Introduction

Pigs are social animals. From an evolutionary perspective, being social conveys a number of benefits, but potentially some disadvantages, especially for certain individuals within the group. Living in a social group can reduce predation, improve successful foraging, improve rearing of offspring, increase chances of mating and help thermoregulation. On the flip side, a group can be more conspicuous to a predator, competition within the group can reduce access to resources for some individuals, and may increase the risk of disease (1).

By definition, “social behavior is comprised of those patterns of behavior that involve two or more members of a species” (2). Thus, social behavior includes sexual behavior and parental behavior. However, the emphasis of this manuscript will be on those behaviors that relate to formation and maintenance of social organization in swine, namely those centered on aggression and social dominance, as these are the aspects of social behavior in swine that have garnered most attention in relation to the animal’s welfare. The animal’s welfare can be defined as its state as regards its attempts to cope with its environment (3).

Natural social organization

In order to better understand the consequences of the systems in which we place pigs during commercial production, it is crucial to acknowledge the pig’s origins and social behavior in a natural setting. The domestic pig is descended from the wild boar, but although they have changed greatly in terms of phenotype, their behavior, when given the opportunity, is extremely similar to their wild ancestors. The data from which we can conclude this comes from three main sources: 1) studies of wild boar in their natural habitat, 2) studies of feral populations of domestic pigs, and 3) studies of domestic pigs released into naturalistic enclosures.

The natural social organization of pigs centers on a core group or ‘sounder’ of 2-4 related sows plus their associated offspring of different sizes and ages (4,5,6). Sows in the group are likely to be sisters or mother and daughters. Group size will be influenced by habitat and resource availability (especially food), as will the size of the home range, but can be as large as 6000 hectares (7). Home ranges may overlap with other sounders, but even when sharing home ranges, sounders will tend to actively avoid open confrontation with each other (6). As the offspring mature, the females split off to form their own sounders and the males split off to form adolescent bachelor groups, becoming solitary as mature boars. During the breeding season, mature boars may associate with sounders, becoming dominant to all sounder members. Within sounders, aggression is very rare. The group usually maintains a simple, linear social hierarchy, which is relatively stable over time. Position within the hierarchy is mostly determined by size and age, with large, mature, physically-strong sows being dominant over smaller sub-adults and juveniles (4). Aggression does occur during competition for resources, especially food, but most often, subordinate animals actively avoid conflict with dominant animals (8). Food will be scattered but available ad libitum in their complex environment, as long as the pigs forage. This social organization is such that pigs are not exposed to unrelated, unfamiliar pigs. New litters are integrated into the group early in life (7-14 days of age) when the sow returns to the group with her litter after isolation at farrowing, but no aggression has been observed during these interactions (9, 10).

In contrast, pigs housed in commercial systems may be housed individually (but in close proximity to others) or in groups ranging from small (4-5) to large (200+). Regardless of group size, there will be relatively limited space and a relatively simple environment and they may encounter frequent remixing. Access to food may be ad libitum or restricted. Unsurprisingly, aggression will be much more prevalent under commercial conditions than under natural conditions. How prevalent will be largely influenced by: 1) the degree of mixing/remixing, 2) the method of feeding, and 3) the amount and quality of space.

Aggression and mixing

When unacquainted pigs are mixed together, they often fight. The fight does not often break out immediately but can be a complex and gradual event as the pigs investigate each other using a series of specific and often reciprocal behaviors, characterized by nosing, sniffing and gentle nudging (11). This may then escalate into more vigorous pushing and pressing, bites, head-knocks and mounting, which continues until one pig withdraws, with or without being pursued. Most fighting takes place within 2 h of mixing and by 24-48 h post-mixing, the level of aggressive interactions should be basal, and a hierarchy established. The hierarchy is then maintained by threats, avoidance and withdrawal, or short-lived aggressive interactions.

A fight can result in injury to one or both parties and thus the potential cost of fighting can be high, particularly for the loser, both in terms of welfare of the pig but also economically for the producer. For the individual pig, the choice to engage in fight or not in the first place, or to know when to stop calls for the pig to be able to assess its fighting ability relative to the fighting ability of its opponent (12). If pigs were unable to carry out assessment of relative fighting ability, then we may expect that every pig would have to fight with every pig with which it is mixed in order for social order to be established. We know, however, that this is not the case in some instances. For example, a study examined mixing 4 pigs from one litter with 4 pigs from another litter, meaning that there were a total of 16 possible unacquainted pairs in each of 11 pens (12). The actual number of pairs which fought ranged from only 2 to 10 (median 6). The most supported explanation as to why this happens is that within each litter, the pigs had a clear idea of their own position within the hierarchy. Seeing the outcome of an interaction between a pen-mate and an unacquainted pig thus yields useful information about your own likelihood of success in a fight. In
fact the study demonstrated a litter effect, with in each case, a 'dominant' litter moving freely around the pen, with a 'subordinate' litter huddling in one corner (12). In production, this is the most usual scenario – i.e. when pigs are mixed into a pen, there will already be existing pair-wise relationships between some members, which can help individual pigs gather information. We have examined close one-on-one encounters and looked at the sequences of behaviors that occur before a fight breaks out. We have found that escalation is more often preceded by the receiving pig ignoring the attention of the investigating pig. If the receiving pig turns to maintain nose-to-nose contact, then the chance of subsequent escalation is reduced (13).

Not surprisingly, there has been a great deal of research carried out into methods to reduce aggression at mixing (14). Many have little or no effect but there are some which clearly have an effect over the short or long term. Elements of pen design, such as a solid barrier in the center of the pen (15, 16) or the division of the lying area into distinct sub-areas can reduce aggression over the long term (17). Mixing at sunset (18, 19) and the use of drugs such as amperozide (19) and azaperone (20) can have short-term effects, but only so long as it remains dark or the drugs wear off. Mixing in the presence of a super-dominant animal – i.e. a boar – can reduce number of aggressive interactions, skin damage and flight distance (21). Other longer-term solutions include early social experience, repeated mixing, pre-mixing and use of pre-exposure pens. Allowing piglets to mix before weaning can benefit their social development and enable them to form stable social hierarchies quicker (22, 23). Repeated mixing during growth may help replacement gilts acquire social skills that serve them better later in life (24). Pre-mixing of sows into groups at weaning can help them when they are subsequently mixed into a larger group post-service (25). Finally, placing pigs into adjacent pens or a small pen within a pen, so that they can have contact without the ability to fight, prior to mixing together can greatly reduce aggression (26).

What is clear is that any method that might facilitate communication, be it olfactory, vocal or, to a degree, physical will help the pig's ability to assess its chances better and thereby avoid fighting or at least avoid prolonged contests.

**Aggression and feeding**

Naturally, pigs tend to synchronize feeding and actively forage for relatively low quality food for many hours during the day, with peaks in activity around dawn and dusk. Again, this is potentially very different from the commercial situation. In production, pigs will have access to high quality feed, which can meet their nutritional requirements quickly and it may only be available for an extremely limited period of time each day. Whereas the grow/finish herd may have ad libitum access, with restricted number of feeding spaces, the breeding herd usually has access to a single food drop a day, with food present for about 15-20 minutes every 24 h. In many ‘intensive’ production systems, pigs do not have access to any alternative foraging substrate, such as straw, and thus, access to food becomes an important resource and one that may play a major role in determining the amount of aggression being displayed within a system. For sows, feeding systems that promote competition for access, such as floor feeding, can have relatively high levels of aggression. Feeding systems that reduce competition by enclosing sows in stalls or being available ad libitum, can have relatively low aggression.

Floor feeding may be cheap and ‘low tech’ in terms of equipment, but it is highly competitive (27) with dominant sows able to monopolize the feed if it is not widely distributed (28). The aggression elicited by floor feeding, and its production consequences, can be manipulated by ensuring that the feeding area is as widespread as possible and that group size is kept small and stable, with animals of similar body condition and nutritional needs (29). Trough feeding is another method of feeding a group simultaneously, but without any partitions, dominant animals can again monopolize large lengths of trough space, displacing subordinate sows, especially if food distribution along the trough is uneven. Aggression can be reduced by using wet feed (30), which flows better along the trough, and by using dividers to separate the trough into individual feeding spaces. Use of trickle feeders for delivery can also help to keep sows ‘tied’ to a single feeding space and reduce displacements (29).

Other feeding options for sows include individual feeding stalls into which the sows can be shut either manually or under their own control (free-access stalls) and thereby eat at their own rate without threat of displacement. Electronic Sow Feeder (ESF) systems have the big advantage of allowing each sow to eat an individual, stockperson-controlled allowance without fear of displacement, but sows have to feed sequentially. With a single feeder per 40-60 sows, the feeder station may be occupied for much of the day with sows queuing outside. Usually a fairly stable feeding order develops, with dominant sows accessing the feeder soon after the daily cycle begins and the more subordinate sows waiting to feeding towards the end of the cycle. However, the entrance to the feeder can become a focal point of activity for large parts of the day and hence, a focal point for aggression (31).

For the growing/finishing pig, feed is usually available ad libitum. Although feeding behavior and actual feed intake is stimulated by allowing pigs to feed simultaneously, there is still the need to have allocated individual feeding spaces incorporated into the feeder design to keep aggression as low as possible (32). There is also the question of how many feeding spaces are made available for the number of pigs in the pen, whether these should be in the form of one ‘multi-space’ feeder or several ‘single-space’ feeders and where the feeder or feeders should be placed in the pen (33, 34). The term ‘social workload’ has been used to describe the effort required and aggression encountered in negotiating a route through pen-mates to a feeder and displacing pigs which are either feeding or obstructing the feeder (35). Ad libitum feeding has also been investigated for sows using high fiber diets which have increased bulk and low energy. In general, increasing fiber doubles the amount of time that sows spend eating and reduces stereotypic behavior, restlessness and aggression (36).

**Aggression and space**

The amount of space that pigs have, and the quality of that space, can have a large impact on their behavioral repertoire, including agonistic social behavior. With sows, the minimum amount of space given to sows in current commercial systems is that encompassed by a gestation crate, which at about 1.25m2 encloses the sow’s static space requirement (37). The sow, enclosed within this space has no pen-mates and thus, it is commonly assumed that she is free from the aggression attributed to group housing systems. In reality, this is not true. She may be free from the physical effects of aggression – i.e. the skin lesions and other injuries that group-housed sows may show – but
several studies have shown that aggression between neighbors in crates can be high. Initial attack is more often followed by retaliation in crates, resulting in escalation in the intensity of aggression rather than the withdrawal and cessation of interaction most often seen in group housing systems (38, 39, 40).

In pen systems, the amount of space given per animal will impact aggression. In general, as space allowance decreases, the total number of aggressive interactions increases (41). However, few studies have investigated the effects of space allowance as a single factor. In many comparative studies, when space allowance has varied, so have other aspects of the pen design or the group size, making drawing conclusion about space per se difficult. In some instances, space allowance may not show a linear relationship with aggression. For example, a study examining the effects of communal area space behind free-access sow stalls shows that decreasing communal space allowance may show in inverted U-shape relationship with aggression. At high space allowance, sows using the communal area can avoid each other and at low space allowance, they utilize the free-access stalls more, also reducing aggression. When the space allowance is intermediate, the sows are motivated to use the space, but are unable to avoid agonistic interactions so easily and thus, this treatment shows most aggression.

The other important aspect of space is its quality. Much of the current research in to group housing in North America involves the changing of stall systems to pen systems within similar types of building – i.e. into fully-slatted or part-slatted, non-bedded group housing. Usually, space is still fairly restricted and the environment offers no real enrichment’ apart from pen-mates with which to interact. In these systems, there may be increases in skin lesions and aggression-associated lameness compared with sows in crates. However, if other enrichment is included, such as a foraging substrate and bedding, then aggression is often reduced compared with sows in non-enriched pens (42).

Welfare impact of aggression

The most obvious physical impact of aggression can be injury. This can take the form of lameness, skin lesions - which are often seen on the shoulders, flanks, hindquarters and ears - or vulva biting, seen in sows in particular. If occurring near slaughter, severe physical damage may lead to condemnation of parts of the carcass, thereby financially impacting the producer. Another economic impact can be decreased growth. If individuals are unable to access enough food to meet their requirements, then economic impact can be decreased growth. If individuals are unable to avoid agonistic interactions so easily and thus, this treatment shows most aggression.

In terms of internal physiology, we also know that aggression activates both the sympathetic-adrenal-medullary axis and the hypothalamic-pituitary-adrenal axis, resulting in increased heart rate (31), increased plasma cortisol concentrations, increased plasma epinephrine and norepinephrine levels. For the breeding sow, this can explain the potential impact of stress due to aggression on fertility. For the slaughter pig, this can also help explain the effects of aggression on growth. With activation of the stress axes also comes a negative impact on immunity and thus disease incidence and rate of healing of any injury may be impacted. Finally, there is recent evidence that for the breeding sow, the stress due to aggression that she encounters during gestation can impact both the behavior and stress-reactivity of her offspring (44).

References


