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Positive handling in late pregnancy and the consequences for maternal behaviour and production in sows

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Abstract

Fifty-two sows were subjected to a human approach test (HAT) at 2 weeks, and again at 3–4 days, before expected farrowing. Latency to contact and time spent exploring the experimenter, and overall confidence score (1 = low to 6 = high) were recorded. Fifty percentage of the sows received positive handling for 1 min twice daily, 5 days a week from first HAT to farrowing, whilst the others were controls without additional handling. Behaviour was video-recorded from 2 days before until 4 days after farrowing.

In the first HAT, 37% of sows immediately made contact with the experimenter (score 6), whereas 20% withdrew (scores 1 and 2). To give the sows a positive association to the handler, feed rewards were given. The sows accepted a feed nut from the hand significantly sooner than petting ($P = 0.05$). After 2 weeks of handling, the confidence score had increased significantly ($P < 0.001$), but a similar tendency occurred for controls ($P = 0.06$). For the most fearful sows (scores 1 and 2), the handling procedure resulted in a major increase in confidence score ($P < 0.001$).

There were no significant differences in piglet mortality or early lactation piglet weight gain between treatments. In the control group, sows with a high (6) initial confidence score tended to have shorter farrowing duration than sows with a low (1 or 2) initial confidence score ($P = 0.07$). For sows

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with a low initial confidence score, the positive handling resulted in a shorter farrowing duration, but the effect was not significant. In the last 8 h before farrowing, positively handled sows also tended to rest more than sows in the control group.

Keywords: Positive handling; Sows; Fear; Maternal behaviour; Piglet mortality

1. Introduction

Fear of humans is an important welfare indicator for many reasons. First of all, fear reactions are the most immediate responses that the animals show to potentially dangerous stimuli in the environment. Secondly, it is associated with physiological stress and has negative effects on growth, food intake (performance), important health parameters (immune status) and, not least, reproductive performance (Gonyou et al., 1986; Hemsworth et al., 1981, 1986, 1987, 1989, 1994, 1999; Boissy, 1995; Jones, 1997; Janczak et al., 2003a). Fear responses to humans show great similarities between different species of farm animals, and can be easily monitored both under experimental conditions (e.g. Janczak et al., 2003b), and on commercial farms (e.g. Hemsworth et al., 1994). Furthermore, fear responses are fairly consistent over time (i.e. represent a part of personality; Janczak et al., 2003b). Because of the many negative effects of fear of humans, this is an important measure of welfare as well as of great economic interest to the farmer. Even in larger herds, where handling may be minimised by increased technology and more effective handling facilities, there will still be situations where direct contact with the animals is necessary. Positive and consistent handling should therefore be of great importance in any production system.

What is positive handling? To be approached and touched by humans is not necessarily positive from the animal's point of view unless the animal associates something positive with this handling. It is sometimes assumed that talking to and petting the animals is perceived as rewarding in itself. However, the handling is only positive when the animal's behavioural responses during the actual treatment are positive (i.e. when it is perceived as something positive by the animal). This implies approach/seeking contact, but no avoidance, aggression or immobility.

In commercial practice most farmers would agree that using controlled and slow movements (patience), friendly voice, and a portable board for helping the sows in the right direction are all examples of positive interactions with the animals, whereas shouting, sudden and threatening movements and slapping/kicking the animals represent something negative. However, it is important to note that the effects of unpleasant treatments, such as forcing the pigs away whenever they approach may result in similar stress responses to inconsistent handling involving both positive and negative treatments (Hemsworth et al., 1987). It should thus be assumed that petting animals is positive only to the extent that the animals are exposed to this treatment regularly and associate something positive with this interaction.

Although, the individual fear level and the maternal abilities may be set at an early age (Janczak et al., 2003a), positive and consistent handling later in life may also have a great

impact on variables related to maternal abilities and piglet survival (e.g. Hemsworth et al., 1981, 1987, 1989). In contrast to the results found when comparing positive and negative handling treatments, very few differences in production variables have been found when comparing minimal handling (control) and positive (pleasant) handling in pigs (English et al., 1999). From the above-mentioned studies, it is clear that long-term pleasant handling during pregnancy has a positive impact on sow productivity, but the effect of short term handling in late pregnancy is still not known. In addition, only a few experiments have focused on the effects of reducing the level of fear on maternal behaviour in sows per se (Thodberg, 2001). Thus, the aim of the study was to investigate the effects of short-term positive handling in late pregnancy on fear of humans and maternal abilities in sows, measured both as piglet survival and behaviours related to maternal protectiveness. Can positive and consistent handling in the last part of pregnancy modify fearfulness of sows at the time of farrowing, and reduce any negative effects that fear of humans has on reproductive performance and maternal protectiveness?

2. Materials and methods

A total of 50 crossbred sows (Landrace × Large White × Duroc), with different parities, were used in a randomised block experimental design to compare the consequences of two different handling regimes in the last 2 weeks of pregnancy.

The sows were fed once a day with a standard concentrated diet (3.0 kg of a diet with 13.2 MJ digestible energy and 131 g crude protein/kg) at 08:15 h. During pregnancy, the sows were housed in groups of five with individual feeding stalls, which were manually closed during feeding to prevent the sows from changing positions. The pens (2.3 m × 4.6 m, excluding the feeding stalls) had solid concrete flooring, and contained a kennelled lying place (2.3 m × 2.3 m) provided with straw bedding and an activity area with one drinking nipple. Fresh straw was added to the pens every morning.

The animals were provided from the experimental herd of the School of Agriculture, Food and Rural Development of Newcastle in the period between 1st of June and 27th of July 2002, where batches of 7–10 sows farrowed every week. All sows were subjected to a human approach test 13 days before expected farrowing, and repeated again 3–5 days before expected farrowing, just before moving the sows into the farrowing crates. Twenty-six sows were positively handled for 12 days before expected farrowing, and another 26 sows were used as controls. Two sows allocated to the positive handling treatment were subsequently culled because of health problems unrelated to the experiment. The handling procedure was conducted twice a day on 5 days a week (Monday–Friday), starting 12 days before expected farrowing and terminating at the day of farrowing. Since the actual farrowing sometimes happened on the day before or after expected farrowing, the handling period varied from 11 to 13 days.

The human approach test was conducted on individual sows in a separate experimental pen (3.2 m × 3.3 m) located in the dry sow unit. All the sows were familiar with the experimental pen, but they were still allowed to stay in the pen for 1 min before the test started. During the test, the experimenter, wearing one of the stock people's overalls, slowly and silently moved towards the sow, squatted down in front of the sow with the face

directed towards her at a distance of 20 cm, and with both arms resting on the knee. The experimenter kept this posture for 2 min (test period), and sow responses were scored in the following way: (1) the sow actively flees at a distance of more than 1 m from the experimenter, (2) the sow withdraws some steps away from or turns her head away from the experimenter, and stays there or continues with activity for the rest of the test period, (3) the sow withdraws some steps away from or turns her head away from the experimenter, but approaches the experimenter again and initiates physical contact within the test period, (4) the sow neither withdraws from nor approaches the experimenter, but remains in the same posture or continues with activity (no reaction, no fear), (5) the sow neither withdraws from nor approaches the experimenter for most of the test period, but initiates a brief contact in the very end of the test period (slightly positive reaction, no fear), (6) the sow approaches and initiates physical contact with the experimenter (positive reaction, no fear). Latency (s) to contact the experimenter and time spent exploring (nosing) the experimenter (s) was also recorded. This test was repeated after 1 week when the sows were moved to the farrowing crates.

During the handling procedure, the experimenter wearing a white coat (a different colour than the overalls used by the stock people) stretched one hand towards the nose of the sow, but at a distance of 10 cm, and gave her one small piece of sow feed nut (hidden in the palm of the hand) as soon as the sow voluntarily made nose contact with the hand. This contact was immediately followed by gently touching her head and neck for 10 s with the same hand. The experimenter also talked friendly and quietly to the sow. Total test duration was 1 min. If a sow did not approach the hand within 1 min, the feed nut was left in the trough. If a sow approached the hand immediately, the duration of the tactile contact remained the same (10 s), but the visual and vocal contact continued until 1 min had passed. When the sows were kept in groups in the dry sow unit, the handling procedure was conducted immediately after all the sows had consumed their food in the morning while the sows were still confined in the feeding stalls (at 08:15 h). The same procedure was repeated at 12:00 h. To make the sows enter the feeding stalls in the afternoon, a small amount (0.2 kg) of concentrates were put in the trough, and the handling procedure followed thereafter. The same handling procedure was conducted while the sows were kept in the farrowing crates during the last days (3–7) before farrowing. Human contact for the control sows was minimal and limited to necessary veterinary treatments, ordinary inspection, feeding, and cleaning of the pen.

Three to seven days before expected farrowing, the sows were moved to farrowing pens (2.4 m × 1.9 m) with crates (2.4 m × 0.6 m). These pens had partly slatted floors with a heated creep area for the piglets at one front corner of the pen. Shavings were provided on the solid floor area. At the time of farrowing, additional heat was provided at the rear end of the sow. Sows were fed a standard lactation diet (13.9 MJ DE, 171 g CP/kg) twice daily according to appetite. Water was freely available from a drinker within the feed trough. The sows were confined during the whole lactation.

The selected sows were continuously video-recorded from 2 days before until 4 days after farrowing. Eight cameras covering one farrowing pen each were connected to a multiplexer (Robot MV 16) and a videocassette recorder (Panasonic 6730).

Behavioural data and data on farrowing duration were collected from 11 sows with a high initial ‘confidence score’ (score 6; five control, and six positively handled) and 11

sows with a low initial 'confidence score' (score 1 or 2; five control and six positively handled) sows (a total of 22 sows). Nest building behaviour (rooting, pawing, etc.) and time spent lying were scored using instantaneous sampling with 10 min intervals during the 12 and 8 last hours before the onset of farrowing (birth of the first piglet). Time spent resting was also scored the first 8 h after farrowing. Percent of observations when the sows were nest building or lying were calculated. Inter-birth interval (min), farrowing duration (min), and time from the onset of farrowing to the first suckling (s) were recorded. Nursing interval, frequency and duration of non-rewarded and successful nursing bouts were recorded for 24 h from day 2 after farrowing. The number of times the sows were bar chewing was scored continuously for 12 h before expected farrowing.

Frequency and types of posture changes were recorded from the end of farrowing (last piglet born) until 48 h after farrowing. The following posture changes and behaviours were recorded:

1. rolling from lying laterally to ventrally and vice versa,
2. sitting up from lying,
3. standing up from lying or sitting,
4. lying down from sitting or standing.

In addition to information from videotapes, all the dead piglets were subjected to a post mortem examination to determine the cause of mortality. The piglets were weighed at birth and on days 1 and 3 after farrowing (day of farrowing = day 0). Production data were collected from 26 control sows and 24 positively handled sows (50 sows in total).

2.1. Statistics

To analyse the relationship between variables in the human approach test, a Pearson correlation was conducted. Independent-samples *t*-test was used to analyse differences in behavioural responses and mortality variables between handled and non-handled (control) sows. When comparing variables from the first and second human approach test, a Paired-samples *t*-test was used.

3. Results

3.1. Behavioural responses to human approach test and handling

As many as 37% of the sows could be classified with a high confidence score (score 6), initiating physical contact with the experimenter already in the first human approach test (Fig. 1). Twenty-four percent of the sows withdrew from the approaching experimenter at first, but approached again within the test period (score 3), whereas more than 20% of the sows fled or withdrew from the experimenter and stayed away for the rest of the test period (scores 1 and 2; Fig. 1). More than 40% of the sows initiated contact with the experimenter within 20 s from the start of the test, and 31.5% did not contact the experimenter at all

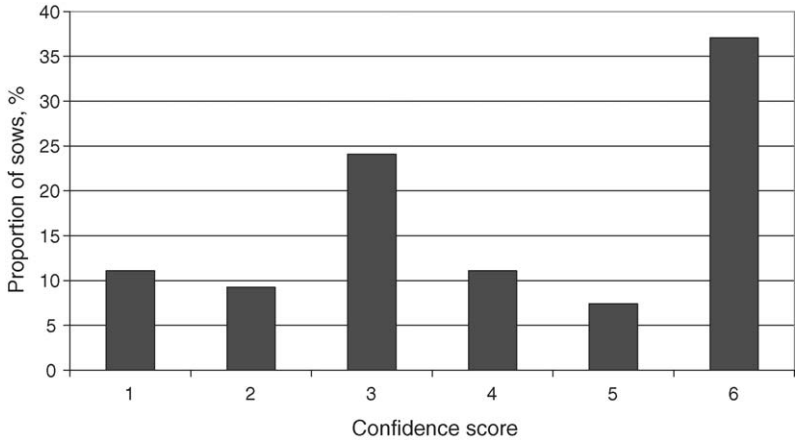

Fig. 1. Distribution of sows with respect to confidence score (1–6) before application of treatments.

(maximum latency of 120 s; Fig. 2). Mean exploration time in the first human approach test was 18.8 ± 3.0 (range 0–88 s).

A high confidence score in the human approach test was associated with a low latency (s) to contact the experimenter ($R = -0.8$, $P < 0.001$), and a long duration (s) of exploring the experimenter ($R = 0.6$, $P < 0.001$).

The sows accepted the feed nut significantly sooner (after fewer trials) than they accepted the petting (2.1 ± 0.5 versus 4.2 ± 0.8; $t = 2.0$, $P = 0.05$). Eighty-one percent of the handled sows accepted the feed nut on the first or the second trial (day 1), whereas only 44% accepted the petting (Fig. 3). After six trials (3 days), 81% of the handled sows had also accepted petting.

After 1 week of handling, the confidence of the sows towards the experimenter had increased significantly (confidence score in human approach test, test 1: 3.8 ± 0.4, test 2: 5.5 ± 0.2, $t = -4.4$, $P < 0.001$). Furthermore, the latency (s) to contact the experimenter

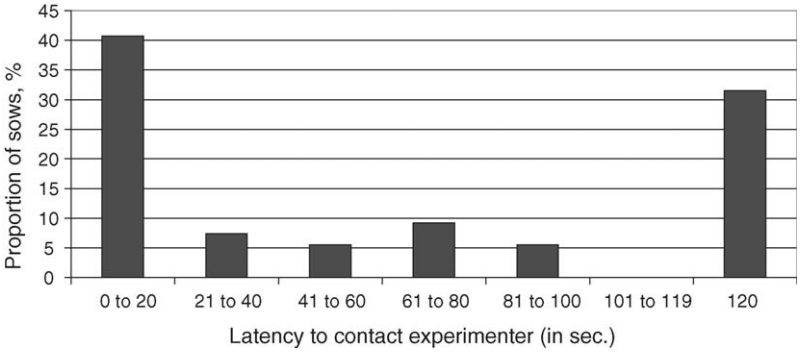

Fig. 2. Distribution of sows with respect to latency to contact the experimenter (s) before application of treatments.

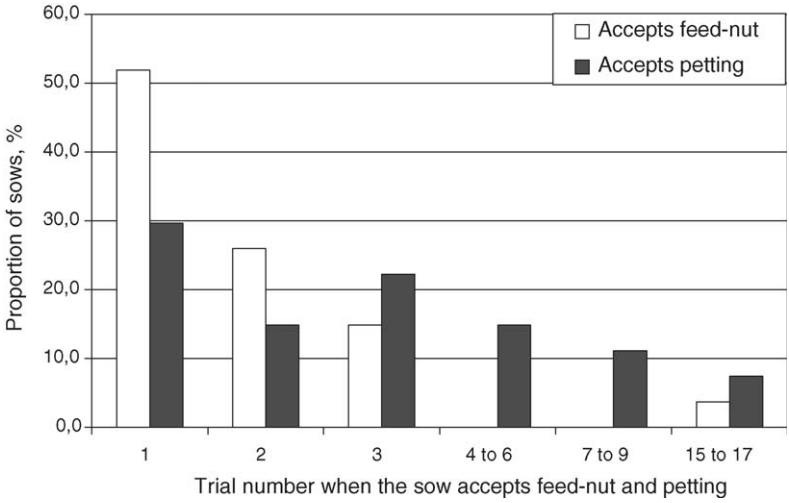

Fig. 3. Distribution of sows that accepted feed nut and petting over trials.

was significantly reduced (60.5 ± 10.5 versus 24.1 ± 8.4; $t = 2.6$, $P < 0.05$) and time spent exploring the experimenter was significantly increased (6.0 ± 2.1 versus 20.3 ± 4.1; $t = -3.8$, $P < 0.001$). A reduction in fear level between the first and second human approach test was also found in the control group (confidence score in human approach test, test 1: 4.1 ± 0.4, test 2: 4.8 ± 0.3, $t = -1.9$, $P = 0.06$; latency to contact experimenter, test 1: 56.2 ± 10.0, test 2: 32.9 ± 8.4, $t = 2.0$, $P = 0.06$; time spent exploring the experimenter, test 1: 6.4 ± 1.6, test 2: 17.4 ± 4.5, $t = -3.0$, $P < 0.01$), but the increase in confidence score was higher in the handled group than in the control group (1.7 ± 0.4 versus 0.7 ± 0.3, $t = 1.9$, $P = 0.07$).

For sows with a low initial confidence score (1 and 2), there was a highly significant increase in confidence score after handling from the first to the second human approach test (first: 1.5 ± 0.2, second: 5.2 ± 0.5; $t = -8.7$, $P < 0.001$). The same tendency also occurred in the control group but to a lesser extent (first: 1.4 ± 0.2, second: 3.8 ± 0.9; $t = -2.4$, $P = 0.07$).

3.2. Behavioural differences between control and positively handled sows

3.2.1. Nest building and activity around farrowing

There were no significant differences between positively handled and control sows in the number of observations where the sows were rooting or pawing on the ground in the last 12 h before farrowing (control: 92.5 ± 11.2 versus handled: 67.7 ± 15.1, $t = 1.3$, $P = 0.2$). Similar results were found for low confidence sows (control ($n = 5$): 71.0 ± 16.7, positively handled ($n = 6$): 94.8 ± 20.1; $t = -0.9$, $P = 0.4$).

In the last 8 h before farrowing, positively handled sows tended to rest more than sows in the control group (Fig. 4). There was no significant difference in the time spent resting during the first 8 h after farrowing between the positively handled and control sows (control: 95.4 ± 1.1 versus handled: 96.1 ± 0.8, $P = 0.6$).

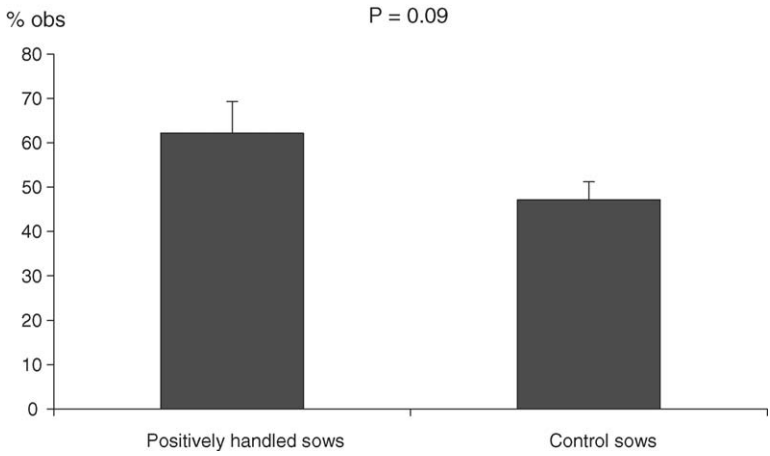

Fig. 4. Percentage of observations where the sows were lying in the last 8 h before farrowing.

3.2.2. Nursing behaviour

There was no significant difference in nursing duration (control: 7.1 ± 0.5 min versus handled: 6.3 ± 0.3 min; $t = 1.6$, $P = 0.14$) or nursing interval (control: 37.2 ± 2.8 min versus handled: 38.8 ± 2.3 min; $t = -0.5$, $P = 0.7$) between positively handled sows and control sows.

3.2.3. Posture changes

Positively handled sows did not differ significantly in the number of posture changes on days 1 and 2 after farrowing from the control sows (Table 1).

Table 1
Number of positional changes for sows in the positively handled and control groups on days 1 and 2 after farrowing

Posture changes	Control ($n = 11$)	Positively handled ($n = 11$)	t-Value	P-value
Day 1 after parturition				
Rolling (lying laterally to ventrally and vice versa)	2.6 ± 0.8	2.8 ± 1.1	−0.1	ns
Sitting up from lying	5.3 ± 1.2	6.4 ± 1.3	−0.6	ns
Standing up from lying or sitting	3.7 ± 1.4	3.5 ± 1.2	0.1	ns
Lying down from sitting or standing	6.7 ± 1.3	7.7 ± 1.7	−0.5	ns
All posture changes	18.4 ± 3.7	20.4 ± 4.3	−0.3	ns
Day 2 after parturition				
Rolling (lying laterally to ventrally and vice versa)	3.6 ± 1.0	3.6 ± 1.7	−0.1	ns
Sitting up from lying	7.2 ± 1.2	7.6 ± 2.4	−0.2	ns
Standing up from lying or sitting	3.5 ± 0.9	3.7 ± 0.7	−0.2	ns
Lying down from sitting or standing	8.1 ± 1.3	9.5 ± 2.4	−0.5	ns
All posture changes	22.4 ± 3.4	24.5 ± 6.2	−0.3	ns

3.2.4. Bar chewing

There was no significant difference in the frequency of bar chewing between control and positively handled sows in the 12 h before farrowing (high and low confidence sows—control: 9.7 ± 4.3 versus positively handled: 16.9 ± 10.4, $t = -0.6$, $P = 0.5$).

3.3. Differences in production parameters between control and positively handled sows

3.3.1. Farrowing duration

Control and positively handled sows did not differ significantly in farrowing duration (control: 334.8 ± 73.0 versus handled: 275.3 ± 33.9; $t = 0.7$, $P = 0.2$). For sows with a low initial confidence score, the positive handling resulted in a shorter farrowing duration, but the effect was not significant (positively handled ($n = 6$): 300.7 ± 53.3 min versus control ($n = 5$): 451,6 ± 13.6 min; $t = 1.0$, $P = 0.17$). In the control group, sows with a high (6) initial confidence score tended to have shorter farrowing duration than sows with a low (1 or 2) initial confidence score (high initial confidence score ($n = 6$): 237.5 ± 23.5 versus low initial confidence score ($n = 5$): 451.6 ± 149.2; $t = 1.7$, $P = 0.07$).

3.3.2. Piglet mortality

From a total of 50 litters with 520 live born piglets, and with a mean litter size of 10.4 piglets, mortality within the first 4 days after farrowing was 9.4 ± 1.8% (of live born), and the proportion of stillborn piglets (of total born) was 11.2 ± 2.1%. From the stillborn piglets, 3.2% were mummified or immature. Four percent of the live born piglets that died had not received any milk, and 5% were crushed (from these only 2% had not received any milk).

There were no significant differences in mortality variables between the control sows and positively handled sows (Table 2).

For sows with a low initial confidence score (1 and 2), the proportion of mummified or immature foetuses tended to be less for positively handled sows ($n = 6$) than for control sows ($n = 5$), but there were no significant differences in any of the mortality variables between control sows and positively handled sows within this group (Table 3).

Table 2
Mortality of piglets for control and positively handled sows

Mortality	Control ($n = 26$)	Positively handled ($n = 24$)	t-Value	P-value
No. of live born piglets	10.4 ± 0.6	10.4 ± 0.6	0.1	ns
Stillborn (% of total born)	12.2 ± 3.3	10.2 ± 2.4	0.5	ns
Mummified/immature	5.3 ± 3.1	2.1 ± 1.0	1.0	ns
Stillborn (mature)	6.9 ± 1.8	8.1 ± 2.2	−0.4	ns
Postnatal mortality (% of live born)	7.1 ± 2.1	11.7 ± 3.0	−1.3	ns
Not received any milk	2.3 ± 1.0	5.6 ± 1.7	−1.7	ns
Crushed (not received milk)	2.4 ± 1.1	0.6 ± 0.6	1.4	ns
Crushed (received milk)	2.1 ± 1.1	5.1 ± 2.0	−1.4	ns

Table 3
Mortality of piglets for control and positively handled sows with a low initial confidence score (1 and 2)

	Control ($n = 5$)	Positively handled ($n = 6$)	t-Value	P-value
No of live born piglets	11.4 ± 1.5	11.8 ± 0.6	−0.28	ns
Stillborn (% of total born)				
Mummified or immature	6.3 ± 2.8	1.1 ± 1.1	1.8	0.10
Stillborn, mature	8.9 ± 4.7	7.1 ± 3.5	1.1	ns
Postnatal mortality (% of live born)				
Not received milk	3.3 ± 3.3	7.8 ± 5.1	−0.7	ns
Crushed (not received milk)	0.0 ± 0.0	0.0 ± 0.0		ns
Crushed (received milk)	1.5 ± 1.5	3.1 ± 2.0	−0.6	ns

The number of live born piglets tended to be higher for sows with a low initial confidence score (scores 1 and 2) than for sows with a high initial confidence score (score 6) both within the group of control sows and positively handled sows, respectively (control sows: low confidence score, 11.4 ± 1.5 versus high confidence score, 8.8 ± 1.9; $t = -1.9$, $P = 0.09$; positively handled sows: low confidence score, 11.8 ± 0.6 versus high confidence score, 8.6 ± 1.3; $t = 2.2$, $P = 0.05$). Concerning the other mortality variables, there were no significant differences between sows with a low versus high confidence score.

3.3.3. Piglet weight gain

There were no significant differences in the mean piglet weight on day 1 after farrowing or piglet weight gain from day 1 to 3 after farrowing between control sows and positively handled sows (mean piglet weight on day 1, control: 1.7 ± 0.06 kg versus positively handled: 1.7 ± 0.07 kg, $t = 0.7$, $P = 0.5$; mean weight gain from day 1 to 3, control: 0.3 ± 0.03 kg versus positively handled: 0.3 ± 0.03 kg, $t = -0.1$, $P = 0.9$).

For sows with a low confidence score, there were no significant effects of handling on piglet weight on day 1 after farrowing or piglet weight gain from day 1 to 3 (mean piglet weight on day 1, control: 1.6 ± 0.1 kg versus positively handled: 1.5 ± 0.2 kg, $t = 0.2$, $P = 0.8$; mean weight gain, control: 0.4 ± 1.0 kg versus positively handled: 0.4 ± 0.0 kg, $t = 0.3$, $P = 0.8$).

4. Discussion

This experiment emphasized the effects of short-term positive handling in the last 2 weeks of pregnancy on maternal behaviour in sows and piglet mortality. No significant effects were found either on maternal behaviour, piglet mortality variables nor piglet weight gain. Still, in accordance with previous findings (e.g. English et al., 1999; Janczak et al., 2003a), there was a clear tendency for a shorter farrowing duration in sows with a high initial confidence score (low fear towards humans) compared to sows with a low initial confidence score (high fear towards humans) within the control group. Furthermore,

among the sows that had a low initial confidence score, the positively handled sows also spent less time farrowing than the control sows. Another positive effect of the positive handling treatment was that the sows were resting more the last 8 h before farrowing. Older sows with a relatively high percent of stillborn piglets dominated the present study, and the number of live born piglets was thus lower than would have been expected from younger sows. This could also probably explain the relatively low postnatal mortality and the low variation in postnatal mortality in this study. It is questionable if 2 weeks of positive handling in late pregnancy is enough to outweigh the effects of a previous negative or at best a neutral relationship with humans. The effects of positive handling may also have been reduced by social stress during pregnancy since the sows were housed in groups. It is also shown that confining sows in late pregnancy may increase mortality compared to being loose (Otten et al., 2001; Tuchscherer et al., 2002; Kanitz et al., 2003). These sows were confined in farrowing pens 1 week before farrowing, and this may have affected the results. It is difficult to prevent other types of stressors in the environment to cover the effects of positive handling in these types of studies. An experimental set-up for further handling experiments would be to use extremes with respect to fear level and to study the effects of different handling treatments in these two types of individuals.

Previous finding by Janczak et al. (2003a), show that pigs with a high level of fear towards humans already apparent at 8 weeks of age have a longer farrowing duration and a higher piglet mortality in their first born litter. This means that fear towards humans at an early age could have a great impact on maternal abilities. Thus, we should also expect a larger effect on positive handling in sows with a low initial confidence score than in highly confident sows.

There was a strong relationship between the different measures of sow confidence towards humans (latency to contact, exploration time, scoring from 1 to 6) in the present experiment, and the scoring system from 1 to 6, six being the most confident, can be considered equivalent to the other and more traditional measures (e.g. possible measures of fear: Hemsworth et al., 1994; Grandinson et al., 2003; Janczak et al., 2003b). The positive handling treatment involving a 2 min-vocal and physical contact after accepting feed rewards resulted in a major reduction in the fear towards humans already after 1 week in the present study, especially for the sows with an initial low confidence score. Interestingly, the sows accepted the feed nut sooner than they accepted the petting. This underlines the importance of making a positive association to human contact, and in that sense the handling procedure was successful. This also shows that, despite the fact that fear towards humans as a part of the personality in pigs is set at an early age (Janczak et al., 2003b), a short period of rewarding (positive) experience with humans for the sows is enough to form positive associations and reduce the level of fear. A handling treatment is positive whenever the behavioural indicators during the actual treatment are positive (i.e. when it is perceived as something positive by the animal). A positive response is when the animal voluntarily seeks contact and when no fear response is expressed. Reduced fear can also be achieved because of habituation through forced handling, but this is still not perceived as a positive interaction by the animal and is thus less efficient in learning them to cope with humans as a stressor in the environment. Regular close exposure to people can also give some degree of habituation, as demonstrated by the control sows in this experiment. However, consistency in the positive treatment is also of great importance since inconsistent handling both

involving positive and negative treatments, gives similar stress responses as unpleasant treatments (Hemsworth et al., 1987).

In conclusion, the present study showed that short-term positive handling in late pregnancy in low confidence sows greatly reduced fear towards humans. There was also a slight tendency for a longer resting time before farrowing and a shorter farrowing duration for positively handled sow compared to control sows. On the other hand, this positive treatment had no significant effects on piglet survival or weight gain in the first week after farrowing.

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