increased with the length of feed deprivation ( $p < 0.001$ ). Eating speed did not increase with the length of feed deprivation ( $p > 0.05$ ). In trial 2, nine of ten pigs in treatment D5 ran faster than those in S5. Seven of the ten pigs in treatment S1 ran faster than those in treatment D1. The pigs in treatment D5 had significantly higher feed intake ( $p < 0.001$ ) and eating speed ( $p < 0.05$ ) than the pigs in other treatments. In trial 3, there were significant differences on running speed between D1 and D6 ( $p < 0.01$ ) and between D2 and D1, D3, D4 and D5. The inferior pig ran faster in D2 but from 3 to 6 it was the dominant pig that showed the greatest speed in completing the whole course. The results demonstrated that the pigs with low feeding motivation may cause low running speed to feed and low feed intake of the neighbor when compared with pigs kept individually. (*Asian-Aust. J. Anim. Sci.* 2004, Vol 17, No. 2 : 271-277)

**Key Words :** Pigs, Feed Deprivation, Running Speed, Social Facilitation, Feed Intake, Frustration

## INTRODUCTION

Pigs are social animals and are usually fed in groups. When animals are fed in groups, their feeding behavior can be influenced by their social behavior. One of the interesting social behaviors is social facilitation. Social facilitation can be defined as an increase or decrease in the frequency or intensity of responses, already in an animal's repertoire, shown in the presence of other animals (Hsia, 1981). Social facilitation has been studied for very long time. The first experiment used human as a model found that the racing cyclists can improve speed when accompanied by a pacemakers (Triplett, 1898). Several very good reviews on social facilitation have been published (Zajonc, 1965; Clayton, 1978; Strauss, 2002). However very few reports has shown the intervention effects of one specific behavior under social conditions of pigs.

The effect of feed deprivation on the running speed of pigs has not been investigated in detail previously. The purpose of these experiments was to investigate whether high and low feeding motivation could influence by other

factors (e.g. fear, play, etc) in a social situation. Here both the running speed and feeding behavior of pigs was used as an index of the feeding motivation and also of the influence of other factors.

## MATERIALS AND METHODS

### Trial 1

The first trial investigated in more detail the relationship between feed deprivation and running speed. The second trial studies the influence of other factors on high and low feeding motivation. The third trial investigated whether frustration could affect the feeding motivation. Ten castrated male pigs were used in this trial. The average initial BW was 33.0 kg. The pigs were deprived feed for 1, 5, 10, 15 or 20 h and then allowed to run to a food trough 60.28 m away.

The passage of the pig's house (Figure 1a) was used as a running course. The pigs were kept in room 1. The west side door of which was shut all the time. They were kept in pairs in the 5 pens of the room and five pigs were used in each of two replicates. The pigs were ranked from the heaviest to the lightest after weighing. Every two consecutive pigs in the rank were put into the same pen.

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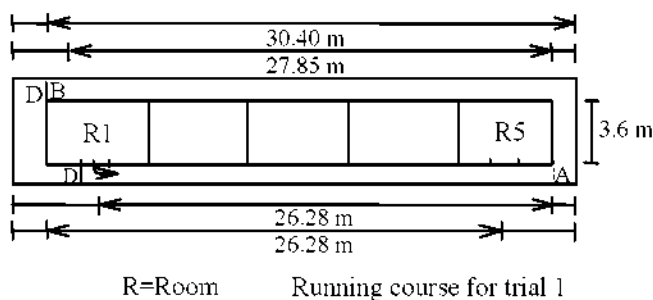


Figure 1a. Plan of the pigs' house for the running experiment

Each of the five pigs was put through a row of a 5×5 Latin square in each replicate in 5 d. Each row had five treatments. The rooms were separated by insulated solid wall. The other four rooms did not raise pigs.

The newly arrived pigs were kept in a group during the first 3 d and put into Room 1 during the afternoon. The room had plenty of straw for bedding. On the first night in room 1 only water was provided. The east side door of Room 1 was opened and let pigs explore for 3 days. Feed was provided in two long troughs all time at the point (A) of the passage (Figure 1a). For 2 d, the pigs were allowed to explore all the passages. From the fourth morning the pigs were confined in the stalls of Room 1 whilst the straw was removed. The pigs were then only allowed to come out to eat at point (A) twice per day, once in the morning and once in the evening. The pigs had access freely to the trough as long as they wished. They were trained to leave the room alone and to eat alone at point (A) for 6 d, twice daily.

The test started on the tenth morning after the pigs had put in Room 1. Once the test started, the pigs were fed alone once in the morning (zero point run) at point (B) and once alone at point (B) according to the requirement of deprivation time of the 5×5 Latin square design (test run). The running speed and feed consumption was recorded during the test run. The following measurements were taken during the test run: 1. The total wandering time in Room 1 after the stall gate was opened. 2. Running time from the door of Room 1 to the first corner (26.28 m) (Figure 1a). 3. Running time from the first corner to trough at point (B) (34 m). 4. Total feeding time. 5. Individual total food consumption. 6. Eating speed (measurement 5/measurement 4). Water was available on an *ad libitum* basis in each stall of Room 1. The feces were removed by shovel once per day before the zero point run. The D was a 1 m high wooden gate and a steel bar division. The pigs went back to room 1 through coming passage after eating by themselves.

## Trial 2

Ten castrated male pigs were used. The average initial BW was 23.2 kg. There were five treatments in this trial.

*Treatment 1* : Two pigs ran together and ate together

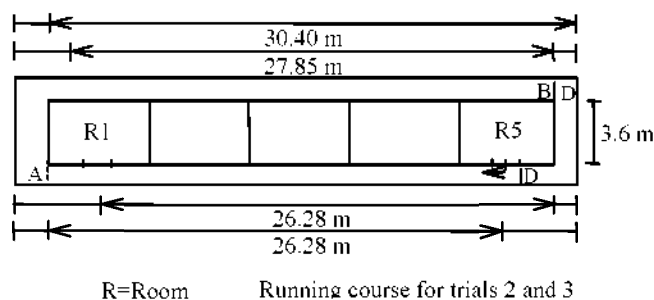


Figure 1b. Plan of the pigs' house for the running experiment

after being deprived 5 h of feed (D5).

*Treatment 2* : Two pigs ran alone and ate alone after being deprived of feed for 5 h before the run (S5).

*Treatment 3* : Two pigs ran together and ate together after being deprived of feed for 1 h before the run (D1).

*Treatment 4* : Two pigs ran alone and ate alone after being deprived of feed for 1 h before the run (S1).

*Treatment 5* : Two pigs ran together, one pig was deprived of feed for 5 h and the other pig was deprived of feed for 1 h before the run (S1). The pigs were fed 1.5 and 5.5 h before running. The pigs finished eating about 30 minutes (0.5 h).

The selection of a 5 h period of feed deprivation was because in Trial 1, the results showed that 10 h of feed deprivation caused the maximum running speed, so, in order to test for social facilitation, a period of feed deprivation causing less than the maximum running speed was chosen.

The selection of 1 h of food deprivation as the lower level for feeding motivation, instead of no food deprivation, was because the pigs may not run at all if they were allowed continuous access to feed.

Once the test started, the pigs were fed once in the morning (zero point run). Whether the pigs ran alone or in pairs in the zero point run depended on the particular test run. If the test run was in Treatments 1 and 3 then the pigs in zero point run would run in pairs. If, on the other hand, the test run was in Treatments 2, 4 and 5, the pigs in the zero point run would run individually.

Because of fire damage in Room 1 after trial 2, the pigs were kept in Room 5, and the feeding point was changed to the east side of Room 5.

Each pair was kept in the same pen. The training procedure was the same as for the pigs in Trial 1. Five pairs of pigs were put through a row of a 5×5 Latin square in 5 d. Five treatments were involved in a row. The feeding trough was 120 cm long, which was long enough for two pigs to eat at the same time. The following measurements were taken during the test run: 1. The running time from the door of Room 5 to the first corner (26.28 m) (Figure 1b). 2. The running time from the first corner to the trough at point (B) (34 m). 3. Total feeding time. 4. Total food consumption for

**Table 1.** The effect of length of feed deprivation time on feeding activities and running speed of pigs

Length of feed deprivation, h	1	5	10	15	20	SE of difference	Level of difference <sup>a</sup>
Food intake, kg	0.267	0.496	1.093	1.176	1.228	0.111	****
Total feeding time, s	460	726	1,659	1,865	1,996	174.7	****
Eating speed, g/s	0.581	0.614	0.669	0.649	0.630	0.035	NS
Wandering, s	494	195	3	2	2	57.8	****
Running speed, seconds/m for 1st section	1.23	0.85	0.52	0.52	0.51	0.14	****
Running speed, seconds/m for 2nd section	0.83	0.74	0.58	0.55	0.57	0.09	*
Running speed, seconds/m for whole course	1.00	0.79	0.56	0.54	0.54	0.10	****
Return running speed, seconds/m for 1st section	0.88	1.17	0.82	1.02	1.16	0.27	NS
Return running speed, seconds/m for 2nd section	0.49	0.69	0.49	0.52	0.54	0.08	NS
Return running speed, seconds/m for whole course	0.66	0.90	0.63	0.74	0.81	0.13	NS

<sup>a</sup>\*\*\*\* p<0.001. \* p<0.05. NS: Not Significant.

two pigs. 5. Eating speed.

### Trial 3

The same ten pigs used in Trial 2 were also used in this part of the experiment and the same 10 pigs passed through all three stages in the treatments. Five pairs of ten pigs were put through the following six treatments.

*Treatment 1* : On the first day, the pigs ran and ate feed at (B) point in pairs after 5 h of feed deprivation (D1). They ran in pairs in the zero point run.

*Treatment 2* : On the second day, the pigs ran and ate alone at (B) point after 5 h of feed deprivation (D2). They ran alone in the zero point run.

*Treatment 3-6* : Frustration treatments. The pigs ran to point (B) in pairs after 5 h of food deprivation and only the dominant pig could eat feed there. The inferior pig was returned to Room 5 and fed there. This stage was continued for four consecutive days, d 3 to 6. It was represented by D3, D4, D5 and D6. However each pair of pigs had eight experiences, four times on zero point running and four times on the test running (D3, D4, D5 and D6). They ran in pairs, but only the dominant pig could get feed. The inferior pig could get feed in room 5.

The feed intake and total feeding time were only recorded during the first two treatments, but running speed was recorded at all three stages. The same pigs were used in part two of the trial, so no training period was required.

Other aspects of procedures and animal husbandry were as in trial 2.

In order to analyze variance, these statistical models were used. The experiment unit for running speed was second/m of individual pig in all trials. The experiment unit for food intake and eating speed were kg/pair pig/2 and kg for 2 pigs/second for 2 pigs respectively in trial 1, 2 and first 2 days of trial 3.

$$\text{Model 1: } Y_{ijkl} = \mu + \theta_j + \alpha_j + \beta_k + \tau_l + e_{ijkl}$$

$$\text{Model 2: } Y_{jkl} = \mu + \alpha_j + \beta_k + \tau_l + e_{jkl}$$

$$\text{Model 3: } Y_{jklm} = \mu + \alpha_j + \beta_k + \tau_l + \Phi_m + \Psi_{lm} + e_{jklm}$$

$$\text{Model 4: } Y_{ilm} = \mu + \theta_j + \tau_l + \Phi_m + \Psi_{lm} + e_{ilm}$$

In which :

Y=independent variable.  $\mu$ =grand mean.

$\theta$ =replicate,  $\alpha$ =row,  $\beta$ =column,  $\tau$ =treatment,

$\Phi$ =social order,  $\Psi$ =treatment x social order. e=error

## RESULTS

### Trial 1

The results of total feeding time and running speed and wandering time were analyzed by Model 1. This model is used to measure 2 replicate in Latin square design. The results for feed intake and eating speed were analyzed by Model 2.

For individual pigs deprived of feed for either 1 h or 5 h, there were significant differences ( $p<0.05$ ) in the amount of feed eaten after feed deprivation. However, the means were examined, the feed intake after 5 h of deprivation was greater than after 1 h of deprivation (Table 1).

There were no significant differences in feed intake of the pigs after deprivation for either 10, 15 or 20 h. However the average amount of feed eaten did increase with increased length of deprivation.

Furthermore, pigs deprived of feed for  $\geq 10$  h consumed significantly more feed than pigs deprived for only 1 or 5 h ( $p<0.005$ ) (Table 1).

Pigs deprived of feed for either 1 or 5 h showed no significant differences in total feeding time. Also there were no significant differences in the total feeding time for the pigs deprived of food for 10, 15 or 20 h. The crucial period of time for deprivation was between 5 and 10 h, because there were significant differences in total feeding times between the short deprivation period (1 and 5 h) and the long ones (10, 15 and 20 h) ( $p<0.005$ ) (Table 1). There were no significant differences in eating speed among treatments (Table 1). The wandering time was significantly different among treatments ( $p<0.005$ ) (Table 1). As expected, the pigs deprived of feed for 1 h had the longest wandering time ( $p<0.005$ ). This wandering time was significantly longer than that of the pigs deprived of feed for 5 h ( $p<0.01$ ). The pigs with longer deprivation schedules (10,

**Table 2.** The effect of treatment on feeding activities and running speed of pigs

Treatment	D5	S5	D1	S1	51	SE of difference	Level of significance <sup>a</sup>
Food intake, kg	1.122	0.983	0.334	0.402	1.045	0.089	****
Total feeding time, s	1,204	1,076	472	508	1,249	93.8	****
Eating speed, g/s	0.472	0.463	0.349	0.391	0.422	0.032	*
Running speed, seconds/m for 1st section	0.27	0.49	11.00	9.25	0.38	3.91	*
Running speed, seconds/m for 2nd section	0.32	0.41	0.82	0.53	0.38	0.09	***
Running speed, seconds/m for whole course	0.30	0.45	5.26	4.33	0.38	1.74	*
Return running speed, seconds/m for 1st section	0.49	0.61	1.03	0.72	0.57	0.29	NS
Return running speed, seconds/m for 2nd section	0.97	0.44	1.18	0.97	0.62	0.39	NS
Return running speed, seconds/m for whole course	0.76	0.51	1.11	0.86	0.60	0.24	NS

<sup>a</sup>\*\*\*\*  $p < 0.001$ . \*\*\*  $p < 0.005$ . \*  $p < 0.05$ . NS: Not Significant.

15 and 20 h) showed no significant difference in the length of wandering time among deprivation treatments. However in all the long deprivation treatments the wandering time was much less than in the 5 h treatment ( $p < 0.01$ ).

The running speeds of the pigs were significantly different ( $p < 0.001$ ) among treatments in the first section of the course (Table 1). The pigs ran significantly more slowly ( $p < 0.01$ ) when they had been deprived of feed for 1 h than when they had been deprived of feed for  $\geq 5$  h. There were no significant differences in the running speeds of pigs deprived of feed for 10, 15 and 20 h on the first section of the course.

The running speeds of the pigs on the second section of the course were significantly different between treatments ( $p < 0.05$ ) (Table 1). The running speeds of the pigs that had been deprived of feed for 1 and 5 h were significantly slower ( $p < 0.05$ ) than those of pigs deprived of feed for 10, 15 and 20 h. Furthermore, the running speeds were not significantly different for pigs deprived of feed for 1 or 5 h. The differences in running speeds of pigs between Treatments 3, 4 and 5 also did not differ significantly on Section 2 of the course.

The running speeds of the pigs in the whole course were significantly different among treatments ( $p < 0.001$ ) (Table 1). The pigs that had been deprived of feed for 1 h ran significantly more slowly ( $p < 0.05$ ) than the pigs that had been deprived of feed for 5, 10 and 20 h. Also the pigs that had been deprived of feed for 5 h ran significantly more slowly ( $p < 0.05$ ) than the pigs that had been deprived of feed for 10, 15 and 20 h. Once again the long deprivation treatments (10, 15 and 20 h fast) showed no significant differences in running speeds.

The speed of the return was considered for Sections 1 and 2 separately and also for the whole course (i.e., Section 1 plus Section 2). These results showed no significant differences, and the length of the deprivation period had no influence on the speed of return (Table 1).

## Trial 2

The results of feed intake and eating speed were analyzed by Model 2. However the results of total feeding

time and running speed were analyzed by Model 3.

There were significant differences ( $p < 0.001$ ) in the feed intakes of pigs in different treatments (Table 2). The difference between treatments D1 and S1 was not significant, but four of the five groups of pigs ate more in the treatment S1 than in the treatment D1. In only one group was there no difference in feed intake between treatments D1 and S1. There were no significant differences among treatments D5, S5, and 51, but once again four of the five groups ate more in the D5 than in the S5 treatment, and only one group of pigs ate more in the S5 treatment than in the D5 treatment. The differences in feed intake between treatments D5, S5, or 51 and D1 or S1 were significant ( $p < 0.01$ ).

There were significant differences among treatments in the total feeding time ( $p < 0.001$ ) (Table 2). These differences occurred between D1 and S1 and D5, S5, or 51 ( $p < 0.05$ ). There was no difference in the total eating time between treatments D1 and S1 or between D5, S5 and 51.

The eating speeds of the pigs were significantly different among treatments ( $p < 0.05$ ) (Table 2). Treatments D5 and S5 had a faster eating speed than treatments D1 and S1 ( $p < 0.05$ ). There were no significant differences in the eating speed of pigs in treatments D5, S5, and 51, or finally, between S1 and 51.

Running speeds in Section 1 of the course did show significant differences among treatments ( $p < 0.05$ ). There were no significant differences in running speed among treatments D5, S5, and 51, but nine pigs out of ten pigs ran faster in the D5 treatment than in the S5 treatment.

There were also no significant differences in the running speeds of the pigs between treatments D1 and S1, but six pigs ran faster in treatment D1 than in treatment S1. This contrasted with the remaining four pigs which ran faster in S1 than in D1. In Treatment 51 the pigs that had been deprived of feed for 5 h did run faster than the pigs deprived of feed for 1 h in four of the five groups.

Section 2 of the course also produced significant differences in running speeds ( $p < 0.005$ ) (Table 2). The pigs ran more slowly in treatment D1 than in any other treatment ( $p < 0.01$ ) and faster in D5 than in treatment S1 ( $p < 0.05$ ).

**Table 3.** The effect of feeding in pairs and alone on feeding activities of pigs

Treatment	Feeding in pairs	Feeding alone	SE of difference	Level of significance
Food intake, kg	1.326	1.075	0.105	NS
Total feeding time, s	1,362	1,115	114.9	NS
Eating speed, g/s	0.495	0.491	0.025	NS

NS: Not Significant.

**Table 4.** The effect of social facilitation and frustration on running speed of pigs

Treatment	1	2	3	4	5	6	SE of difference	Level of significance <sup>a</sup>
Running speed, seconds/m for 1st section	0.18	0.48	0.22	0.27	0.31	0.38	0.08	*
Running speed, seconds/m for 2nd section	0.38	0.44	0.40	0.38	0.37	0.41	0.02	NS
Running speed, seconds/m for whole course	0.29	0.45	0.32	0.33	0.34	0.41	0.04	**

<sup>a</sup>\*\*  $p < 0.01$ , \*  $p < 0.05$ , NS: Not Significant.

There were no significant differences in the running speeds of the pigs in treatments D5, S5, and 51, even though nine of the ten pigs in D5 ran faster than those in S5. The differences in running speeds between treatments S1 and S5 or between S1 and 51 were not significant.

When the running speed of the pigs on the whole course was considered, the results showed significant differences among treatments (Table 2). There were no significant differences among treatments D5, S5 and 51, but nine out of ten pigs in treatment D5 ran faster than those in S5. Also there were no significant differences among treatments D1 and S1 on this score, but seven of the ten pigs in treatment S1 ran faster than those in treatment D1.

None of the treatments had any influence on the speed of the return from the feeding trough in any part of the course (Table 2).

### Trial 3

The feed intake of the pigs in treatments D1 and D2 was analyzed by Model 4. The results showed that the differences in feed intake of the pigs in the two treatments did not reach a significant level (Table 3), but all the pigs in the five groups had higher feed intakes in the paired treatment D1 than in the individual treatment D2.

The total feeding time of the pigs in treatments D1 and D2 was analyzed by Model 4. The results showed that the difference in total feeding time between the two treatments did not reach a significant level (Table 3), but nine of the ten pigs spent a longer time feeding in the paired treatment D1 than in the individual treatment D2. The dominant and inferior pigs showed no differences in feeding time.

The eating speed of the pigs in treatments D1 and D2 was analyzed by Model 4. The results showed no significant difference between the two treatments (Table 3). There were no interaction between treatment and social order for total feeding time and eating speed.

The running speed of the pigs on Section 1 of the course was analyzed by Model 4 and there were significant differences ( $p < 0.05$ ) among the six treatments (Table 4). The pigs were significantly faster ( $p < 0.05$ ) in D1 than in D2

or in D6. In some pigs the running speed was lower on d 3 but in other it did not fall until d 6. The differences between the dominant and inferior pigs reached significance ( $p < 0.05$ ). The dominant animal ran much more slowly ( $p < 0.05$ ) in D2 than the inferior pig did. From D3 (d 3) to D6 (d 6) the average running speed of the inferior pigs was slower than that of the dominant pigs.

The running speeds of pigs on the whole course for the six treatments were analyzed by model 3 and the results showed significant differences ( $p < 0.01$ ) among treatments (Table 4).

There were significant differences between D1 and D6 ( $p < 0.01$ ) and between D2 and D1, D3, D4 and D5. The social hierarchy had no significant influence on the running speed for the whole course. The interaction between social order and treatments was significant. On d 2 (D2) the inferior pig ran faster but from d 3 (D3) to d 6 (D6) it was the dominant pig that showed the greatest speed in completing the whole course.

There were no significant differences among treatments and between social orders of running speed of the pigs when returning either for the whole course or for Section 1 or 2.

## DISCUSSION

### Trial 1

The effects of feed deprivation time on feed intake, total feeding time, and eating speed were similar to results reported by Hsia (1981). The interesting thing was the effect of feed deprivation time on the running speed, which gave a similar picture to total food intake in relation to the periods of food deprivation. This suggests that running speed can be considered as one index of different levels of feeding motivation.

One interesting result, which was not analyzed statistically, is that pigs deprived of feed for 1 h on average ran faster in the second course than in the first course, but pigs deprived of feed for  $>5$  h ran on average faster in the first section of the course than in the second section. One of

the reasons which might have caused the pigs, deprived of feed for longer, to run more slowly in the second section of the course is that they reduced speed when they actually reached the trough. The second reason might be because they were tired, but it is not thought that this is the whole explanation and it needs more detailed study in the future.

The return running speed was not related at all to the length of the period of feed deprivation before feeding. This suggests that once the pigs were satiated some other kind of motivation became dominant. They were motivated in the first short period of time either by high exploration and (or) by low feeding motivation. The occurrence of which kind of motivation seemed to depend on the individual animal.

### Trial 2

From the results of total feed intake, total feeding time, and running speed there was an indication that with high motivation the pigs ran faster when they were in pairs than when alone. This shows positive social facilitation.

These results support the theory of Zajonc (1965, 1969) on the causes of social facilitation. The explanation of the present results in terms of Zajonc's theory is as follows. When the animal had a higher feeding drive, the presence of a conspecific animals energizes the dominant responses (feeding) at the expense of the subordinate ones (the other behavior). This effect in this situation caused the pigs to eat more, eat longer, and run faster when paired than when they were alone. When the animal had a low feeding drive then the presence of a conspecific animal may have energized a different behavior, rather than eating, and in that case the pigs ate less in pairs than when alone.

Another interesting result is shown on Table 2 that the average total feeding time and running speed are higher in 51 group than D1 and S1. The meaning of the result is that the pigs deprived of feed for 1 h in the treatment 51 not only ran faster than they did in the D1 and S1 treatments, but also the total feeding time of the pigs deprived for 1 h was higher in the 51 treatment than in the same pigs in D1 and S1 treatments and about the same as in D5 and S5 treatments. These results suggest that the pig with a low feeding drive may not reach its highest level of feed intake or running speed when accompanied by another pig with a low feeding drive or when eating alone. However the performance of the pig was facilitated by the presence of a pig with a high feeding motivation.

### Trial 3

The results of this part showed that the pigs ran faster in pairs than when alone, when they had been deprived of food for 5 h.

The result of this part of the experiment showed that the incentive to feed could be reduced at the end of the course. Although the running speed of the pigs at the frustrating

stage during the first three days (D3, D4, and D5) was faster than the pigs in D2 (individually run), the significance decreased between D6 and D2.

This raises two interesting points. 1. Why did the frustrated inferior pig still run and run fairly quickly? The results from a study on dogs (Vogel et al., 1950) suggested that allelomimetic behavior caused the frustrated dogs to run. On the other hand, the extinction rate was slower in pigs and dogs when they were in a social situation. In the present experiment, the frustrated inferior pigs only ran eight times and whether these pigs would continue to run with prolonged frustration is not certain. 2. However it also could be argued that the pigs show allelomimetic behavior easily, so that the slow extinction rate was due to their allelomimetic behavior. This idea is supported by some evidence, in that if the animals do not show allelomimetic behavior, such as the cat, then the lack of reward of feed would result in no positive social facilitation for the winner and a definite social interference for the losers (Winslow, 1944). Whether the extinction rate is slowed down by allelomimetic behavior is still not clear, and further study on this subject is required.

In an experiment with dogs, Scott and McCray (1967) rewarded each dog when it ran singly on alternate days. On the other days two dogs ran together but the inferior dog was never rewarded at the end of the run. Under these condition it may be difficult to produce frustration, because all the dogs were rewarded on alternate days when run singly. The present experiment frustrated the inferior pigs continuously from d 3 onward to produce a clear result of frustration on running speed, and indeed the present results showed that some animals learned quickly for they reduced their running speed after only one experience of frustration, whereas others were slower to learn. Kratzer (1971) suggested that the learning ability of pigs varied according to the individual.

Trial 2 of the experiment showed that the running speed of pigs deprived of feed for 1 h could be facilitated by a pig deprived of feed for 5 h. This part of the experiment showed that the non-frustrated, dominant pigs, ran more slowly in Treatments 3 to 6 than in Treatment 1, and this may be due simply to the influence of the decreased running speed of the frustrated inferior pig. Vogel et al. (1950) suggested that social facilitation is more important for slow animals than for the faster ones, but the present results show that both slow and fast pigs were facilitated by the social environment. The problem with the fast animal is that if the speed is already near the upper limit of its ability then it may not easily be facilitated by other factors.

### IMPLICATIONS

Low feeding motivation when pigs are kept together

may reduce running speed of pigs and vice versa. In practice, it may not be a good system to allow feed pigs ad libitum access to feed because of due to low feeding motivation in the system when compared with pigs which allow pigs eating more frequently per day after a short period of fasting.

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