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Sow behaviour involved in the crushing of piglets in outdoor farrowing huts—a brief report

Caroline Vieuille^{a,*}, François Berger^{b,1}, Gilles Le Pape^a,
Dominique Bellanger^c

^aDESCO, Faculté des Sciences de Tours, Parc de Grandmont, 37200 Tours, France

^bChambre d'Agriculture de la Mayenne, Service Elevage, 19, rue de l'Ancien Evêché,
B.P. 1229, 53012 Laval Cédex, France

^cChambre Régionale d'Agriculture des Pays de Loire, 61, Av. J. Joxé,
B.P. 325, 49003 Angers Cédex 01, France

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Abstract

This study focuses on maternal activities involved in the trapping of piglets by the sow's body in outdoor farrowing systems and examine the mother–piglet context leading either to the death of piglets or to their survival. The behaviour of six Large-White × Landrace sows and their litters was continuously video recorded at their first and second parity, during the 40 h following parturition. Crushing mainly occurred at evening and night, during the first 12 h of farrowing and involved changes between lying, sitting and standing positions, as well as between udder and side lying. No piglet died from savaging. Nevertheless, aggressive behaviours of sows were observed, particularly in their first maternal experience. The immediate context of trapping was related to the labour of the sow and to the feeding and resting of piglets. The immediate crushing context was related to active avoidance of restless piglets while lying down, as well as sitting and standing behaviours. These results are discussed in terms of differential reactions of the sow to suckling attempts of piglets.

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1. Introduction

The high level of neonatal piglet mortality remains an important problem for European pig producers in outdoor keeping of breeding sows (Edwards, 1994; Mortensen et al., 1994;

* Corresponding author. Tel.: +33-2-47-36-69-96; fax: +33-2-47-36-72-85.

E-mail address: vieuille@univ-tours.fr (C. Vieuille).

¹ Present address: ERCA BIO, 162, rue du Bas des Bois, 53000 Laval, France.

Le Denmat et al., 1994). Compared to national indoor production, the piglet loss is higher in outdoor conditions, especially for the second litter and this was consistent for 10 years (Berger et al., 1997). Some factors appear to improve piglet survival, such as a sufficient amount of straw (Chambre d'Agriculture, 1993), or the amount of grass on the paddock (Berger et al., 1997). Conversely, losses are higher in producers keeping watch on the sow's parturition (21.2% against 18.2%; Berger et al., 1997).

Most of the deaths occur within the first 48 h postpartum (Cronin and Smith, 1992; Chambre d'Agriculture, 1993) and death resulting from overlying by the sow counts for one-third of piglet's mortality (Svedensen et al., 1986) or more (Chambre d'Agriculture, 1993), even with the presence of anti-crushing systems (Berger et al., 1997).

The problem of piglet losses by crushing in outdoor pig production (Mc Glone and Blecha, 1987) leads to the need for better knowledge of the behavioural context in which death occurs. Moreover, in most studies results can be influenced by the presence of an observer inside the farrowing huts.

The aim of this study is to measure the behaviour of sows and their litters in the standard farrowing huts used in France, in order to identify which time periods and behaviours are involved in the crushing of piglets during the first two parities. We determined which movements were correlated to crushing and which behaviours were associated to the immediate context that led either to the mortality of piglets or to their survival.

2. Animals, materials and methods

Observations were carried out at Trinottières Experimental Station, France.

Six cross-bred Large-White × Landrace sows were video recorded over their first two parturitions. Sows were kept in groups during gestation and moved into 500 m² individual enclosures 1 week before the expected date of farrowing. In the middle of each paddock, there was a half-circle farrowing hut containing about 25–30 kg of straw.

Every 3 weeks, one sow per group was introduced into an enclosure with a hut specially equipped for night and day video recording. Two infrared video cameras were diagonally positioned under the top of the hut giving the largest vision. A microphone registered the sounds inside the hut and an infrared spotlight was used during the night. Frames were digitalised, then sent by Hertzian waves to a receptor. For each sow, continuous recording began 48 h before the expected date of farrowing and ended 48 h after the birth of the first piglet. Only the first 40 h following birth remained available for analysis with an acceptable picture quality.

Ethogram was issued from preliminary observations. Total time spent lying, sitting, standing and outside the hut was calculated, as well as the frequencies of 22 behavioural items (Table 1).

Each time a piglet was caught by the mother's body and was continuously squealing, the movement of the sow occurring just before the piglet's trapping was noted. The outcome for the piglet (death or survival) was recorded too.

Table 1

Description of the 22 behavioural items

Lying sow parturition movements	
Abdominal contraction	
Body tension posture	Stiffening of the whole body in lateral recumbent
Lying sow's movements related to piglets milking attempts	
Throwing out a piglet	Foreleg movements throwing out a piglet from udder massaging
Pushing back	Moving away from the piglet with a vigorous movement of the whole body
Shakes	Intermittent trembling shakes of the whole body
Start	Sudden movement with a start
Rolling up	Slight rolling movement exposing the lower teats
Rolling down	Slight rolling movement hiding the lower teats
Others lying sow's movements	
Head raising up	Raising the head watching
Foreleg scraping	Foreleg movement on the ground, not directed towards a piglet
Foreleg flexing	Slow flexing movement of a foreleg
Hind leg flexing	Slow flexing movement of a hind leg
Back movement	Vigorous back movement raising the body before getting up
Sitting, standing or walking sow's movements	
Rooting the nest material	Moving the straw with snout
Foreleg scraping	Scraping while standing or sitting
Chewing	Snout chewing movements
Walking	With at least two legs taking one or more steps
Posture transitions	
Transitions between standing, sitting, lying on the udder (udder), lying on one side (lateral)	Udder-stand, lateral-stand, sit-stand; stand-udder, stand-lateral; sit-lateral, lateral-sit, udder-sit, sit-udder, lateral-udder, udder-lateral
Threatening movements	Piglet-directed head movement with open mouth
Piglets activities	
Collective rest	At least three-fourths of the litter is asleep or without any activity
Collective suckling	More than 50% of the litter is suckling while the sow emits suckling grunts
Squeal	Acute continuous sound of a trapped piglet
Competition scream	High intermittent vocalisations around teats

In order to identify differences in the immediate context leading either to the survival or to the death of the caught piglet, a continuous recording of all mother's successive movements was performed during the 10 min before each crushing. Because all subjects were not continuously visible, only unambiguous events (such as squeals) were noted for piglets. We then searched earlier recordings for the most recent trapping by the sow with survival of the piglet and the same description of the previous 10 min was performed. This allowed a comparison between each crushing sequence and its upstream control sequence.

Daily climatic parameters (minimum and maximum temperatures, rainfall and wind speed) were recorded.

3. Statistical analysis

The non-parametric Spearman rank correlation test (Siegel and Castellan, 1988) was used to study the relationship between number of crushed piglets, litter size and climatic parameters.

The binomial test (Siegel and Castellan, 1988) was used to compare crushing and control sequences, survival being considered as “success” and piglet’s death as “failure”.

4. Results

4.1. Piglets trapped and piglets crushed

Eleven out of 414 piglets who were trapped under the mother’s body subsequently died (Table 2). Most of the crushing (9 out of 11) occurred between 4:00 p.m. and 4:00 a.m., which was a period with low human activity near the farrowing sows, and most of them (9 out of 11) occurred at the second parity. Three females did not crush any piglet at the first parity but did at the second one. One female crushed piglets at both parities and two females did not crush any piglet at any parity. Therefore, losses at second parities were mainly due to females that did not crush piglets at their first parity. A total number of 87 piglet-directed head threatening movements (from five sows in six) was recorded, but no piglet died from a mother’s attack. All threats occurred at the first parity. The number of crushed piglets was positively correlated with the size of the live litters ($r = 0.779$, $P = 0.004$), but not with the number of trappings by the mothers, nor the temperature, the rainfall or the wind speed. Most of the crushing (7 out of 11) and half of the trapping (214 out of 414) occurred within the first 12 h following the first piglet’s birth, which was a high mortality risk period.

Table 2

The total number of sow’s activities resulting in trapping a piglet by a part of the sow’s body (piglets trapped) and in the piglet’s death (piglets crushed) over the whole 40 h of observation

Sow’s activity	Number of piglets trapped	Number of piglets crushed
While lying		
Body movement	162	0
No apparent movement	86	0
Changes lateral \Leftrightarrow udder	26	2
While changing position		
Lie–sit	15	1
Sit–lie	15	3
Lie–stand	8	0
Stand–lie	31	3
Stand–sit	6	1
While standing		
Body movement	65	1
Total number	414	11

Table 3

The number of the sow's and piglet's successive behaviours during the sequences leading to a piglet's death (10 min before being caught) and sequences leading to its survival (10 min before being caught)

Sow's behaviours	Crushing sequences	Control sequences	<i>P</i>
Lying, back movement	0	8	1
Lying, abdominal contractions	7	27	0.9999
Lying, hind leg flexing	19	42	0.9991
Lying, shakes	46	66	0.9766
Lying, body tension posture	9	18	0.9739
Lying, foreleg flexing	4	10	0.971
Lying, body pushing back	8	1	0.019
Lying, body rolling down	8	1	0.019
Lying, foreleg scraping	34	12	0.0008
Walking	14	1	0.0005
Sitting, rooting nest material	11	0	0.0004
Standing, rooting nest material	25	4	0.00001
Piglet's behaviours			
Suckling, competition scream	0	5	1
Collective rest	1	10	0.9995
Squeal while being caught	11	0	0.0005

Binomial test probabilities were used to sort behaviours significantly related to one or the other outcome. Behaviours with the lowest *P*-values are significantly related to a piglet death, conversely behaviours with the highest *P*-values are related to a piglet's survival.

4.2. The successive behaviours leading up to a piglet being trapped by the sow's body

The behaviours related to the survival of piglets (Table 3) were farrowing movements of the mothers when lying down and collective rests, or feeding screams of piglets.

On the other hand, the sow's behaviours related to the death of piglets were lying escape movements from suckling attempts (pushing back), movements hiding the lower teats (body rolling down), scraping movements, trappings of piglets making them squeal, but also active sitting and standing behaviours.

5. Discussion

Although the term of crushing was used every time the piglet died after being trapped by the sow's body, the death can be immediate or postponed. It was called crushing when no movement of the trapped piglet appeared after a change in the sow's posture. Although piglets can die from injuries as well as from suffocation, a long time spent under a sow does not necessarily mean a dead piglet. For example, one piglet was still alive after spending 2 h and half-trapped under the sow.

Crushing of the piglets mainly resulted from the sow's transitions between lying/sitting/standing positions and from the rolling movements between lying ventrally and laterally. Dangerous movements for piglets in farrowing huts included some transitions already

described indoors, such as stand–lie and sit–lie (English and Smith, 1975; Edwards and Malkin, 1986; Svedensen et al., 1986), lie–sit and changes between udder and side (Weary et al., 1996), but also other movements, such as stand–sit and lie–stand.

The relationship between the total mortality and a large litter size was mentioned in previous studies, but mainly in indoor conditions. Our results suggest more precisely a relationship between the amount of crushed piglets and the number of piglets being alive around each sow. The widespread use of hyperprolific selected sows could be detrimental to the piglets welfare. Large litters contain more piglets with low birth-weight. Weaker piglets are likely to fail in suckling and need to warm themselves next to the mother, leading to a higher risk of being crushed.

The neonatal mortality by crushing did not occur when farmers were usually busy around farrowing paddocks. We did not record any crushing between 8:00 a.m. and 12:00 noon, when feeding and taking off dead piglets took place.

Five primiparous sows in six behaved aggressively towards some piglets, but this did not lead to savaging, which was also reported as a cause of death relating to the sow's behaviour (Cronin and Smith, 1992; Fraser et al., 1995). These aggressive mothers stood up after the birth of their first piglet and showed evident fear reactions when they neared it. In such cases, the sow's movement was to recoil suddenly while knocking against the hut's side. Later on, when piglets approached the sow when lying down or reached the udder, these mothers first responded by threatening them. We noticed that while piglets from primiparous females seemed quicker to move away from the mother when she suddenly changed her position, piglets from second parturition tended to stay beside the mother. The repeated experience of aggressive behaviours might lead piglets to become more reactive and therefore less easily crushed. In addition, primiparous sows seemed to be more responsive to the squeals emitted by trapped piglets than sows in second parity.

The immediate context of crushing was specified by continuous detailed observations. When piglets survived a trapping, the 10 min preceding the trapping appeared to be a relatively quiet period, with a mother reacting to birth labour while most of the piglets were resting and some were suckling.

When piglets died from trapping, the mothers seemed to be irritated during the previous 10 min. Sows performed a lot of scraping leg movements and also abrupt back body movements while some piglets were massaging the udder. As the sows were also engaged in active sitting and standing postures, we suppose that some teat contacts could lead to unpleasant or painful feelings for the mother, and then to position changes. The contrasted results from crushing versus control sequences suggest that suckling attempts might be perceived differently, according to the moment they take place. The sows seemed to tolerate them when they occurred during rhythmical grunts. Conversely, they looked much more reactive to non-feeding suckling. The sow's behaviour could be to try to move away from piglets. Although our sample size limits the impact of our results, they lead to research openings on this particular mother–piglet relationship. If the relationship between non-feeding suckling attempts and crushing is confirmed, technical accommodations to prevent crushing must take this into account. One method used in indoor farming consists in inhibiting the sow's movements. It reduces the incidence of crushing and overlying (Fraser et al., 1995), but also the sow's welfare. In outdoor huts, the presence of bottom anti-crushing bars has contradictory results on mortality depending on farms, and

consequently, cannot be generally considered as a reliable method. A third method consists in attracting piglets away from the udder outside feeding times. Indoor piglets are offered non-slippery carpets heated by lamps, but they seem to be attracted by the lamp only after the first 2 days of life and remain close to the udder before. Some farmers prefer to move the neonates under the lamp. In farrowing huts, the presence of nest accommodation for piglets might also be insufficient to attract them, but the piglet's thermal comfort could also be improved by increasing the amount of straw brought into the hut.

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