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Relation between parity and feed intake, fear of humans and social behaviour in non-lactating sows group-housed under various on-farm conditions

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Abstract

The number of group-housed, non-lactating sows is increasing rapidly in Europe. However, systematic information of the between-sow variation in animal welfare related factors under various on-farm conditions is lacking. Indicators of feed intake, fear of humans and social behaviour in non-lactating, group-housed sows were monitored in 14 herds. Regarding indicators of feed intake, the results revealed that back fat gain increased with increased parity number to a larger extent in group feeding than in individual feeding systems. Furthermore, behavioural observations showed that sows older than third parity spent significantly more time eating than younger sows during feeding in group feeding systems. With respect to indicators of social behaviour, first parity sows had significantly more skin lesions than older sows in herds with no escape possibilities (small group sizes and no feeding stalls), whereas second and third parity sows had the highest number of skin injuries in herds with escape possibilities. The results emphasise a need for management initiatives to consider the requirements of especially young sows in group housing. This is of particular importance in systems with small group sizes and group feeding systems.

Keywords: *animal welfare, back fat, farm study, group feeding, individual feeding, skin lesions*

Introduction

The number of group-housed, non-lactating sows is increasing rapidly in Europe due to animal welfare considerations. Clearly, group housing offers certain animal welfare-related benefits, but may also result in increased competition for available resources and low-ranked sows may thus be disadvantaged.

There is a distinct lack of systematic information concerning the between-sow variation in animal welfare-related factors such as feed intake, fear of humans and social behaviour in sows group-housed in the non-lactating period, under various on-farm conditions. This may be attributable in part to the fact that traditional methods of assessing these factors can be expensive and/or time-consuming and therefore difficult to employ practically on a large scale. Recently, Kongsted (2004) proposed indicators, suitable for use in group-housed sows under various on-farm conditions.

The aim of this study was to evaluate the variation between different parity groups, in indicators of feed intake, fear of humans and social behaviour in non-lactating sows group-housed under various on-farm conditions.

Materials and methods

Design and herds

During an 11-month period, ten randomly chosen sows (F-sows) in each of four batches were observed from weaning to farrowing in each of 14 herds with group-housed, non-lactating sows (a total of 554 sows). Eight herds practised group feeding with the feeding system Biofix®, on the floor and in long feeding troughs and six herds practised individual feeding (free-access feeding stalls, individual feeding stalls, electronic sow feeding and automatic nipple feeder) in the pregnancy unit.

Measurements

Back fat depth was measured by means of a digital ultrasound back fat indicator, 65 mm from either side of the backbone at the 12th (last) and 10th rib. Eating behaviour was registered in the herds, which practised group feeding. Whether the sow was observed eating was recorded every 30 seconds during feeding. The recordings began the moment feed was supplied and continued for a maximum of 25 minutes or until the last sow had finished eating. The number of times the sow was not eating compared to number of recordings (maximum 50) was calculated for each sow (% not eating).

The total number of aggressive interactions in which the individual sow participated was recorded during the first hour after mixing at weaning and during half an hour in the morning after feeding, three weeks after mating. The total number of skin lesions on the head, ears, neck and shoulders were recorded for each sow. Every five minutes during the expected resting period, for 25 minutes, it was registered whether the sow was lying solitary (defined as lying at a distance of 20 cm or greater from other sows) or socially. If the sow was lying alone more frequently than socially (during the 25 minutes), the sow was categorised as lying solitary.

Two Forced Human Approach tests, FHA-test 1 (Andersen *et al* 2003) and FHA-test 2 (Pedersen *et al* 2003) were performed in the home area of the sows in the morning after feeding. Only sows which scored low (indicating fleeing behaviour) in both tests were categorised as fearful.

The back fat, aggressive interactions, skin lesions and lying behaviour of the F-sows were monitored at weaning and three weeks after mating. Eating behaviour and reactions in fear tests were assessed three weeks after mating.

A more thorough description of materials and methods is provided in Kongsted (2006).

Statistical analyses

Parity was classified into: 1, first parity sows; 2, second and third parity sows and, 3, sows older than third parity. The system was categorised as group versus individual feeding when analysing the indicators of feed intake. The system was categorised in relation to escape possibilities when analysing social behaviour, skin lesions and fear. Escape possibilities was defined as positive with group sizes above 50 or access to individual feeding stalls. Escape possibilities was defined as negative with group sizes below 25 and no access to feeding stalls.

The following mixed model was applied:

$$E(Y_{ijklm}) = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + A_{k(j)} + B_{l(kj)}$$

Y_{ijklm} is the value observed for the individual sow transformed by the natural logarithm (skin lesions) or square root (% not eating and aggressions). E() indicates expected value. μ is the overall mean of the observations, α_i is the fixed effect of parity group, β_j is the fixed effect of layout, $(\alpha\beta)_{ij}$ is the interaction between parity group and layout, $A_{k(j)}$ and $B_{l(kj)}$ are the normal distributed random effects of herd (within layout) and batch (within herd), respectively. For all continuous indicators, $Y_{ijklm} \sim N(E[Y_{ijklm}], \sigma_{ijklm}{}^2)$ whereas for all categorical indicators, $Y_{ijklm} \sim B(1, p_{ijklm})$.

Continuous indicators were analysed with the MIXED procedure (Littell *et al* 1996) in SAS® whereas for categorical indicators, the glmmPQL function in the MASS package (Venables & Ripley 2002) of R was used.

Results

The overall averages and the variation of the continuous indicators between sows across all 14 herds are presented in Table 1.

The mean and variation of the categorical indicators are presented as the variation between batches (Table 2).

All significant effects of parity group (main effects and interactions) are shown in Table 3 and described in the following.

Back fat and back fat gain increased with increasing parity to a larger extent in herds with group feeding than in herds with individual feeding ($P < 0.05$ for interaction). Percentage of sows not eating differed significantly between parity groups in that sows older than third parity were spending more time eating than younger sows.

There was a significant interaction between parity group and escape possibility for number of skin lesions three weeks after mating. The number of skin lesions decreased with increasing parity group number in herds without escape possibilities, whereas in herds with escape possibilities sows in parity group 2 had the highest number of skin lesions.

The number of acts of aggression at weaning increased with increasing parity group number. No significant effect of parity group or escape possibilities was found on acts of aggression three weeks after mating and no parity group × escape interaction was seen.

The probability of lying solitary was significantly higher for sows older than third parity than for younger sows. There was no effect of parity group, escape possibilities or interaction for lying solitary three weeks after mating.

No main effect of parity group, escape possibilities or interaction between parity group and escape possibilities were found for the FHA-tests.

Discussion

It was evident that young sows had a lower feed intake than older sows in the group feeding systems. 6% of all sows had a back fat depth of less than 10 mm at farrowing in the group feeding systems, compared to 2% in the individual feeding systems (results not shown). In addition, 11 out of 256 sows ate in less than 20% of all observations during feeding and four sows did not eat at all during the observations. In this study, all the sows were fed amounts of feed below their capacity for feed intake during pregnancy. We may, therefore, presume that the majority of sows were motivated to eat and that sows which did not eat were displaced from the feed or 'chose' to stay away to avoid acts of aggression. Taken together, the results indicate a serious welfare problem for the few sows unable to cope in this kind of system. Also, the apparent overfeeding of the older sows in the group feeding systems may constitute both a welfare and a productivity problem. Locomotor problems and a low feed intake during lactation are well-known consequences of high feed intake during pregnancy (Kongsted 2005).

Three weeks post mating, after sows had been relocated to the pregnancy unit, first parity sows had significantly more lesions than older sows in herds with no escape possibilities. Conversely, in systems with escape possibilities, where first parity sows have more chances to avoid the older and probably more dominant sows, the second and third parity sows had the highest number of skin injuries.

Several studies have found a positive correlation between parity and rank (Arey & Edwards 1998). The findings of this study seem, therefore, to be in accordance with previous experimental works in which mixing of sows into small groups (ie little free space available) led to the highest level of skin injuries (Olsson & Svendsen 1997) and cortisol

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Table 1 Overall mean and variation shown as the 5% (P5) and 95% (P95) percentiles for all continuous indicators (sow level).

	n	Mean	P5	P95
Back fat at weaning (mm)	551	15	9	23
Back fat three weeks after mating (mm)	524	16	10	24
Back fat gain from weaning to three weeks after mating (mm per day)	481	0.03	-0.08	0.16
Not eating three weeks after mating (%)	299	27	0	74
Number of lesions at weaning	554	2	0	12
Number of lesions three weeks after mating	543	37	3	86
Number of aggressions at weaning	552	4.0	0	13
Number of aggressions three weeks after mating	479	1.5	0	5

Table 2 Mean and 25% (Q25) and 75% (Q75) quartiles for all categorical indicators (% sows per batch).

	n	Mean	Q25	Q75
Lying alone at weaning	52	25	0	11
Lying alone three weeks after mating	55	8	10	30
Fearful (FHA-test 1) three weeks after mating	56	47	30	60
Fearful (FHA-test 2) three weeks after mating	56	48	30	66

Table 3 Effect of parity group on back fat (mm), back fat gain (mm per day), eating behaviour (not eating in % of all observations around feeding), number of aggressive interactions involved in, number of skin lesions and lying behaviour (% lying alone). LS-means and number of sows in parentheses.

	Parity			*P*-values	
	1st	2nd - 3rd	>3rd	Parity	Parity × system
Back fat three weeks after mating					
Group feeding	13.5 (79)	15.9 (131)	18.3 (87)	-	< 0.01
Individual feeding	14.4 (68)	15.3 (74)	16.0 (88)		
Back fat gain from weaning to three weeks after mating					
Group feeding	0.012 (72)	0.042 (123)	0.062 (80)	-	< 0.05
Individual feeding	0.019 (65)	0.026 (65)	0.029 (75)		
Not eating three weeks after mating	24.8 (66)	23.6 (120)	16.4 (79)	< 0.05	-
Skin lesions three weeks after mating					
+ Escape	31 (48)	32 (60)	22 (87)	-	< 0.01
- Escape	35 (104)	28 (151)	14 (93)		
Aggressions at weaning	2.3 (153)	3.1 (217)	4.5 (181)	< 0.001	-
Lying alone at weaning	0.6 (67)	0.6 (103)	0.8 (82)	< 0.05	-

in plasma (Tsuma *et al* 1996) in the low ranked sows; whereas mixing into large groups led to the highest level of cortisol in the intermediate sows (Mendl *et al* 1992).

Group housing of non-lactating sows benefits animal welfare to a degree in terms of social contact and freedom of movement. However, the results of this on-farm study emphasise a need for management initiatives to consider the requirements of the individual sow, particularly younger individuals. This is of particular significance in systems with small group sizes and group feeding systems.

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