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Swine TECHTALK

Weaning Nutrient disruption in pigs, causes and consequences.

Introduction

Low feed consumption during the first three days post-weaning can be considered as a natural consequence of the accumulative stressful factors that characterize piglets' separation from their mother, resulting in perturbation of intestinal microbiota, intestinal digestion, absorption capacity, and mucosal immune function, with consequences on poor growth performance, morbidity, and mortality.

Continuity of nutrient intake as soon as piglets are weaned must be guaranteed for a successful nursery performance. The purpose of this article is to review and discuss the reasons for nutrient disruption after weaning and its consequences.

Causes of postweaning nutrient disruption:

- Stress: All the stress events experienced by the piglet after weaning, are thought to suppress feed consumption due to the anorectic effects of corticotropin release factor (CRF)[1], which is the first hormone released in response to acute stress, initiating the body's stress response system.
- Failure to adapt to a new environment: Beside weaning stress, a reduction in feed intake is associated to the failure or delay to adapt from liquid milk to a solid dry feed that is less digestible and palatable. The transition is usually complicated by the learning process to a different environment with separate feed and water sources as compared to the single milk-based diet (sow's milk), which requires them to adapt and to familiarize themselves with the difference between hunger and thirst satiety[2]. Once feed is discovered, normal eating and drinking patterns are established and pigs become more comfortable in their new environment. It is for this reason that water intake tends to be the greatest nutrient consumed in the first 24 hours and remains elevated for the first several days post-weaning (Brooks et al., 1984), suggesting that dietary supplements may be more beneficial when administered through the water rather than feed (Dybkjær et al., 2006).
- Immune system activation: Release of inflammatory cytokines after immune system activation are known to further suppress appetite, reducing food intake and nutrient absorption (Escobar et al, 2004).

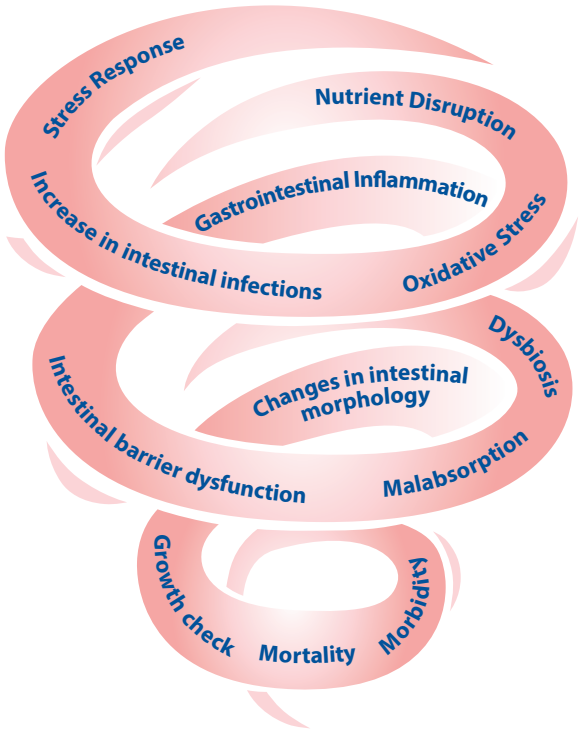
Consequences of nutrient disruption after weaning

The stress response is probably the triggering factor of a sequence of events that impair gut health after weaning, this can be visualized as a spiral of alterations or changes similar to a tornado with severe effects that can evolve to disease and mortality (fig 1).

Stress and intestinal health

Moeser et al. (2007), reported an increased serum corticotrophin-releasing factor (CRF) and cortisol in weaned pigs indicating that weaning induces activation of stress pathways which may be mediating the intestinal dysfunction.

Fig 1. Nutrient disruption spiral



From: TechMix Global, Nutrient resiliency brochure, 2024.

Gastrointestinal inflammation

Post-weaning enteric inflammation is the consequence of an increased pro-inflammatory activity. An imbalance in autophagy (reduced autophagic flux) and excessive apoptosis resulting from weaning stressors could be involved in an increased pro-inflammatory cytokine activity and the consequence of post-weaning enteric inflammation. (Tang et al 2021).

Morphological and physiological changes

Nutrient disruption results in decreased intestinal barrier function and villous atrophy, (Brooks and Tsourgiannis, 2003, Cera et al. 1988, Kelly et al. 1991a and 1991b, McCracken et al. 1995, Pluske et al. 1996a and 1996a). Clear evidence that absence of food in the intestine leads to adverse morphological changes and even atrophy of the mucosa (Hughes and Dowling 1980, McManus and Isselbacher 1970, Steiner et al. 1968) indicates the importance of considering the effects of feed intake on intestinal structure and function in weanling pigs.

McCracken et al (1999), reported that inflammatory responses and villus atrophy correlate with depressed feed consumption and that intestinal inflammation is reduced and epithelial morphology improves when normal feed intake patterns are resumed.

Hampson et al (1986), demonstrated that villous height can rapidly decrease by about 25 to 35% of pre-weaning height within the first 24 hours in pigs weaned at 21 days of age. The decrease in villous height continued until about five days after weaning, when the villi were approximately only half of the initial height.

Mal absorption

As reviewed by Pluske et al. (2018), the physiological changes experienced by weaned pigs affect the absorptive capacity of the small intestine which might influence feed efficiency. Smith et al, (2010), reported that the alterations in mucosal architecture resulted in reduced ability of villi to transport amino acids.

Dysbiosis

Research showed that the pig gut microbiota alters in a predictable manner during post-weaning period and weaning age has a temporary effect on this microbiota (Dong et al, 2023). The temporary effects include an increase in microbial diversity three to seven days post-weaning.

Higher susceptibility to intestinal infections

During the first four days after weaning, a continued nutrient disruption predisposes to small intestinal barrier dysfunction that will play a role in a higher susceptibility to intestinal infections, (Wei et al, 2021).

When piglets suffer weaning stress, the intestinal environment is susceptible to invasion by pathogenic microorganisms such as Escherichia coli (E. coli), which stimulates the intestinal mucosa to secrete inflammatory factors and damage the function of the intestinal mucosal barrier.

Poor Growth performance

Low feed intake after weaning reduces the flow of nutrients through the gastrointestinal (GI) tract, resulting in what is commonly known as a post-weaning growth check. This period is marked by body weight (BW) loss and intestinal disturbances that lead to a high occurrence of GI inflammation (McCracken et al., 1999) and diarrhea.

In general, pigs lose about 100–250 grams body weight (BW) the first day after weaning, (regardless of weaning age) and recover this loss in BW by about day four post-weaning (Le Dividich and Seve, 2000). Tokach et al. (1992) reported that weight gain in the first week after weaning impacts the total days to market (at approximately 110 kg BW). When pigs gained more than 0.5 lbs/day during the first seven days postweaning, they were 17 lbs heavier at market than pigs that lost weight during that period after weaning.

Nutrient disruption also triggers cytokines release which will shift the partitioning of nutrients from growth toward the immune system (Johnson, 1998; Buchanan and Johnson, 2007; Kvidera et al., 2017). This shift of nutrients, together with an often-observed reduction in feed intake in case of immune stimulation, reduces pig performance after weaning, especially under heavy challenged scenarios. (Klasing and Johnstone, 1991; Pastorelli et al., 2012a).

Conclusion:

In this TechTalk, we put emphasis on the relationship between weaning, nutrient disruption, and gut health, to value the importance of maintaining a continuous supply of nutrients to enhance the post weaning growth performance, minimizing morbidity and mortality. In the next TechTalk we will cover how nutritional interventions can help to promote Nutrient Resiliency for a better performance of pigs.

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