Literature Review and Needs Assessment of Housing Systems for Gestating Sows in Group Pens with Individual Feeding

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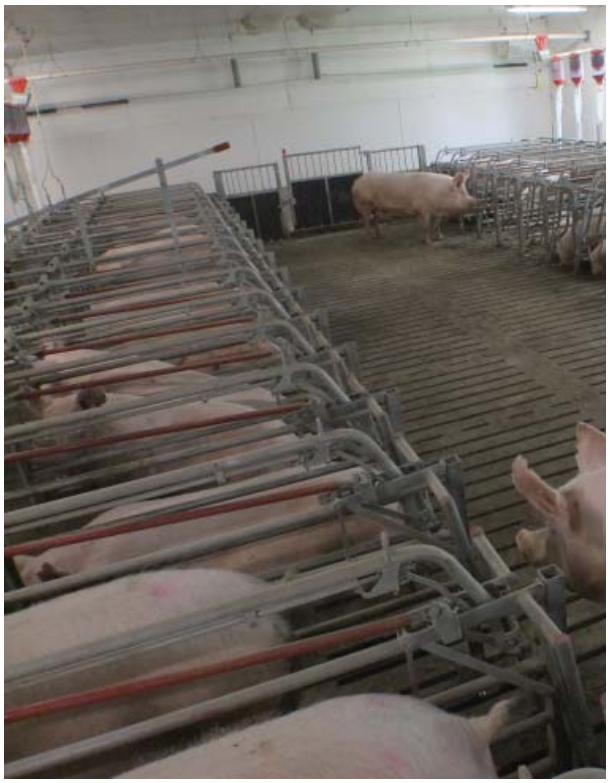
In the U.S., the public has expressed concern over the use of sow gestation stalls via ballot measures in a number of states. Likewise, large companies such as Smithfield Foods and Canada's Maple Leaf Foods are voluntarily restricting the use of gestation stalls by 2017. Gestation stalls have already been banned in the U.K. since 1999, with the rest of Europe phasing them out by 2013, and Australia by 2017. On the surface, it may appear that this is a step towards improving the welfare of gestating sows, however, animal welfare is a multi-faceted concept and scientific data is needed to assess all components. Many aspects of the sow housing environment and husbandry must be taken into consideration in order to accurately determine which types of gestation housing are the most welfare-friendly. Group housing can be a complex system and facilities come in many forms. At present, there is a lack of research adequately comparing all of the different options available for the group housing of gestating sows. An extensive body of literature exists on the influence of environmental enrichment, stocking density, and group size on the behavior of sows in group housing. However, substantial research gaps have been identified with regard to genetics, air quality, physiology and sow productivity.

To measure the overall sow welfare in group sow housing systems which utilize one or more types of individual feeding methods, a variety of outcome measures can be evaluated, including: behavior (i.e., aggression, responses to behavioral tests, general behavioral time budgets, stereotypies), injuries (i.e., scratches, lesions, vulva bites, lameness), physiology (i.e., cortisol concentration, heart rate, muscle/bone strength) and productivity (i.e., fertility, litter size, litter weight, piglets/sow/year, backfat, body condition, longevity). These parameters are based on the Five Freedoms (Webster, 2001), which include freedom from: 1) hunger, thirst and malnutrition, 2) thermal and physical discomfort, 3) injury or disease, 4) suppression of normal behavior, and 5) fear and distress. Additionally, standard parameters used by commercial producers to evaluate production profitability and sustainability can be considered, which include: 1) high biological performance, 2) low labour input, 3) ease of management, 4) acceptable capital cost, and 5) acceptable financial return (Edwards, 1990).

Experts have ranked the following housing systems according to sow welfare: tethers and stalls (lowest); indoor group housing (middle); group housing with outdoor and substrate access (highest) (Bracke et al., 2002). Most of the research conducted on sow welfare has involved comparing group housing with gestation stalls. However, only comparing group and stall housing does not provide adequate information to conclude that one group housing system is better than another with regard to overall sow welfare. Further complicating the fundamental question of how confinement affects pregnant sow welfare is the issue of the number of alternative group housing



Sows in group housing with individual feeders

designs and management regimes available. For example, within group sow housing systems there are a variety of feeding methods to choose from: sows may be fed as a group (either on the floor or in troughs) or individually.

In group housed gestating sows managed through individual feeding systems such as electronic sow feeders (ESF) or individual feeding stalls, some key themes were found amongst the scientific literature reviewed.

Space Allowance

Reduced space allowances result in more injuries in systems with both ESF and individual feeding stalls, as reduced space also results in more social interactions and aggression (Weng et al., 1998; Remience et al., 2008). Furthermore, physiological and productivity measures did not differ in sow groups differing in stocking density, regardless of the feeding system used (Remience et al., 2008).

Group Size

Increasing group size in an ESF system has different implications than in a system with individual feeders. Increasing a group with individual feeding stalls would require more feeding stalls to accommodate all sows. However, in ESF systems, an increase in group size would not only have implications for the social dynamics within the group, but would also put more pressure on the use of the ESF station(s). With more animals expected to use a single feeding station, competition would naturally increase (Svendsen et al., 1992).

Group Type and Composition

With regard to group type, dynamic groups often experience more aggression and injuries than static sow groups. Furthermore, the newest sows added to a dynamic group tend to receive the most injuries (Strawford et al., 2008). Overall, the first week post-mixing results in more aggression compared with the remaining weeks in both static and dynamic groups. Sows in small static groups were less active than sows in large dynamic groups (Durrell et al., 2002). However, sows in static and dynamic groups were found to have similar salivary cortisol concentration (used as an indication of stress in farm animals) (Anil et al., 2006; Strawford et al., 2008). A discrepancy was found in productivity results which compared sows in static and dynamic groups; some studies have found differences while other studies have not. Low ranking sows were also found to be at a disadvantage in both static and dynamic groups, especially in an ESF system, as these sows received more aggression and injuries, while also exhibiting poorer productivity compared with high-ranking sows (O'Connell et al., 2003). However, salivary cortisol levels did not differ among sows of different social status in either static or dynamic groups.

Flooring and Bedding

Providing straw bedding as a source of enrichment has many positive effects on sow behavior, however these same properties may not be unique to straw alone (Arey, 1993). As such, more alternatives to straw bedding need to be investigated further. As a whole, sows provided with good bedding material tend to incur fewer injuries and exhibit less pen mate directed aberrant behaviors (e.g. ear and tail biting). However, both aggression and foot health problems can still persist in deep-bedded group housing systems, regardless of feeder type used (Tuyttens, 2005). The specific impact of bedding on overall performance (e.g. milk production and growth) depends on the quality of the conducted research and what was measured. The effect of bedding alternatives on sow physiology have not been studied to any real extent. However, thoroughly bedded sow housing systems have been shown to decrease reproductive failure, increase pregnancy uptake, and increase farrowing rate. Interactions between feeder type and enrichment materials have not been specifically studied with regard to group housing of gestating sows.

Sow Research Unit at Prairie Swine Centre. Each group of 32 sows can chose between being inside the free access stall or out in the loafing area

Feeding Regime

Restricted feeding in gestating sows is common practice as a means of decreasing farrowing difficulties. However, restricted feeding in group housed sows leads to increased hunger and frustration, which stimulates an increase in stereotypic and aggressive behaviour (Meunler-Salaün et al, 2001). Adding quality fiber to the sow diet increases satiety and doubles eating time, thereby effectively reducing the incidence of aberrant behaviors. The current scientific literature provides many viable ideas of ways to include additional fiber in the sow diet in conjunction with ESF or individual feeding stall systems (Brouns et al, 1994; van der Peet-Schering et al., 2003).

In addition to behavioral concerns, restricted feeding regimes can also lead to increased skin and hoof lesions, vulva biting, and tail biting, which also impact the number of cull sows (Rizvi et al., 1998). Some of these problems can also be reduced through an increase in dietary fiber. However, overall aggression may not differ significantly between feed restricted sows and those given a high fiber diet. The literature suggests that feed restricted sows, regardless of feeding system, show higher basal cortisol levels and rectal temperatures, bulking diets with added high quality fiber may buffer the impact (Stewart et al., 2008).

Feed/Water Resource Allocation

Feed station design is a very important determinant of behavior in group sow housing systems with individual feeding. The majority of studies have focused on aggression and injuries associated with ESF systems (e.g. lameness, vulva biting, tail biting, and agonistic interactions resulting in injuries). Overall, stress cortisol and immune function data in the scientific literature is sparse, but valuable information for assessing different feeding systems, particularly in light of noted behavior and injury problems correlated with varying feeding station designs (Broom et al., 1995; Barnett et al., 1996; Spoolder et al., 1996). More research is needed with regard to the effect of individual feeding systems on sow productivity measures.

Air Quality

Air quality in group sow housing has not been studied with specific attention to feeder type or design. Overall, ammonia emissions are the primary air quality concern with regard to group sow housing, and were found to change considerably with the feeding schedule (Groenestein et al., 2001; Groenestein et al., 2006). In particular, flooring designs which also reduce slipping and lameness in group housed sows also tend to improve the environment with respect to air quality. No research has been conducted on the effects of group sow housing air quality parameters on sow physiology or productivity.

Sow Genetics

Genetics may anecdotally play a role in stereotypy development and general activity in group sow housing, however without sufficient studies to specifically investigate the effect of genetics, no firm conclusion can be drawn. Preliminary data suggest that it may be possible to select against aggression in sows without reducing maternal behavior, however feeding system was not a factor in the study design (Lovendahl et al., 2005).

CONCLUSION

Due to growing concern for animal welfare, group housing of gestating sows has received more attention over the past few years. While group-housed sows may benefit from being able to perform more natural behaviors, and maintain bone and muscle strength, these systems can also result in increased aggression and decreased welfare, particularly for lower ranking animals. As gestation stalls are phased out and group housing is phased in, more research is required in order to understand how to best manage some of the welfare challenges associated with group sow housing systems. There are many components of a group housing system that need to be evaluated when examining the systems' overall impact on animal welfare and economic feasibility for the producer.

Literature Cited

Anil, L., S.S. Anil, J. Deen, S.K. Baidoo, and R.D. Walker. 2006. Effect of group size and structure on the welfare and performance of pregnant sows in pens with electronic sow feeders. Can. J. Vet. Res. 70: 128-136.

Arey, D.S. 1993. Effect of straw on the behavior and performance of growing pigs in "Straw-Flow" pens. Farm Building Progress. 112: 24-25.

Barnett, J.L. G.M. Cronin, T.H. McCallum, E.A. Newman, and D.P. Hennessy. 1996. Effects of grouping unfamiliar adult pigs after dark, after treatment with amperozide and by using pens with stalls, on aggression, skin lesions and plasma cortisol concentrations. Appl. Anim. Behav. Sci. 50: 121-133.

Bracke, M.B.M., J.H.M. Metz, B.M. Spruijt, and W.G.P. Schouten. 2002. Decision support system for overall welfare assessment in pregnant sows B : Validation by expert opinion. J. Anim. Sci. 80: 1835-1845.

Broom, D., M. Mendl, and A. Zanella. 1995. A comparison of the welfare of sows in different housing conditions. Anim. Sci. 61, 369-385.

Brouns, F., Edwards, S.A., and English, P.R. 1994. effect of dietary fiber and feeding system on activity and oral behavior of group housed gilts. Appl. Anim. Behav. Sci. 39 : 215-223.

Durrell, J.L., I.A. Sneddon, V.E. Beattie, and D.J. Kilpatrick. 2002. Sow behavior and welfare in voluntary cubicle pens (small static groups) and split-yard systems (large dynamic groups). Anim. Sci. 75: 67-74.

Edwards, S.A. 1990. Bulky feeds for the dry sow: satisfying the appetite of hungry sows and improving their welfare. Pig Newslett. 1: 9-11.

Groenestein, C.M., J.M.G. Hol, H.M. Vermeer, L.A. den Hartog, and J.H.M. Metz. 2001. Ammonia emission from individual- and group-housed systems for sows. Netherlands J. Agric. Sci. 49: 313-322.

Groenestein, C.M., L.A. den Hartog, and J.H.M. Metz. 2006. Potential ammonia emissions from straw bedding, slurry pit and concrete floors in a group-housing system for sows. Biosystems Engineering. 95: 235-243.

Lovendahl, P., L.H. Damgaard, B.L. Nielsen, K. Thodberg, G. Su, and L. Rydhmer. 2005. Aggressive behavior of sows at mixing and maternal behavior are heritable and genetically correlated traits. Livestock Prod. Sci. 93: 73-85.

Meunier-Salaün, M.C., S.A. Edwards, and S. Robert. 2001. Effect of dietary fiber on the behavior and health of the restricted sow. Anim. Feed Sci. and Tech. 90: 53-69.

O'Connell, N.E., V.E. Beattie, and B.W. Moss. 2003. Influence of social status on the welfare of sows in static and dynamic groups. Anim. Welfare. 12: 239-249.

Remience, V., J. Wavreille, B. Canart, M. Meunier-Salaun, A. Prunier, N. Bartiaux-Thrill, B. Nicks, and M. Vandenheede. 2008. Effects of dry space allowance on the welfare of dry sows kept in dynamic groups and fed with an electronic sow feeder. Appl. Anim. Behav. Sci. 112, 284-296.

Rizvi, S., C.J. Nicol, and L.E. Green. 1998. Risk factors for vulva biting in breeding sows in south-west England. The Veterinary Record. 143: 654-658.

Spoolder, H.A.M., J.A. Burbidge, S.A. Edwards, P.H. Simmins, and A.B. Lawrence. 1996. Effects of food level and straw bedding during pregnancy on sow performance and responses to an ACTH challenge. Livestock Prod. Sci. 47: 51-57.

Stewart, C.L., N.E. O'Connell and L. Boyle. 2008. Influence of access to straw provided in racks on the welfare of sows in large dynamic groups. Appl. Anim. Behav. Sci. 112: 235-247.

Strawford, M.L., Y.Z. Li, and H.W. Gonyou. 2008. The effect of management strategies and parity on the behavior and physiology of gestating sows housed in an electronic sow feeding system. Can. J. Anim. Sci. 88: 559-567.

Svendsen, J., M. Andersson, A.-C. Olsson, D. Rantzer, and P. Lundqvist. 1992. Group housing systems for sows. Swedish J. Agric. Res. 22: 163-170.

Tuyttens, F.A.M. 2005. The importance of straw for pig and cattle welfare: a review. Appl. Anim. Behav. Sci. 92: 261-282.

van der Peet-Schering, C.M.C., H.A.M. Spoolder, B., B. Kemp, G.P. Binnendijk, L.A. den Hartog, and M.W.A. Verstegen. 2003. Development of stereotypic behavior in sows fed a starch diet or non-starch polysaccharide diet during gestation and lactation over two parities. Appl. Anim. Behav. Sci. 83: 81-97.

Webster, A.J. 2001. Farm animal welfare: the five freedoms and the free market. Vet J. 161(3), 229-237.

Weng, R., S. Edwards, and P. English. 1998. Behavior, social interactions and lesion scores of group-housed sows in relation to floor space allowance. Appl. Anim. Behav. Sci. 59. 307-316.