Flank or belly nosing in weaned pigs

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Summary

Objective: To examine growth rate of pigs that engaged in, or were the recipients of, flank or belly nosing.

Methods: Data was collected from 332 weaned pigs during a 6-week period after they were weaned at 16 to 18 days of age. Sixteen pens of pigs were observed for nosing activity during the first 16 days postweaning, and associated skin lesions and growth rate throughout the entire 6 weeks in the nursery were recorded.

Results: Nosing activity was not observed until 3 days postweaning and peaked in number of pigs involved and duration of activity about 1 week after weaning. Nearly half of all pigs were observed performing some flank- or belly-nosing activity. Pigs that nosed were more likely to become the smallest pigs, although initial weight did not differ between pigs that nosed and those that didn't. In this study, sexes were housed separately, and no difference between gilts and barrows was detected in amount of nosing activity, measured either by number of days observed nosing or total seconds observed nosing. However, barrows had more skin lesions caused by nosing than did gilts.

Implications: Although flank or belly nosing is esthetically annoying to animal caretakers, it did not slow the growth rate of recipients. However, there was confounding of effect, since the most rapidly growing pigs were the most attractive targets for the perpetrators. While being a recipient of belly nosing did not affect growth, being a perpetrator was strongly associated with a reduction in growth rate.

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Flank or belly nosing, also referred to as navel sucking, flank rubbing, and persistent inguinal nose thrusting, is considered a maladaptive behavior pattern.[1] On occasion, flank rubbing has resulted in severe necrosis of skin with ulcer formation at the site of attack, and in one pig, total deterioration of the flank wall and evisceration.[2] However, in most cases, flank or belly nosing produces less severe lesions, which appear as hyperemia and edema of the skin with loss of hair and superficial erosion.

Behavioral aspects of belly nosing have been well documented. The onset of belly nosing is first seen several days or occasionally even longer after weaning,[3,4,5,6] and peak nosing activity occurs about 2 to 4 weeks later.[3,6,7] The time that pigs spend in belly-nosing activity rarely exceeds 2% of their total time budget.[3,5,6,7,8] Belly nosing is more prevalent in pigs weaned at earlier ages,[3,5,6,8,9,10] and occurs more often in barren rather than complex environments.[7,8] Pigs that perform nosing are different individuals than pigs that are recipients of the activity,[4,6] and nosers are more restless than recipients.[5,6] The pattern of development of the behavior over time and within pens suggests that belly nosing might be contagious.[3,4]

Several theories have been proposed to explain why nosing develops. Belly rubbing may extend from udder-seeking or exploratory rooting behavior, or may represent a coping mechanism. Some feel that inguinal rubbing is related to maternal loss, and theorize that with removal of the sow, piglets not only are deprived of her familiar presence, but also appear to miss the oral and nasal gratification of nursing, be it suckling or non-nutritive.[11] At 3 weeks of age, piglets are still strongly motivated to suck.[12] The frustration that results from removal of the sow may cause suckling behavior to be redirected towards pen mates.[5,8,13] Another theory is that nosing may be redirected rooting or exploratory behavior.[7] Because the onset of nosing is delayed for a few days after weaning, and nosing activity doesn't peak until 2 to 4 weeks postweaning, this behavior may represent a gradually learned coping mechanism.[6] All theories include a component of frustration or stress, which has been confirmed by Worsaae and Schmidt, who found significant correlations on the individual pig level between specific behavioral reactions to early weaning and plasma cortisol concentration.[14]

Information on the growth performance of pigs performing nosing is minimal and conflicting. Two studies used individual pig analyses to examine growth rate of nosers. Gonyou et al[6] found no effect on growth, while Fraser[3] reported lower growth rate in nosers. Dybkjar analyzed data by treatment group and reported that weaned pigs in a barren environment with a high pig density did more belly nosing and grew more slowly than pigs at a lower animal density in a complex environment.[7] Information about the growth rate of recipients of nosing activity has not been documented.

In commercial situations, it is common to observe that nosing behavior is more frequently performed by the smaller, less thrifty pigs in the pen. Producers often move these small, persistently nosing pigs to another pen in order to eliminate the (perceived) negative effects of the behavior on the other pigs in the pen, and to place the perpetrator with other smaller pigs in an effort to reduce competition and social stress that are felt to trigger the behavior. The validity of this reasoning and management strategy has not been demonstrated.

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Concerns about flank or belly nosing center around animal well-being. Dybkjar has called belly nosing a "behavioral indicator of stress." However, while it has been established that the behavior is more prevalent in earlier weaned piglets housed in barren environments, and it is presumed that earlier weaning is more stressful, the cause of belly nosing is largely unknown. Knowing how belly nosing affects the growth rate of perpetrators and recipients is important because it provides an economic incentive to alleviate the condition (or the stress that precipitates its development).

In this study, relationships among nosing behavior, initial weight at weaning, rate of gain, and development of skin lesions in piglets weaned at 16 to 18 days of age were examined. The primary objective was to determine the association of belly nosing with the perpetrators' and recipients' rates of gain.

Materials and methods

Animals and behavior sampling

Pigs used in this study originated from a 1200-sow herd that weaned litters at 16 to 18 days of age into a 3000-head, six-room, off-site nursery. Approximately 500 pigs were weaned each week, half on Tuesday and half on Friday, and placed by weight and gender into pens in a nursery room. Each pen measured 1.8 × 3 m (6 × 10 ft) and was equipped with two nipple-type drinkers. The feeder provided 122 cm (48 in) of trough space. The pen floor consisted of metal slat (Tri-bar®) over a pull-plug waste removal system.

For this trial, some of the pigs in two nursery rooms were used. In each nursery room, four gilt pens and four barrow pens were observed. Pens were randomly selected within room, gender, and fill date. Overall, a total of 16 pens, initially containing 332 pigs (168 gilts and 164 barrows) were included in this study. During the 6-week period of the study, 25 pigs were lost to follow-up. Five pigs died and 20 pigs were removed by the nursery manager to a "sick pen" which was not one of the 16 pens included in the trial. Most of these 20 pigs were moved within 3 to 4 days after weaning. Six of these pigs had a medical problem (lame, hernia, eye injury) that had not been observed at weaning, but was identified the next day. The other 14 pigs "fell back" after weaning. They were gaunt with tucked up abdomens, indicating that they had not been eating, and were moved to the "sick" pen where gruel feeding was employed.

Pens used in this study contained 20 to 23 pigs each and represented mid-weight range pigs in the rooms. Because nursery rooms were filled twice a week using the available number of pigs from that weaning group, numbers of pigs per pen differed at the start of the trial. Removal of pigs due to death or illness did not substantially change the group sizes or pig densities in the pens. At the time of placement into nurseries, pigs were individually ear-tagged and weighed. At the start of the trial, the mean weight of the 332 pigs was 6.54 kg, SD 1.09 kg (14.5 lb, SD 2.4 lb), with a range of 4.0 to 9.9 kg (8.9 to 22 lb).

Because nosing has been reported to occur most frequently in the early weeks after weaning,[6,11,12] pigs were specifically observed during the first 16 days of the trial to identify those performing nosing activity. Pens were observed daily for the first 10 days after placement, then at 2-day intervals for another three observations. The pens in each room were not observed in the same order on consecutive days. Observers entered the room approximately 15 minutes before beginning each observation period, which lasted 30 minutes and was performed between 9 am and 11 am. Feed was added to feeders at 8 am, and sufficient feed was added each day so that feeders were never empty during the first 16 days in the nursery. Persistent nosing activity, i.e. nosing that lasted at least 10 seconds, was recorded with respect to the identity of the perpetrator ("noser"), time spent in the nosing activity, and the site rubbed (ventrum, flank, head, tail, or leg). During a 30-minute observational period, all pigs in the pen were observed simultaneously. Two observers watched two adjacent pens (1 pen per observer) simultaneously and communicated with each other during observation periods. Preliminary data collected prior to the start of this trial indicated a high degree of agreement between observers (duration of nosing episodes agreed within 10%).

Production and lesion measures

Twice a week over the 6-week period, pigs were individually weighed and examined for lesions that developed as a result of nosing activity. Pigs with lesions were classified as "recipients." Lesions, rather than observational data, were used to define recipients, because lesions reflect all nosing activity rather than just what occurs during limited observation periods, and the severity of lesions reflects the intensity or persistence of nosing activity. Lesion location and severity (normal = 0, mild = 1, moderate = 2, severe = 3) were recorded. Mild lesions were barely detectable as a reddening or slight swelling of the skin. Moderate lesions were readily observed as reddening and (or) swelling of the skin, and severe lesions involved the loss of the superficial layer of skin. Photographs of lesions representative of each class were referred to at the times of inspection and weighing. At the end of the study, in addition to the lesion score recorded each time they were weighed, pigs were given a cumulative lesion score that was the sum of all the individual lesion scores throughout the trial.

Statistical analyses

Descriptive summaries of the data were produced using a statistical analysis package (SAS).[15] Summary statistics were used to describe nosing behavior by gender, time postweaning, number of seconds and days observed in nosing activity, number of pigs per pen nosing, body area nosed, and the presence of lesions on any area of the body.

General linear models and chi-square analysis were used for comparisons of gender and extent of nosing activity. The association between gender and nosing activity was also evaluated with a repeated measures logistic regression model using the Genmod procedure of SAS.

The individual pig was used as the unit for analysis. A primary objective of this study was to examine the effect of nosing on individual recipients of the activity, and in a preliminary analysis, room and pen were included in our model as random-effects variables and found not to be significant. Rate of gain for each piglet was evaluated for an association with the number of days on which the pig was observed in nosing activity, and the total number of seconds observed in nosing activity. Rate of gain for each piglet was also evaluated for an association with the cumulative score of lesions on the navel or sheath, on the flank, and at any location. Linear and quadratic polynomials were evaluated, but not included in the final

Table 1: Percent of belly-nosing activity directed toward specific body area by time period after weaning for pigs weaned at 16 to 18 days

Target of nosing activity	Percent of nosing activity directed toward each target on days after weaning				
	1–3 days	4–6 days	7–9 days	10–12 days	13–16 days
Ventrum	0.0%	77.4%	66.7%	54.3%	76.9%
Flank	12.5%	13.7%	30.0%	38.8%	0.0%
Head	50.0%	5.9%	0.4%	1.6%	0.0%
Tail	37.5%	2.0%	1.7%	3.1%	23.1%
Leg	0.0%	1.0%	1.3%	2.3%	0.0%
Total incidents	6	119	273	199	67

Table 2: Extent of nosing behavior in 307 pigs observed during the first 16 days after weaning, and initial body weights (±SD) of pigs in each category.

Total days observed in nosing activity	Number of pigs observed nosing	Initial weight of pigs (kg ± SD)*
0	154 (50.2%)	6.52 ± 1.01
1	68 (22.1%)	6.56 ± 1.01
2	34 (11.2%)	6.62 ± 1.27
3	27 (8.8%)	6.49 ± 1.32
4	14 (4.4%)	6.94 ± 1.19
5	5 (1.6%)	5.59 ± 1.53
6	4 (1.2%)	7.23 ± 1.08
7	1 (0.4%)	6.71 ± 0.0
Total seconds observed in nosing activity	**Number of pigs observed nosing**	**Initial weight (kg ± SD)***
0-9	154 (50.2%)	6.52 ± 1.01
10-50	56 (18.1%)	6.62 ± 1.11
51-100	28 (9.2%)	6.21 ± 0.88
101-150	18 (6.0%)	6.76 ± 1.21
151-200	20 (6.4%)	6.89 ± 1.45
201-250	5 (1.6%)	6.43 ± 1.03
251-300	9 (2.8%)	6.82 ± 1.45
301-850	15 (4.8%)	6.41 ± 1.38
1150 or 3350	2 (0.7%)	6.67 ± 0.06

* Values in this column not significantly different at $P<.05$

model because they were not statistically significant ($P<.05$). Gender and initial starting weight were included in these analyses as fixed-effect independent variables, and room and pen (within room) were included as random-effect variables.

General linear models were used for comparison of initial weight with severity of the cumulative score of lesions at any location, the number of days on which a pig was observed in nosing activity, and the total number of seconds observed in nosing activity.

Results

Behavior

Nosing activity was not observed until 3 days postweaning, and on that day was seen in only four of the 16 pens. Increasing numbers of animals engaging in nosing activity were observed in subsequent observation periods. The number of pigs per pen engaged in nosing activity, the total seconds of nosing activity per pen, and the time that each pig spent in nosing activity began to increase a few days after weaning and reached a relative plateau 5 to 7 days postweaning.

Table 1 gives the percent of nosing incidents directed toward each targeted body area. Within the first 3 days after weaning, there were a limited number of nosing incidents, and nosing was mostly directed towards the head, tail, and flank. Subsequently, as nosing became more frequent, activity was directed primarily towards the ventrum or flank. Some pigs nosed only one pen mate during the observation period, while other pigs nosed three or more pen mates. Nosing activity was broken off when the recipient walked away, and nosers then re-directed their activity to another (usually more stationary) pig.

Number of days and total duration of nosing behavior observed was examined. Half of the pigs were observed on at least one occasion to engage in nosing behavior. The distribution of the cumulative time that individual pigs were observed in nosing activity is shown in Table 2. Pigs that were seen engaging in nosing behavior did not differ from their non-nosing pen mates in starting weight ($P=.44$). Starting and final weights for pigs are shown in Table 2, and are expressed according to the number of days and number of seconds that they were observed in nosing behavior.

The proportion of nosers was not different between genders: 51.2% of barrows engaged in nosing activity compared to 48.4% of gilts (chi-square $P>.10$). Barrows spent no more time engaged in nosing behavior than did gilts, as measured by either the total number of seconds observed in nosing activity ($P=.50$) or the number of days on which a pig was observed in nosing activity ($P=.56$). Total seconds of nosing observed per pig over the trial period was not higher for barrows than for gilts (barrows 110.6 sec, gilts 72.1 sec, $P=.26$). Number of days per pig that each animal was observed in nosing behavior was also numerically, but not significantly, higher for barrows than for gilts (barrows 1.195 days, gilts 0.944 day, $P=.17$).

Room and pen within room had been included in the models testing effects of nosing on rates of gain, but did not have significant effects. Nosing and severity of lesions were fairly evenly distributed across pen and room. Using the repeated-measures logistic regression model, the overall association between gender and nosing activity was not significant ($P=.20$). However, gilts were significantly less likely to engage in nosing activity than were barrows on day 5 ($P=.020$) and day 6 ($P=.052$). On day 9, gilts were more likely to be engaged in nosing activity than were barrows ($P=.057$). At all other

Table 3: Numbers of gilts, barrows, and all pigs that had each cumulative sum of belly-nosing lesions at all site (accumulated over 6 weeks), and mean body weights of the pigs in each cumulative score group at the beginning and the end of the trail

Cumulative sum of lesions	Number of pigs with each cumulative lesion score			Mean body weight (kg ±SD) all pigs	
	Gilts n = 155	Barrows n = 157	All pigs n = 312	Initial (16-17 days old)	Final (58-60 days old)
0	29 (18.7%)	9 (5.7%)	38 (12.2%)	6.22 ± 0.95	18.84 ± 3.86
1	40 (25.8%)	23 (14.7%)	63 (20.2%)	6.24 ± 1.03	19.05 ± 3.73
2	29 (18.8%)	34 (21.7%)	63 (20.2%)	6.72 ± 1.17	20.09 ± 3.84
3	29 (18.7%)	27 (17.2%)	56 (17.9%)	6.53 ± 1.23	18.95 ± 4.01
4	11 (7.1%)	28 (17.8%)	39 (12.5%)	6.94 ± 1.05	20.70 ± 3.39
5	7 (4.5%)	12 (7.6%)	19 (6.1%)	7.14 ± 1.00	20.38 ± 4.00
6	4 (2.6%)	8 (5.2%)	12 (3.8%)	6.77 ± 0.91	20.22 ± 2.59
7	1 (0.6%)	8 (5.1%)	9 (2.9%)	6.84 ± 0.82	19.10 ± 3.41
8	4 (2.6%)	4 (2.5%)	8 (2.6%)	6.88 ± 0.68	23.60 ± 4.17
9	1 (0.6%)	1 (0.6%)	2 (0.6%)	*	*
10	0 (0.0%)	1 (0.6%)	1 (0.3%)	*	*
11	0 (0.0%)	1 (0.6%)	2 (0.6%)	*	*
12	0 (0.0%)	1 (0.6%)	1 (0.3%)	*	*

* Less than 1% of pigs

times, comparisons between gilts and barrows were not significant (P>.1).

Lesions

Lesions were seen infrequently early in the trial, gradually increased to a maximum 17 to 20 days after weaning, and then decreased. Lesions were observed on 88% of the pigs, although most lesions were mild. On the scoring system of 0 to 3, there were no grade 3 lesions, and only 5% of recorded lesions were grade 2. Therefore, the cumulative score of lesions at any location for each pig generally reflected the number of days with lesions (Table 3). Barrows (cumulative score 3.28) were much more likely (P=.0001) to have lesions than gilts (cumulative score 1.91).

Performance

The mean growth rate for all pigs during the 6 weeks in the nursery was 0.33 kg per day (SD 0.09). Growth rate was examined for nosers with respect to number of days observed in nosing activity and total seconds of nosing activity. Growth rates of pigs with lesions were examined with respect to cumulative severity of lesions at individual sites and overall. Weight at the time of entry into the nursery was compared between nosers and recipients.

Table 4 shows the association between rate of gain and nosing behavior (measured as the total number of seconds and days on which a pig was observed in nosing activity), and the cumulative severity of lesions caused by nosing at the navel, flank, or all sites combined. Each line represents a separate statistical model, each of which also includes gender and initial starting weight as fixed-effects variables and room (and pen within room) as random-effect variables. Both measures of nosing behavior have negative coefficients for the linear model, indicating that smaller, slower growing pigs were associated with increased nosing behavior. In contrast, lesions caused by being the recipient of nosing were more severe in larger pigs with a greater rate of weight gain.

When the total number of seconds that pigs were observed nosing was displayed in a histogram, there was a Poisson distribution between 0 and 300 seconds that included most of the pigs, with the values for 13 pigs lying far to the right of the Poisson curve. These 13 pigs were observed to nose for a total of 400 or more seconds during the study. Their mean starting weight (6.46 kg, 14.4 lb) did not differ (P=.44) from that of other pigs (mean starting weight 6.55 kg, 14.5 lb), but they grew more slowly during the 6 weeks in the nursery (P=.0015), with an ADG of 0.276 kg (0.61 lb), compared to 0.333 kg (0.74 lb) for the rest of the pigs. On the other hand, recipients that accumulated total lesions of 5 or more were heavier at the time of entry to the nursery (P=.0002): mean starting weight of recipients was 6.78 kg (15.1 lb) compared to 6.50 kg (14.4 lb) for the rest of the pigs. Throughout the 6 weeks, recipients continued to be heavier and have higher rates of gain (P=.0002).

Discussion

Flank or belly nosing is esthetically annoying to animal caretakers, but did not slow the growth rate of recipients, although there was confounding of effect since the most rapidly growing pigs were the most attractive targets for the perpetrators. While being a recipient of belly nosing did not affect growth, being a perpetrator was strongly associated with a slower growth rate. Nosers were not smaller at weaning than non-nosers, but became smaller over time. Pigs that were observed nosing for 400 or more seconds during the observation periods gained, on average, 1.8 kg (4 lb) less during the 6 weeks in the nursery than pigs that were never observed to nose.

Nosing appeared as a behavioral expression

Table 4: Belly-nosing lesion and behavior scores associated with rate of gain for pigs in the 6 weeks after weaning

Fixed variablea	Coefficient	Significance
Cumulative score of lesions at any location	.0088	.0002
Cumulative score of flank lesions	.010	.25
Cumulative score of navel lesions	.0095	.0012
Cumulative score of navel lesionsb	.0012	.059
Total number of seconds observed in nosing activity	-.000094	.0015
Total number of days observed in nosing activity	-.0036	.029
Total number of days observed in nosing activity[b]	.029	.0053

a Each line is a separate model. Also included in each model are the fixed-effect variables for starting weight and gender and the random-effect variables for room and pen within room.

b Represents the square of the fixed variable

concurrent with a pig's failure to adapt to its new environment. Half of the pigs were observed on at least one occasion to engage in nosing behavior, but because there were only 13 observations on each animal, by random chance, a proportion of pigs would not be observed nosing even though they were nosers. The proportion could be calculated as the probability of a pig not being observed in one observation, raised to the 13th power, or about 16%.

The results of this study are in agreement with findings of other studies that reported that belly nosing did not occur in the days immediately after weaning.[3—6]

Gender differences in nosing behavior were minor. Barrows were observed to perform slightly (but not significantly) more nosing behavior than were gilts, and had significantly more lesions. The more severe lesions in barrows may have resulted from a greater amount of undetected nosing behavior in barrows, because data was collected during 30-minute observation periods rather than continuously. Another explanation may be that the amount of nosing is not different between barrows and gilts, but because the barrow's sheath protrudes from the abdomen, it receives more abrasion from the same amount of nosing behavior. Even in the absence of nosing behavior, the sheath may receive lesions from contact with the floor. However, on subsequent examinations of these pigs when they weighed between 25 and 50 kg (55.6 to 111 lb), no lesions on the sheaths were observed.

An interesting finding of this study is that pigs that became nosers did not differ from their pen mates in weight at the time of placement into nursery pens. Apparently, absolute weight at weaning, and body size relative to other pigs in the pen, play little or no role in determining whether a pig will develop nosing behavior. Other factors that might trigger or alleviate nosing behavior were not identified in this study.

Pigs that accumulated the most lesions were heavier at the start and remained heavier throughout the study. In the study of Gonyou et al, nosing other pigs and being nosed were negatively correlated.[6] The biggest pigs may have been the target of nosing because they did not engage in nosing themselves, and therefore moved around less, making them more available to be nosed.

Implications

- Absolute weight and body weight relative to other pigs placed in the same pen at weaning do not determine whether a pig will develop nosing behavior.
- The bigger pigs in a pen are less likely to be engaging in nosing behavior.
- The bigger pigs in a pen are usually recipients of nosing behavior, and have the most lesions caused by this behavior.

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