Current situation in commercial farms around farrowing and during lactation period

Nowadays, nearly one out of seven piglets dies before weaning in European commercial herds. Such a high mortality rate is a major source of economic loss and a subject for animal welfare concern.\textsuperscript{53}

The profitability of a pig enterprise is mainly influenced by the sow and litter performance. The sow performance is assessed by litter size and weight at farrowing, litter size and weight at weaning and number of farrowing’s per year. The litter performance before weaning is mainly influenced by the sow’s colostrum and milk yield. Colostrum contains natural growth factors for the normal development of vital life-sustaining organs.

The major role of colostrum is to provide the piglet with energy, passive immunity and in the development of the gastrointestinal tract of the piglet. Litter size, birth weight, number of parity, genotype, endocrine status, stress before, during and after farrowing and nutrition seem to influence colostrum and milk yield.\textsuperscript{54} To achieve good health and pre- and post- weaning growth a colostrum intake of 250 gram per piglet is recommended.\textsuperscript{55}

Research showed that 35% to 55% of the sows didn’t produce enough colostrum to provide for their litter.\textsuperscript{56} Literature also suggest that heat stress and stress around farrowing have negative effects on colostrum yield.\textsuperscript{57} Unlike milk yield, colostrum yield seems to be only moderately influenced by litter weight of born alive piglets and vitality at birth.\textsuperscript{58} In the first hours after farrowing, colostrum is ad libitum available, and nursing is asynchronous and continuous. Larger and heavier litters may take advantage of this phenomenon and be able to obtain a greater colostrum extraction from the mammary glands.\textsuperscript{59}

It is normal for polytocous species such as the pig to have intra-litter variation in birth weight. However, as sows were selected true time for ever larger litters, the variation in birthweight also increased. This is economically important because of its positive correlation with preweaning mortality and lower postnatal growth rates.\textsuperscript{60} The optimal birth weight of piglets lays between 1350 and 1500 g. The weight in a healthy piglet is primarily determined at the end of gestation. This is the reason why at the end of gravity the sows need optimal feeding conditions to ensure a high end weight for the piglets and without the sow losing condition.

In litters with high level of variation in birth weight, the smallest piglets are not able to compete with their heavier siblings for the best teats. Therefore, these animals consume a lower amount of

\begin{footnotesize}
\begin{itemize}
  \item H.Quesnel 2011
  \item King’ori 2012
  \item Quesnel et al 2012
  \item Quesnel et al 2012 ; Decaluwe et al 2014
  \item C. Farmer et al 2009
  \item Devillers et al 2007
  \item A.P. Machado et al 2016
  \item Wolf et al 2008
\end{itemize}
\end{footnotesize}
colostrum and have lower milk intake, which leads to poor acquisition of passive immunity and low nutritional status. Consequently small piglets are physiologically deprived of energy stores. Therefore they are more susceptible to hypothermia and have a lower capacity to maintain body temperature after birth. This lack of homogenous litters are resulting in higher mortality, less efficient production and more labor.

Nutrition is undoubtedly a major factor during gestation and farrowing. Recuperation of weight loss that occurred during previous lactation is best completed by day 75-80 of gestation. From this point onwards starts the development of the mammary gland. If the sows gains weight (fat) from this point, it is associated with fat build up in the mammary gland leading to less functional and active gland tissue. It also prevents metabolic disorders which may cause mastitis and can lead to a reduced colostrum and milk yield.

At farrowing it is a necessity that the birth canal has enough space to provide a fluent delivery of the piglets. This means that there can’t be too much content in the gastrointestinal tract and in particular the colon. To prevent constipation in sows it is important there is enough fiber present in the diet. This also prevents an overconsumption of water because the sow will have the feeling of a full stomach.

Moving the sows to the farrowing pen a few days before farrowing is common practice these days. In most cases it means that the sows will already get their lactation diet. This can give cause to less productive sows as mentioned above. Until farrowing it is recommend that the sows get the same diet as during the gravity period. Any overfeeding during gestation will systematically compromise the feed intake of sows or gilts in lactation to come.

Research has repeatedly shown that too restrictive feeding patterns in early lactation (to prevent udder congestion, hypogalactia, piglet scouring, sow constipation and off feed events) can reduce total lactation feed intake for two reasons; 1) Feed intake in the last three weeks of lactation is not influenced by the intake in early lactation; and 2) The lost feed intake opportunities of early lactation cannot be recuperated in the later stages of lactation.

These conclusions are widely accepted and documented with the body of evidence showing why lactation is such a crucial cornerstone of sow production and reproductive efficiency. Therefore, for the modern lean and prolific sow everything must be done to maximize lactation feed intake.

Literature statements about intrauterine growth restriction (IUGS), fetal growth and IGF-1

Individual fetal growth represents the culmination of interaction between the fetal genome and the intrauterine environment determined by maternal-placental function. There is also evidence that fetal growth as measured in late gestation, is dependent not only on the maternal environment but on events that occurred during the conception period (see chapter: Insulin, Growth hormone and Insulin-like growth factor I (IGF-1) concentrations and their role in reproduction).

The dominant fetal growth regulator in late gestation is IGF-1, produced by the fetal liver and other tissues. In contrast to the postnatal situation, the dominant regulator of IGF- production in the fetus is...
not growth hormone (GH) but fetal insulin. This fetal insulin is under regulation by fetal glucose availability. This proves that the fetal IGF-1 system and therefore fetal growth is sensitive to maternal nutrition. ⁶⁷

The dominant cause of growth retardation in mid and late gestation relates to a diminished supply of nutrients, including oxygen. Placental transport capacity and diffusion area, which is linked to uterine size and vasculature, are primary contributors. It has been proven that IGF-1 has an important role in the stimulation of angiogenesis (formation of new blood vessels) and also does it has a major influence in the development of the placenta ⁶⁸, allowing for a better nutrient exchange between mother and fetus. ⁶⁹

During intra-uterine growth restriction, growth factor-expressing genes like IGF-1 are tuned down by epigenetic modifications in the promoter regions of their DNA. This causes the sensitivity of fetal tissues to IGF-1 to be disturbed, resulting in smaller piglets that often never fully recover or reach their full genetic potential ⁷⁰. AhR-activation through administration of Lianol reverts the epigenetic silencing of growth factor genes that occurred in the unborn piglet. (See chapter: What is Lianol and how does it work)

It has been stated that fetal growth relies on optimal nutrient compartmentalization that occurs with high to normal levels of IGF-1 on both sides of the placenta. ⁷¹. The above mentioned effects of IGF-1 around farrowing highlights the importance of constant high IGF-1 plasma concentrations in the sow. It showed that growth retarded piglets can even gain weight in the last days before farrowing therefore increasing their chance on survival. But it can also help them and their siblings after farrowing through higher milk yields of the sow caused by higher cell division rates in the mammary gland. ⁷²

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Fig 7: Influence of IGF-1 on fetus and placenta

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⁶⁷ Oliver et al 1996
⁶⁹ Peter D. et al 2003
⁷⁰ Oliver et al 1996
⁷¹ C.T. Roberts et al 2007
⁷² R.F. Nicosia et al 1994
⁷² Qi Fu et al 2014
⁷² Bauer et al 1998
⁷² E. James squires. Applied animal endocrinology 2010
Supplementing your sows with the right additives before farrowing.

Trial 3: Walloon agricultural research centre

The use of 10 gram Lianol Solapro as topdressing per day per sow from 7 days prior to farrowing till 3 days post farrowing increases piglets vigour as well as colostrum intake and production.

Material & Method:
- Forty Belgian Landrace sows, divided over the control and the Lianol group.
- The Lianol group received 10 grams of Lianol Solapro per sow per day, during 10 days around farrowing (seven days prior till three days post farrowing). The control group had no treatment.
- IGF-1 serum levels where measured in sows, piglets and colostrum.
- Farrowing’s, number of piglets born alive and stillborn and feed intake were monitored as like colostrum intake to determine colostrum production.

Results:

<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>Lianol group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of piglets at birth (g)</td>
<td>1490</td>
<td>1504</td>
</tr>
<tr>
<td>Weight of piglets at 24hs (g)</td>
<td>1556</td>
<td>1629</td>
</tr>
<tr>
<td>Colostrum intake (g/24h)</td>
<td>293</td>
<td>353</td>
</tr>
<tr>
<td>Colostrum production (g/24h)</td>
<td>3064</td>
<td>3770</td>
</tr>
<tr>
<td>IGF-1 level in plasma sows (ng/ml)</td>
<td>29</td>
<td>69</td>
</tr>
<tr>
<td>IGF-1 level in plasma piglets (ng/ml)</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>

Conclusion:

Lianol® Solapro added to the feed of sows increased piglet vigor as well as colostrum intake and colostrum production. Also the IGF-1 levels of the sows after 4 days post-partum showed remarkable differences.
Trial 4: PVL Bocholt – Test and formation centre

The use of a 10 gram Lianol Vital bolus per day per sow 1 week prior to farrowing provides heavier piglets at birth.

Material & Method:
- 71 Topigs-20 sows, divided over the control and the Lianol group. With 1044 born alive piglets
- The Lianol group received a bolus of 10 grams Lianol Vital per sow per day, during 1 week prior to farrowing. The control group had no treatment.
- Piglet birth weight and ADG till weaning have been tested.

Results:

<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>Lianol group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of piglets at birth (g)</td>
<td>1330</td>
<td>1400</td>
</tr>
<tr>
<td>ADG till weaning (g/day)</td>
<td>213.4</td>
<td>229.5</td>
</tr>
</tbody>
</table>

Conclusion:

The use of Lianol® Vital bolus in sows prior to farrowing gave heavier piglets at birth with a higher average daily growth.