LACTATION SUCCESS

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ABSTRACT

Lactation success is key to the profitability of a farrowing unit and producers are now faced with an increased challenge because of the current use of hyperprolific sow lines. Numerous factors come into play to affect lactation success and one major aspect which has been overlooked in the past is mammary development. The current overview will succinctly cover various factors that can affect sow milk yield and will then focus on mammary development, namely, when it happens, how it happens and what can be done to stimulate it. Lastly, results from a project looking at the importance of teat use in first lactation for its milk yield in second lactation will be presented.

SOW MILK YIELD

Sow milk yield is the main determinant of piglet growth rate as it is the only source of energy for suckling piglets. Sows do not produce enough milk to sustain optimal growth of their litter and this problem was made worst with the current use of hyperprolific sow lines. Milk yield is influenced by numerous factors such as litter size, parity, nutrition, genetics, management, environment and endocrine status. Yet, one important factor that is often overlooked is mammary development. Indeed, sow milk yield is dependent on the number of milk-producing cells that are present in mammary glands at the onset of lactation. There is a positive correlation between the number of mammary cells and piglet growth rate. Periods with relatively high mammary growth are of particular interest since it is during those periods that mammary growth may be susceptible to being stimulated by nutritional or hormonal manipulations.

MAMMARY DEVELOPMENT IN SWINE: HORMONAL CONTROL

Mammary development in swine occurs at 3 developmental stages: from 3-months of age until puberty, during the last third of pregnancy, and during lactation. It is controlled by a complex interaction of various hormones. During gestation, estrogens and prolactin are essential for mammary development and relaxin is also needed to stimulate total mammary gland growth. Few studies have looked at the effect of providing hormones on mammary development. Gilts receiving injections of porcine prolactin for a period of 28 days, as of 75 kg BW, increased their mammary development (based on visual appraisal) and also had lacteal secretions already present (McLaughlin et al., 1997). Interestingly, the degree of mammary gland development did not appear to be related to the dose of prolactin injected. A further study where gilts were slaughtered and mammary development actually measured, confirmed that injections of porcine prolactin to gilts for a period of 29 days, starting at 75 kg BW, stimulate mammary development at puberty (Farmer et al., 2005). Yet, the impact of
such a treatment on subsequent milk yield is not known. Furthermore, porcine prolactin is not currently available commercially.

**CAN PREPUBERTAL NUTRITION AFFECT MAMMARY DEVELOPMENT?**

Nutrition does influence mammary development in growing gilts, yet, data on the subject is sparse (see review by Farmer, 2013). Either a 20% or a 26% feed restriction from 90 days of age until puberty drastically reduces mammary tissue mass (Table 1).

**Table 1. Effects of feed-restriction and reduced protein intake during prepuberty on mammary parenchymal mass at puberty.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Parenchymal mass</th>
<th>Statistical significance</th>
<th>Reference</th>
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<tbody>
<tr>
<td>Control gilts</td>
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<tr>
<td>34% feed restriction from days 28 to 90</td>
<td>69.9 g/gland</td>
<td>65.4 g/gland</td>
<td>Not significant</td>
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<td></td>
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<td>Sorensen et al. (2006)</td>
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<tr>
<td>26% feed restriction from days 90 to 170</td>
<td>81.6 g/gland</td>
<td>53.7 g/gland</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sorensen et al. (2006)</td>
</tr>
<tr>
<td>20% feed restriction from days 90 to 202</td>
<td>344.9 g/udder</td>
<td>254.3 g/udder</td>
<td>Significant</td>
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<td></td>
<td></td>
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<td>Farmer et al. (2004)</td>
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<tr>
<td>Reduced dietary crude protein (14.4 vs. 18.7%)</td>
<td>344.9 g/udder</td>
<td>377.3 g/udder</td>
<td>Not significant</td>
</tr>
<tr>
<td>from days 90 to 202</td>
<td></td>
<td></td>
<td>Farmer et al. (2004)</td>
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On the other hand, earlier feed restriction, from 28 to 90 days of age, did not affect mammary development at puberty (Table 1). Furthermore, lowering protein intake (14.4 vs. 18.7% CP) during the period from 90 days of age until puberty does not hinder mammary development of gilts (Table 1). Composition of diets fed to prepubertal gilts influences their mammary development. Phytoestrogens are naturally-occurring plant compounds that can have estrogenic properties. They are present in large amounts in soya and one class of these phytoestrogens comprises the molecule genistein. Gilts fed 2.3 g/day of genistein from 3 months of age until puberty had a 44% increase in the
number of mammary cells at 183 days. On the other hand, dietary supplementation with flax as seed, meal, or oil during prepuberty brought about the expected changes in circulating fatty acids without any alteration in mammary development. Yet, when 10% flaxseed was supplemented from day 63 of gestation until weaning, beneficial effects (30.9% increase in parenchymal mass and 11.6% increase in number of parenchymal cells) were noted in the mammary tissue of the female offspring of these sows at puberty. This was the first demonstration of such an in utero effect and it opens new avenues in terms of potential management schemes to stimulate mammary development of gilts.

**NUTRITION IN LATE GESTATION AND LACTATION: EFFECTS ON MAMMARY DEVELOPMENT**

Effects of late gestation and lactation feeding on mammary development in swine were recently reviewed by Farmer (2013). During gestation, feeding very high energy levels (44 vs. 24 MJ ME/day) may have detrimental effects on mammary development and subsequent milk production whereas increasing the amount of dietary protein (16 vs. 4 g lysine/day) did not affect mammary development but may increase subsequent milk production. When manipulating body composition of gilts by changing their protein and energy intakes during pregnancy, overly fat gilts (36 mm backfat at the end of gestation) on a high energy-low protein diet had reduced mammary development (Head et al., 1991) and produced less milk than leaner gilts (25 mm backfat) at the same body weight (Head and Williams, 1991). However, backfat of gilts in that study was much thicker than what is normally seen and the ideal body condition required to ensure maximal mammary development in late gestation should be investigated further. Feeding in lactation also affects mammary development; an increase in weight of functional mammary glands is seen when sows are fed either more protein (65 vs. 32 g of lysine/d) or more energy (17.5 vs. 12 Mcal ME/d; Kim et al., 1999). It is therefore imperative to maximise sow feed intake during lactation.

**INVOLUTION OF MAMMARY GLANDS**

Mammary involution at weaning is an essential process of the mammary gland and much remains to be learned about it in swine. It is associated with dramatic changes occurring rapidly in the 7 to 10 days following weaning, with a loss of more than two thirds of the weight of mammary glands (Ford et al., 2003). Mammary gland involution also takes place in early lactation when a gland is not being suckled. It occurs rapidly during the first 7 to 10 days after farrowing and was irreversible after 3 days of non-suckling. On the other hand, involution is reversible after 24 h of non-suckling, but the “rescued” gland will never produce as much milk as if used right from the onset of lactation (see review by Farmer 2013).

**DOES TEAT USE IN FIRST LACTATION AFFECT ITS MILK YIELD IN SECOND LACTATION?**

With today's hyperprolific sow lines, swine producers are faced with a problem in their farrowing rooms: should they “load” the primiparous sows with as many piglets as possible or should they leave some teats unused to give these sows a “respite”. This is
particularly important in first parity sows with poor body condition, to avoid the “lean sow syndrome” that potentially leads to reproductive problems. New findings demonstrate for the first time that teats that are used in first lactation will produce more milk in the second lactation (Farmer et al., 2012). Indeed, piglets suckling teats which were previously used weighed 1.12 kg more on day 56 than piglets suckling a previously unused teat. Furthermore, development of a teat that was previously used is improved in the second lactation and piglets suckling teats which were not used previously show a greater level of hunger in second lactation. Interestingly, piglets seem to be able to differentiate between previously-used and -unused teats.

CONCLUSIONS
A combination of factors are involved in the control of sow milk yield and with the current use of hyperprolific sow lines it has become imperative to provide the best-adapted management and feeding strategies to improve upon it. Nutrition of replacement gilts and of late-pregnant sows requires special attention to ensure maximal mammary development and future milk yield potential. Management of first-litter sows can also impact subsequent lactation performances. We now know that teats which were suckled in first lactation produce more milk and have a greater development in second lactation than teats which were not suckled in first lactation. Such knowledge is critical for producers to make the best decision in terms of management strategies for their first-parity sows.

LITERATURE CITED