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Facilitating 'learning from mom how to eat like a pig' to improve welfare of piglets around weaning

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ABSTRACT

Piglets in commercial husbandry are weaned abruptly and at a rather young age. Many weanling piglets are poorly adapted to ingest solid food, often resulting in a period of underfeeding. The underfeeding generally leads to a poor growth, diarrhoea occurrence and the development of damaging behaviours such as belly nosing, indicating reduced welfare, in the immediate postweaning period. Weaning problems are multifactorial, but an early intake of solid food and reduced stress around weaning are major determinants of a quick adaptation of piglets to the new postweaning situation. In this paper we focus on improving welfare of piglets around weaning by allowing piglets to interact more with the sow during lactation, as would occur under more natural conditions. Besides providing piglets with more opportunity to learn from the sow about what, how and where to eat, we also discuss information transfer already before birth, perinatal flavour learning, and the merits of learning in an enriched environment.

Being able to interact more with the sow is important to reduce the reluctance of piglets to eat novel foods, to increase preweaning solid food intake, and to reduce the development of damaging behaviours and increase play behaviour after weaning. Perinatal flavour learning reduced stress around weaning and increased postweaning performance and welfare. Preweaning enrichment of the environment, by providing substrates and a larger pen, can increase preweaning growth and development of feeding-related behaviours before weaning as well as food intake after weaning. Postweaning enrichment increased growth and play behaviour, and reduced the occurrence of diarrhoea and damaging behaviours. When enrichment is provided before weaning it is important to also provide enrichment after weaning. Learning from the sow and environmental enrichment are important for piglets to more easily adapt to being weaned. We conclude with recommendations for application of these results in current and future pig husbandry systems to improve welfare of newly weaned piglets.

1. The challenge of weaning

Piglets in the wild experience a gradual weaning process that usually ends between week 14 and 17, in which mother's milk as a nutritional source is gradually replaced by the ingestion and digestion of solid food (Jensen and Stangel, 1992). Piglets in commercial intensive pig husbandry are often abruptly weaned between 3 and 4 weeks

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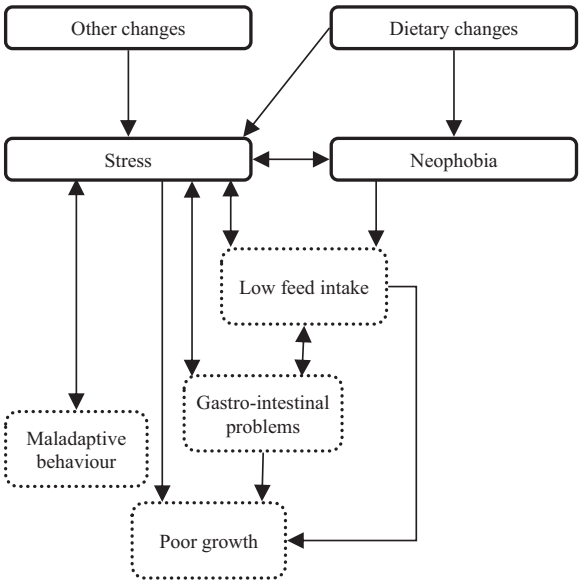

Fig. 1. Overview of weaning related problems. Dietary and other changes ultimately result in low feed intake, gastro-intestinal problems, poor growth and welfare problems
Figure reprinted from (Bolhuis et al., 2009) with permission from Wageningen Academic Publishers.

of age for economic reasons. EU legislation does not allow weaning before piglets are 28 days old, or 21 days when transferred to specialized, disinfected pens separated from the sows. Early-weaned piglets often have limited experience with solid food before weaning, with large within- and between-litter variation (Pajor et al., 1991; Bøe and Jensen, 1995). As a result they often have a period of variable but generally low food intake immediately after weaning, accompanied by a poor growth or weight loss and reduced welfare (Brooks and Tsourgiannis, 2003; Bolhuis et al., 2009, see Fig. 1 for an overview of weaning related problems). The period of fasting can result in malabsorption in the gut and consequently diarrhoea when piglets start to eat again. The malabsorption is caused by a shortening of villi in the small intestine, thereby slowing the maturation of the gut, as well as reducing enzyme activity (Ball and Aherne, 1982; Hampson, 1986; McCracken et al., 1999; Boudry et al., 2004; Smith et al., 2010; Zhu et al., 2012). Weaning can also result in inflammation and increased permeability of the gut, which in turn increases the chance of toxins and bacteria, for instance *Escherichia coli*, entering other tissues (Pluske et al., 1997; Spreeuwenberg et al., 2001; Moeser and Blikslager, 2007; Moeser et al., 2007). The compromised growth and high occurrence of diarrhoea may in addition lead to high costs for the farmer and high antibiotic use (Bruininx et al., 2001). Low food intake and diarrhoea occurrence are the major contributors to low performance around weaning. Diarrhoea is typically treated by administration of antibiotics for an extended period around weaning (MARAN, 2009). Reduction of antibiotic use in animal husbandry and human medicine is, however, of large importance, due to increased antibiotic resistance of certain bacteria.

Newly weaned piglets face many stressors in addition to being malnourished and experiencing intestinal problems that further negatively affect welfare. The stressors around weaning under commercial conditions generally consist of maternal separation, relocation, a new physical environment and thus a new microbial environment. Piglets are often exposed to unfamiliar piglets around weaning, which results in a period of vigorous fighting (Blecha and Kelley, 1981; D'Eath, 2005; Weary et al., 2008). Besides high levels of aggression, newly weaned piglets also tend to develop maladaptive behaviours such as belly nosing, mounting and oral manipulative behaviours such as chewing on another piglet's body (Dybkjær, 1992; Dudink et al., 2006; Torrey and Widowski, 2006; Gerritsen et al., 2009; Oostindjer et al., 2011d). These behaviours are not only indicators of high stress levels of the animal that performs the behaviour but can also compromise the welfare of the animal on which the behaviour is performed (Dybkjær, 1992; Dudink et al., 2006). Mixing of piglets and the move to a new environment both have major impacts on welfare in an additive way (Merlot et al., 2004; Hötzel et al., 2011; Colson et al., 2012).

These stressors, in addition to the underfeeding, can increase the incidence of diarrhoea (Rao et al., 1998; Taché et al., 1999). Many piglets have little experience with eating solid food during the lactation period, and will have to start eating solid food at weaning. Most individuals may experience some level of food neophobia, or a reluctance to eat unfamiliar foods, which may prevent an early sufficient intake of solid food right after weaning. The environment can influence food neophobia: a stressful situation (novel environment, anxiety) increases food neophobia, and thus limits the intake of unfamiliar food as has been demonstrated in rats, sheep and humans (Job and Barnes, 1995; Pliner et al., 1995; Burritt and Provenza, 1997), and may also play a role in low food intake in the immediate postweaning period in pigs. High stress levels can also directly affect the gastro-intestinal tract by changing motility and gastric emptying, again increasing the occurrence of diarrhoea (Rao et al., 1998).

2. Strategies to stimulate an early food intake

2.1. The importance of an early food intake

To prevent weaning associated problems, piglets should preferably start eating before weaning. Overall, there is a positive correlation between preweaning and postweaning food intake under commercial conditions (Berkeveld et al., 2007; Sulabo et al., 2010). Piglets classified as eaters preweaning, by use of chromic oxide as a visual faecal marker of creep feed intake, have their first solid food intake postweaning faster than piglets classified as non-eaters, show higher food intakes postweaning and have higher body weights in the early postweaning period, and a higher absorption by the small intestine, which is negatively correlated with postweaning diarrhoea (Bruininx et al., 2002; Kuller et al., 2007a,b).

Weaning age is one factor that affects how fast piglets adapt to the postweaning situation. Many studies show early weaning (e.g. 7 or 14 days) is detrimental for