

Environmental enrichment in the commercial pig industry

By Anna Dean

Introduction

In the commercial pig industry, animals are often housed in barren pens with little space allowance. The ways in which different housing systems impact on animal welfare can be determined by studying behavioural and physiological responses to the environment and the associated effects on growth, reproductive ability and general health (Barnett, Cronin, Hemsworth, Hutson, Jongman, 2000).

Behaviour

A study by Dawkins and Webster (2000) showed that the degree of enrichment of the lactation environment affects subsequent behavioural patterns, hence impacting on welfare. Eighty sows were housed outside in an enriched environment, in farrowing arks constructed of galvanized sheet steel, with a 12cm deep bedding of straw. One hundred indoor sows were housed in barren farrowing crates lined chiefly by concrete, with only a small amount of straw added (Dawkins et al, 2000).

Piglets from both of these lactation environments were mixed together within six indoor weaning pens. From 8 to 57 days post-weaning, outdoor-bred pigs displayed more rooting behaviour than indoor-bred pigs. This behaviour was not linked to hunger, as rooting behaviour was observed while food was available at the feeders. Rather, outdoor-bred, enriched pigs may be more highly motivated to perform exploratory behaviour (Dawkins et al, 2000). This study illustrates that barren lactation environments may impair the expression of the normal behavioural repertoire of the pig, compromising the animal's welfare (Dawkins et al, 2000).

A study undertaken by Beattie, Moss, and O'Connell compared the behaviour of pigs housed in barren and enriched environments from birth to the time of slaughter. During the lactation stage, enriched-housed piglets inhabited straw-bedded pens in which the sow was unrestricted. Growing piglets were divided into groups of 7 and placed in large pens measuring 14m², divided into five areas, a peat area, a straw area, an enclosed kennel bedded with shredded paper, and feeding and drinking areas. The size of each pen was doubled during the finisher stage of growth. By comparison, barren-housed piglets were placed in smaller farrowing pens with plastic, slatted floors, within which the sow was restricted to a crate. Growers were housed in groups of 7 in flat-deck cages measuring less than 2m², with metal floors. The cages were slightly larger during the finisher period (Beattie et al, 2000a).

Following weekly 10 minute observational periods of one boar and one gilt from each pen, enriched animals were shown to spend more than one quarter of their time exploring substrates. In the absence of such substrates, as in barren environments, pigs spent more time exploring the pen and penmates, through nosing and chewing. As a result, there was a reduction in aggressive behaviour in enriched environments, perhaps due to a decreased need to retaliate against persistent manipulation by penmates (Beattie et al, 2000a). However, this study did not account for the effect of space allowance on aggression levels, although an earlier study indicated that space had little influence on behaviour when compared with the influence of environmental enrichment (Beattie, Sneddon, Walker, 1996).

Learning and Memory

Using identical housing conditions to those above, Beattie, Dunne, Neil, and Sneddon investigated the learning ability of growing pigs at 15-17 weeks of age. Pigs from both environments undertook an operant test involving a feeder that delivered food after a number

of pushes to a nose-operated plate. The average response of enriched-housed pigs was significantly higher than that of barren-housed pigs. A maze test was also performed, where each pig was trained to find food in a randomly assigned container, placed in one of the many partitioned areas. The time and route taken by the pig to reach its food position, when no food was present, was recorded. Pigs from the enriched environment were significantly faster than those in barren conditions (Beattie et al, 2000b). Long-term memory ability was not examined, as the maze test was not repeated at a later date. However, a different study compared maze test ability at 11 and 20 weeks of age. Barren pigs were shown to err more frequently when the test was repeated at 20 weeks of age, suggesting impaired long-term spatial memory (Blokhuis, de Jong, Koolhaas, Korte, Lambooj, Prella, van de Burgwal, 2000a).

These studies illustrate that the pig's rearing environment influences its learning ability. As the "enriched" environment used in this study would be impoverished in comparison with any natural environment encountered by ancestors, the "enriched" environment does not provide cognitive enhancement. Rather, the welfare concern is the cognitive impairment imposed by the "barren" environment. However, further research is required to determine if an interaction between social dynamics and environmental enrichment may be responsible for differences in learning abilities (Beattie et al, 2000b).

Physiological Responses

Pigs housed in dissimilar environments differ not only behaviourally, but also physiologically. In a study undertaken by Blokhuis et al, piglets from enriched and barren lactation environments were transferred to grower pens, the key differences being that enriched pens were larger, with straw bedding. Saliva was collected from all pigs over a period of 24 hours per week, from 9-22 weeks of age.

From 15 weeks of age, barren-housed pigs displayed a blunted circadian rhythm in salivary cortisol, when compared to enriched-housed pigs. As blunted circadian rhythms are found in situations of chronic stress in pigs or rodents, and during some disease states in humans, e.g. depression, these results may reflect decreased welfare of barren-housed pigs. In addition, chronic disturbances to the circadian cortisol rhythm may affect the stress responses of the hypothalamo-hypophyseal-adrenal axis (Blokhuis et al, 2000a). Another study revealed that barren-reared pigs displayed increased manipulation of penmates and significant increases in salivary cortisol in response to preslaughter handling and transportation. These findings suggest that barren-reared pigs are more likely to experience stress than enriched pigs during common preslaughter procedures (Blokhuis et al, 2000b).

Conclusions

The animal welfare implications of barren housing can be illustrated by comparing the behaviour, learning ability, and physiological mechanisms of barren-reared and enriched pigs. The living environment can be enriched by the provision of stimuli which promote the animal's expression of appropriate behavioural and mental activities.

References

Barnett, J.L., Cronin, G.M., Hemsworth, P.H., Hutson, G.D., Jongman, E.C. (2001) A review of the welfare issues for sows and piglets in relation to housing. *Australian Journal of Agricultural Research* 52(1), 1-28

Beattie, V.E., O'Connell, N.E., Moss B.W. (2000a) Influence of environmental enrichment on the behaviour, performance, and meat quality of domestic pigs. *Livestock Production Science* 65(1-2), 71-79

Beattie, V.E., Dunne, L., Neil, W., Sneddon, I.A. (2000b) The effect of environmental enrichment on learning in pigs. *Animal Welfare* 9(4), 373-383

Beattie, V.E., Sneddon, I.A., Walker, N. (1996). An investigation of the effect of environmental enrichment and space allowance on the behaviour and production of growing pigs. *Applied Animal Behaviour Science* 48, 151-158

Blokhuis, H.J., de Jong, I.C., Koolhaas, J.M, Korte, S.M., Lambooj, E., Preme, I.T., van de Burgwal, J.A. (2000a) Effects of environmental enrichment on behavioural responses to novelty, learning, and memory, and the circadian rhythm in cortisol in growing pigs. *Physiology and Behaviour* 68(4), 571-578

Blokhuis, H.J., de Jong, I.C., Koolhaas, J.M, Korte, S.M., Lambooj, E., Preme, I.T., van de Burgwal, J.A. (2000b) Effects of rearing conditions on behavioural and physiological responses of pigs to preslaughter handling and mixing at transport. *Canadian Journal of Animal Science* 80(3), 451-458

Dawkins, M., Webster, S. (2000). The post-weaning behavior of indoor-bred and outdoor-bred pigs. *Animal Science* 71(2), 265-271