SHORT COMMUNICATION

CONSISTENCY OF MEASUREMENT OF SOCIAL STATUS IN DRY-SOWS GROUP-HOUSED IN INDOOR AND OUTDOOR SYSTEMS

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Abstract   *Animal Welfare 2000, 9: 75-79*

Each of two 20-sow groups consisted of gilts ie virgin sows (one third) and sows (parity 2–5, ie sows which had given birth 2–5 times). One group was housed indoors with a straw-covered lying area and dunging area. Another group was housed outdoors with a covered straw lying area and two rooting fields. Behavioural observations were made on both groups: indoor sows were observed for 4h day⁻¹, for 10 days (40h); outdoor sows were observed for 6h day⁻¹, for 21 days (126h). Social interactions were classified as threat, bite, knock and push. Continuous data on the type of interaction and the winner or loser were recorded. Four measures of social status, based on social behaviour, were calculated: i) displacement index; ii) level of interaction; iii) success in interactions; and iv) matrix dominance. Spearman rank correlation coefficients between different ranked measures of social status within each group (outdoor or indoor) were significant for displacement index, success in interaction and matrix dominance. The level of interaction did not correlate with other measures (except for matrix dominance in the indoor group). Measures of displacement, success in interaction and matrix dominance provide highly consistent and correlated measures of social status.

Keywords: *animal welfare, behaviour, dominance, social status, sows*

Introduction

A number of different measures have been employed in order to determine social status in groups of animals and on a number of occasions the analysis of the same data has resulted in the construction of different hierarchies (eg Tomback *et al* [1989] in mule deer, *Odocoileus hemionus*; Bradshaw [1992] in laying hens). Methods for describing the social relationships of farm animals remain unresolved and attempts have even been made to discard the dominant-subordinate classification of individuals (Mendl *et al* 1992).

The measurement of social status and understanding social relationships is particularly important to the study of welfare in dry-sows for two main reasons. First, the mixing of unfamiliar animals, or animals which have been separated for several weeks, can result in high levels of aggression (Mendl *et al* 1992). On many farms, pregnant domestic pigs are

kept in large all-female groups in which individuals leave the group to give birth and re-join it following separation from their offspring (Hunter *et al* 1988). Thus, fighting can be common in groups of dry-sows. Second, social status may influence the performance of various behaviours (eg resting) or access to certain resources (eg a rooting area) which may influence welfare. Thus, it is important to develop meaningful measures of social status in group-housed sows in order to investigate these social aspects of welfare.

In the present study we wished to establish whether: i) different measures of social status resulted in the construction of similar hierarchies in dry-sows; and ii) whether these measures are consistent in different social contexts (eg indoor or outdoor group-housing systems).

Materials and methods
Subjects and housing
The subject groups both consisted of 20 Large White x Landrace sows. Each group (formed for 1 month) consisted of gilts ie virgin sows (one third) and sows (parity 2–5, ie sows which had given birth 2–5 times) with one third of the sows gestating. The low number of sows gestating is unusual in commercial practice but the herds were experimental and were being prepared for batch farrowing in group systems. In both systems, all sows were sprayed with a number on their back to allow individual identification.

One group was housed indoors with a straw-covered lying area (7.5x5.5 m) and a dunging area (9.0x5.5 m) all part of one large room. Part of the dunging area was occupied by an Electronic Sow Feeder (ESF) supplied by Quality Equipment (Bury St Edmunds, UK) in which the sows were fed (Dalgety Ultrabreed 16 nuts, Dalgety, Bury St Edmunds, UK) one at a time from 0500h. Each sow wore a magnetic collar which identified it to the ESF computer and ensured that each sow received the appropriate food ration. Water was available *ad libitum* from nipple drinkers and a water trough situated in the dunging area. The housing system was ventilated by fans and lit by natural and artificial light. The dunging area was cleaned daily and straw was regularly added to the lying area.

The second group was housed outdoors with a covered straw lying area (10x6 m), adjacent feeding area (10x6 m) and uncovered dunging area and two rooting fields (each c 150x25 m). Sows were fed daily from individual stalls adjacent to the lying area at 0800h; *ad libitum* water was available from two troughs.

Data collection
In the indoor system, preliminary investigation showed that the sows had low activity levels before 0500h and after 1900h so observations were confined to between these times. Sows were observed for a total of 40h, consisting of 4h of observation each day recorded in approximately 40min periods spread across the day for 10 days. In the outdoor system, sows were observed (between 0900h and 1600h) for a total of 126h, consisting of 6h of observations each day spread across the day for 21 days.

Behaviours recorded
Agonistic behaviours were recorded throughout the observation periods in both systems. The social interactions were classified as: physical agonistic interaction (bite, knock, push) and non-physical agonistic interaction (threat during which one sow displaced another without physical contact, avoid, chase, ignore and other social interactions which included all other instances of physical and non-physical interaction between sows). An interaction was deemed to have occurred when one individual initiated a behaviour which was clearly directed at another individual in the group and for which a clear outcome could be discerned.

For each interaction, the following information was recorded: the identity of the sows involved in the interaction including the sow which initiated the interaction, the sow which 'won' the interaction and the type of behaviour. A threat was recorded when the pig, with mouth open, made a vigorous lunging movement of its head towards another pig without making contact.

Data analyses

Four measures of social status, based on all data on social behaviours, were calculated for each group of sows:

i)   Displacement index (Mendl *et al* 1992). This was calculated by finding the number of individuals which a sow was able to displace, as a proportion of the total number of individuals with which that sow had had an agonistic interaction. An animal's index could thus vary between 0 and 100;

ii) Level of interaction. This was measured by counting the total frequency of agonistic interactions each sow was involved in (a procedure similar to that described for laying hens in Nicol [1989] and Bradshaw [1992]);

iii) Success in interactions. This was calculated as the percentage of interactions which each sow won (ie displacing an opponent or resisting displacement by an opponent);

iv) A matrix dominance hierarchy. This was constructed using the outcomes of all pairwise interactions (as described by Martin & Bateson [1988]).

In all cases, a ranked dominance hierarchy was calculated for each method. A sow was ranked 1 if that individual had the greatest calculated index value.

Statistical analyses

Spearman rank correlation coefficients were calculated in order to determine the degree of correlation between each ranked measure within each of the two contexts under investigation (ie indoor or outdoor). In the case of rank ties, ranks were allocated by addition of each of the tied rank values and dividing by the number of ties; each sow was then allocated a rank value calculated in this way.

Results

Table 1 shows the Spearman rank correlation coefficients and level of significance for different measures of social status within each group. Correlations of displacement index, success in interaction and matrix dominance showed remarkable similarity within each group

Table 1   **Spearman rank correlation coefficients (r_s) between displacement index, level of interaction, success in interaction and matrix dominance hierarchy for groups housed in indoor (in) and outdoor (out) systems. *$P < 0.05$.**

Measure	Displacement index		Level of interaction		Success in interaction		Matrix dominance	
	out	in	out	in	out	in	out	in
Displacement index	-	-	-	-	-	-	-	-
Level of interaction	0.188	0.127	-	-	-	-	-	-
Success in interaction	0.931*	0.933*	0.215	0.277	-	-	-	-
Matrix dominance	0.944*	0.769*	0.414	0.572*	0.908*	0.850*	-	-

and between groups (ie indoor and outdoor). Only the level of interaction did not significantly correlate with other measures in either system (except for matrix dominance in the indoor system). A total of 300 social interactions were recorded for the indoor system and 498 for the outdoor.

Discussion

Despite the use of measures of social status in studies of group-housed dry-sows (eg Mendl *et al* [1992]) and other farm animal species (eg Nicol [1989]; Tomback *et al* [1989]), there have been few studies comparing different methods employed in the calculation of status and none comparing the same measures in different contexts (or between groups). The most striking feature of the results in the present study is that different measures of social status show great consistency within each group, despite very different housing conditions for the two groups. Measures of displacement, success in interaction and matrix dominance provided highly consistent measures of social status, while indices based solely on the frequency of social interactions correlated less consistently. Thus, in dry-sows, different measures of social status do not result in the construction of different hierarchies, except when measures are based solely on levels of interaction which do not take into consideration the specific outcome of pairwise interactions.

These results contrast with studies involving other species which have found considerable variation between different measures of social status. Nicol (1989) and Bradshaw (1992) acknowledged the difficulties of calculating social status in laying hens by analysing their results using three different measures based on dominance, levels of aggression and frequency of interaction. Tomback *et al* (1989) investigated three measures of social status in mule deer based on the outcome of agonistic interactions. Although several different measures of dominance were highly correlated, different measures of behaviour were recorded which resulted in the construction of different hierarchies. Thus, other studies on domestic species have found considerable variation between different measures based on social behaviour. Ultimately, the measure of the social status most suited to a particular study must be carefully considered and will depend on the questions being asked.

Animal welfare implications
In dry-sows, different measures of social status do not result in the construction of different hierarchies, providing the measures include information relating to the outcome of social interactions. Comparison between social status in groups of dry-sows in different contexts appears valid even if different measures are employed in the two conditions. With the general move towards group-housing of dry sows, this observation therefore has important implications for future studies of social behaviour and welfare.

Acknowledgements

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