

Neonatal piglets are able to differentiate more productive from less productive teats



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ABSTRACT

A previously-validated method to induce variation in milk production between teats of the same udder that is not related to the ante-posterior location of the teat was used. In the first lactation, over half of the sows' teats (teats 1, 2, 5, 6, and 7 from 1 side of the udder, and teats 3, 4, and 7 from the other side) were sealed with tape so that they were non-functional (treated (TRT) teats), whilst the other six unblocked teats were left unblocked so that they were functional (control (CTL) teats). Sixty-four piglets in eight litters were observed on days 2 and 10 of the second lactation when all teats were available. Teat use, piglets' behaviour during nursings and growth performances were analysed according to a 2×3 factorial design including the position (anterior, middle and posterior) and the treatment (CTL vs. TRT) of teats as fixed factors. Analysis of the location of piglets along the udder at milk ejection revealed that teat use on day 2 was affected by position and treatment of teats, but teat use on day 10 was only affected by position. Moreover, on day 2, the total number of fights was greater for CTL than TRT teats (9.6 vs. 6.2 fights/day, respectively; $P < 0.001$) and the percentage of time the teat was suckled during post-massage was longer for CTL than TRT teats (54.9 vs. 44.7%, respectively; $P = 0.022$). Piglets that suckled preferentially from CTL teats in early lactation had an increased growth rate until the end of the post-weaning period (BW at day 56: CTL = 23.66 vs. TRT = 21.32 kg; $P = 0.004$). Current results confirmed that teats used in first lactation produce more milk in second lactation, and that piglets are able to detect this difference. When considering the whole litter, piglets had a preference for previously-used teats and competed to get access to them. We conclude that choice and competition of piglets for higher-producing teats happens in the early stage of lactation, during the establishment of the teat order and that suckling preferentially from such teats has long-term positive effects on piglets' growth.

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1. Introduction

Piglet growth during the first days following birth and throughout lactation is dependent on the quantity of colostrum and milk that they are able to obtain from the udder (Skok et al., 2007; Devillers et al., 2011). During their first three days of postnatal life, piglets progressively establish a teat order and by seven days of age, most of them suck almost exclusively from one teat or one pair of teats (Rosillon-Warnier and Paquay, 1984; de Passillé and Rushen, 1988). Afterwards, teat order becomes more and more stable and usually does not change after the second week of lactation (Hemsworth et al., 1976; Puppe and Tuchscherer, 1999). During establishment of the teat order, piglets have a preference for more anterior teats and compete among themselves to access those teats, especially the 2nd, 3rd and 4th pairs where most of the teat disputes

occur (Fraser, 1975; de Passillé and Rushen, 1989). The greater competition for access to middle/anterior teats leads to a lower teat fidelity and suckling stability (de Passillé and Rushen, 1988; Puppe and Tuchscherer, 1999; Skok and Škorjanc, 2013). The reason for this preference of piglets for more anterior teats has often been discussed. Two hypotheses have been suggested: (1) anterior teats naturally produce more milk (Kim et al., 2000) and/or (2) piglets are attracted by the dam's rhythmic grunts during the nursing bouts, and thus, motivated to be closer to her head (Jeppesen, 1982). The increased growth rate observed in piglets suckling anterior vs. posterior teats could be an obvious consequence of the first hypothesis (Kim et al., 2000; Skok et al., 2007), but it could also be explained by the second hypothesis. Indeed, it was proposed that milk production is increased by the previous post-ejection stimulation of the mammary gland, also called post-massage (Algers and Jensen, 1985; Špinková and Algers, 1995; Jensen et al., 1998). A bigger and healthier piglet can exert a more vigorous stimulation of the mammary gland, thereby increasing milk production and piglet's weight gain. Competition for anterior teats based on their proximity to the

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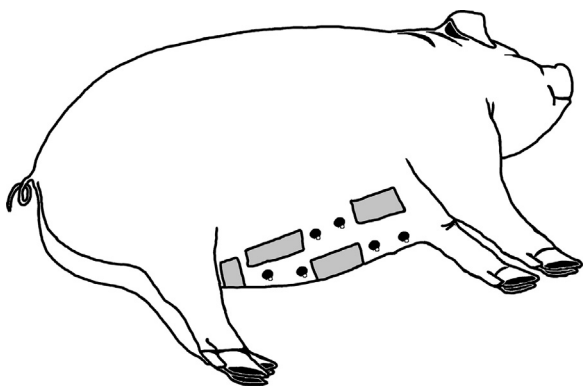


Fig. 1. Teats that were blocked in first lactation. The position of treated teats was swapped between right and left sides for half of the sows.

sow grunts would then make these teats more productive because of the positive effect of post-massage. This 'virtuous cycle' would also explain why a greater birth weight generally increases growth during the whole lactation period (Devillers et al., 2007; Devillers et al., 2011). However, no major influence of birth weight on teat order has been demonstrated, except for a clear tendency for piglets sucking most posterior teats to be lighter in weight (Fraser et al., 1979; Kim et al., 2000). It was therefore proposed that the competition between piglets for access to teats aims at gaining access to a functional teat rather than at gaining access to anterior or more productive teats (de Passillé and Rushen, 1989), and that such competition could even be a simple epiphenomenon (Hudson and Distel, 2013). Hence, it is still unclear whether piglets can detect more productive teats and, should that be the case, if they would fight to get access to them.

In a previous study, it was demonstrated that mammary glands that were sucked during the first lactation produce more milk during the following lactation when compared with teats that were not used before (Farmer et al., 2012). The methodology used in this previous research was used again in the present study and adapted in order to induce variation in milk production between teats of the same udder that is not related to the ante-posterior location of the teat. The objectives of the present study were to determine: (1) if piglets are able to detect a difference between teats that were used (control) or not (treated) during previous lactation, (2) if piglets have a preference for teats depending on their treatment or their location and if this preference changes over time, and, finally, (3) if this teat preference has an impact on the piglets' nursing behaviour or growth performance.

2. Materials and methods

2.1. Animals and treatments

In preparation of the experiment carried out during the second lactation, eight first-parity sows (Yorkshire × Landrace) were bred with semen from a pool of Duroc boars and housed in farrowing crates (0.6 × 2.1 m) as of day 110 of gestation. Sows were selected to have 13 or 14 functional teats. During their first lactation a little over half of their teats (namely teats from one side of the udder for the 1st, 2nd, 5th and 6th pairs, and from the other side of the udder for the 3rd and 4th pairs, as well as teats from both sides of the udder for the 7th pair) were blocked with tape (Fig. 1) for the first 7 days post-partum so that they were non-functional (TRT, treated teats) and the six unblocked teats were functional (CTL, control teats). The side of each blinded teat was reversed for half of the sows to avoid any possible effect of side of the udder. Around birth, litters were standardized to 7 piglets of average litter body weight (all splayleg

piglets or piglets weighing <900 g and additional supernumerary piglets (lightest and/or heaviest) were euthanized or fostered to non-experimental litter during the farrowing process) and at 48 h post-partum, the number of piglets in the litter was reduced to 6 so that there was one piglet per available teat. After weaning, sows were bred on the second estrus.

Observations and measures were done during the second lactation when all teats were available to piglets. After birth, litter size was standardised to 9 piglets of average litter body weight (as for first parity) and at 48 h post-partum, the number of piglets in the litter was reduced to 8 so that there was more than one piglet per CTL teat to induce some potential competition for these teats. Piglets were weighed on days 2, 4 (exactly 48 h after the day 2 weighing), 7, 14, 21, 35 and 56 post-partum. No creep feed was distributed to piglets until weaning (on day 17 ± 1, in order to be comparable with Farmer et al., 2012) and they had no access to the sow's feed, so that the growth of piglets before weaning is representative of their milk intake. Piglets were also scored for presence or absence of facial lesions, which were mostly superficial scratches, (i.e. on the snout, ears and the rest of the head) on days 4 and 14. In the two instances where a piglet presented more severe open wounds on the face, they were treated promptly (topical application of Vaseline® with Tetracycline HCl (200 mg/g)).

Animals were cared for according to the Canadian Council on Animal Care guidelines (CCAC, 2009) and the protocol was approved by the institutional animal care committee of the Dairy and Swine Research and Development Centre (Sherbrooke, Québec, Canada, authorisation #332).

2.2. Behavioural measures

Nursing behaviour of piglets was observed during the second lactation. On days 2 and 10 post-partum, behaviour was recorded for 24 consecutive hours, using video cameras (Panasonic WV-CP 480, Panasonic Canada Inc., Mississauga, ON, Canada) and a digital recording software (Omnicast, Genetec Inc., Montréal, QC, Canada) at the rate of 5–7 frames/s. Piglets and sow's teats were previously numbered with a felt pen so that they could be identified individually. A nursing was defined as the period where at least half of the piglets were active at the udder. A productive nursing was defined as a nursing with a milk ejection, corresponding to a period of synchronised fast sucking movements by the piglets. On both days, each nursing was observed continuously and the following measurements were recorded: duration of the pre-massage (from beginning of the nursing to beginning of milk ejection), duration of milk ejection and of post-massage (from the end of ejection to end of the nursing), duration of the interval between nursings (from the end of the previous nursing to the beginning of the nursing considered), whether the nursing was ended by the sow changing posture or moving, and whether the nursing was productive or not (presence or absence of a milk ejection, respectively). The position of each piglet on teats was noted at milk ejection and different variables were calculated from these observations (see Table 1 for definitions) to characterise teat use (occupation rate, teat retention, number of users per day, total number of fights per day) and piglets' behaviour (teat maximal fidelity, number of teats sucked, number of missed nursings). On day 2, each piglet was also continuously observed during each nursing over a 24 h period and additional variables were calculated (see Table 1) to characterise teat use further (number of switches per nursing, percentage of time suckled, total duration of fights per day) and piglets' behaviour (number of teat changes per nursing, percentages of time suckling and fighting, initiator and winner of each fight). A piglet was considered as using a teat if it was massaging or sucking actively the teat. Any piglet lying motionless at the udder for more than 3 s was not considered using a teat anymore even if it had the teat in the mouth, until it

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