

How flavour use in sows can improve piglet performance

While the weaning process in nature is gradual and takes several weeks/months, between 9-22 weeks of age, to be completed, in modern pig husbandry it is an abrupt transition at a very premature stage (3-4 weeks of age) in life.

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Weaning is associated with a critical period of underfeeding: some piglets refrain from eating for over 50 hours. The feed consumption immediately following weaning varies largely between animals, but is regularly, until days 3-4 after weaning, so low that it does not meet the requirements of ME for maintenance.

This low nutrient intake results in a low and variable growth rate or even weight loss in the first days after weaning. The abrupt transition reduces intestinal functionality leading to an increased susceptibility to enteric pathogens, with various digestive disorders as a result, which are commonly known under the term 'weaning diarrhoea'.

Continuity of feed intake

The low level of feed intake is the principle cause of reduced intestinal integrity rather than the composition of the diet or the subsequent relative overeating. Continuity of feed intake after weaning is therefore crucial to ensure intestinal functionality.

Many attempts have been made to improve attractiveness and palatability of the weaner feed to increase post weaning feed intake but with limited and inconsistent success likely due to the relations between post weaning changes and physiological responses (Fig. 1).

As a matter of fact, weaning is probably too late to start teaching the piglets how they should eat as they can already benefit from

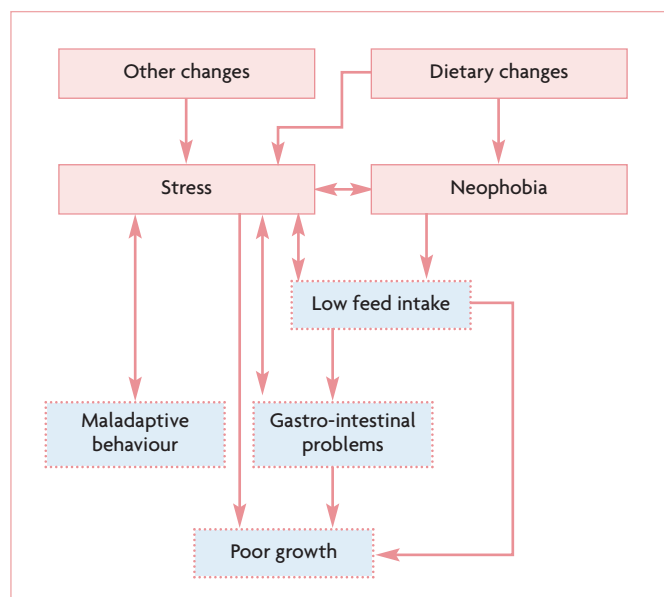


Fig. 1. The proposed links between neophobia, stress and performance around weaning (adapted from Bolhuis et al., 2009).

preweaning experiences to improve the ability to cope with the weaning process and improve subsequent performance. The physiological and neural control of ingestive behaviour is, at least in the beginning, different from that of suckling.

Importance of creep feed

The use of creep feed before weaning can help the piglets to adapt to solid feed and can result in a higher feed intake post weaning. Creep feed consumption before weaning is, however, quite low and extremely variable, leading to inconsistent results in improving post weaning performance. In reality, most young animals are innately reluctant to ingest a novel feed, which is called 'neophobia'.

Neophobia is quite useful in nature as it prevents toxicosis while animals are learning from the post-consumption effects of eating a novel and potentially toxic feed. This innate characteristic reduces the immediate feed acceptance of a novel feed/ingredient also in piglets of commercial breeds.

While many attempts are made to overcome neophobia in piglets improving palatability, quality, or structure of the feed the effects have been variable and mostly only minor.

For omnivores, like pigs, the selection and ingestion of an appropriate diet is a complex challenge that requires the integration of information from a wide variety of sources.

They seem to have a few genetically based predispositions, like an inborn preference for sweet and an aversion to bitter, which enables them to distinguish, only very roughly, between nutritional and potentially harmful substances.

Apart from this, learning is very important for developing feed preferences. Animals acquire information about feed ingredients through a trial-and-error learning process.

Each new smell/taste is followed by a limited intake of the compound only (neophobia) until the process of nutrient sensing is finalised and the compound is considered to be of nutritional value and 'safe'.

The combination of three different

chemosensory systems: smell, taste and 'mouth feel' (biting and chewing sensation) result in the final perception of flavours.

The largest contributor to flavour perception is retro nasal olfaction, i.e. the stimulation of olfactory receptors by odours that travel from the mouth to the nasal cavity during feed ingestion and mouth processing.

Animals learn about the positive and negative consequences of the feeds they ingested in relation to their flavour perception, and subsequently, may come to accept or avoid these flavours. In this way, they learn to distinguish safe and nutritious food items from toxic ones. The outcome of this process, which is called nutrient sensing, is 'learned' linked to the smell and palatability of the compound.

Social learning

In nature where many different feed ingredients are to be 'sampled' individual nutrient sensing can be dangerous and inefficient. Therefore, in general animals not only learn from their own experience but also from observing more experienced eaters.

This is called social learning. Social learning helps animals to benefit from the experience of others, allowing them to adapt more rapidly to new situations. This is of particular interest around weaning.

The best role model to learn from for young animals is undoubtedly their own mother as they are placed in the same environment and are likely to respond similarly, because of the genetic relation, to different feed substances.

But evidence suggests that the transmission of feeding information from mother to offspring already starts before birth. Despite the embryonic membranes that protect the foetus, it is exposed, in the uterus, to a variety of chemosensory stimuli.

Flavours may be transmitted to the amniotic fluid and stimulate foetal olfactory receptors and taste buds directly. As it seems the mammalian

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foetus is able to 'learn' and remember chemosensory information which can influence behaviour after birth.

Prenatal exposure to flavours from the maternal diet generally increases preferences or reduces aversion for these flavours after birth for a prolonged period of time. Therefore, acceptance of solid feed at weaning is related to prenatal flavour exposure.

Not only the maternal diet during late gestation but also the maternal diet during lactation can influence the feed preferences of piglets. Flavours from the maternal diet can be transmitted by body odour, breath, feed particles on the skin, or teeth, or faecal droppings.

This helps piglets to overcome their innate neophobia by an effect of familiarity: due to repeated exposure to a flavour, this flavour may become increasingly acceptable and, in this way, neophobia is eliminated or attenuated.

But the most evident route for flavour transmission during lactation is through the sow's milk. Volatile substances are transferred to the udder mammary glands via vascular routes from the digestive or respiratory system and can subsequently be perceived in the milk.

Oostindjer et al (2010) showed that prenatal exposure to flavour improved post weaning piglet performance (higher feed intake, higher ADG, lower incidence of diarrhoea and lower tendency to fight). For piglets that received both prenatal and postnatal exposure this effect was even more pronounced (Fig. 2).

They concluded therefore that flavour exposure improved feed intake resulting in better growth and intestinal integrity through reduction of neophobia. Furthermore, the presence of flavour in the pre weaning environment seemed to reduce the stress levels in piglets post weaning, which is favourable again for physiological functioning of the animals.

It seems that matching flavour exposure pre- and postweaning reduces neophobia and stress responses. They concluded that the best results are obtained if piglets are exposed to the same flavour pre- and perinatally.

Practical applications for flavour use

In pigs, like in most mammals, social learning of dietary choices from the mother is an important tool to prepare the piglets for the post

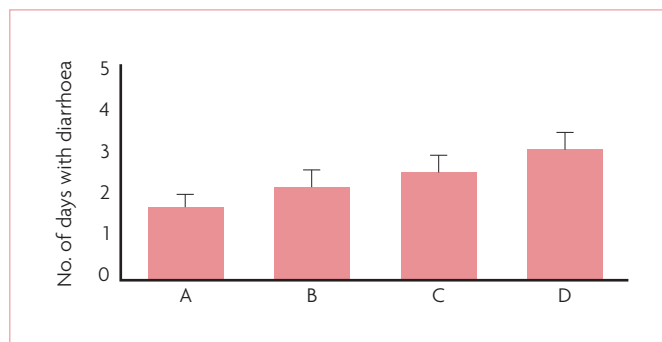


Fig. 2. Number of days with post weaning diarrhoea for piglets with A: pre and perinatal flavour exposure, B: prenatal flavour exposure alone, C: perinatal flavour exposure alone and D: no flavour exposure (adapted from Oostindjer et al., 2010).

weaning period. Prenatal and postnatal exposure to flavours of the maternal diet gives piglets information about the feed its mother has ingested, and increases, in many mammalian species, the acceptance of similarly flavoured feed in later life.

Modern pig husbandry systems could benefit substantially from these vertical learning systems to improve feeding behaviour in weaned piglets.

Results of several studies show that matching flavours between maternal pre- and post farrowing diets and the weaning diet

contributes significantly to the improvement of well being and performance in weaned piglets.

Current practice, to offer piglets diets which differ in smell and flavour from the mother's diet does not take advantage of social learning. It is recommended to allow the piglets exposure to flavours from the maternal diet during the pre- and perinatal period to optimise their possibilities to adapt to their post weaning feeding conditions. ■

References are available from the author on request