New Developments in Feeding Programs for Weaned Pigs

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- Take Home Message

The first diet the pig consumes is not a pre-starter pellet placed in a feeder at weaning. The first diet is consumed by the fetus during gestation. The “second phase” ration is the maternal milk provided during lactation. Manipulating the sow’s diet provides an opportunity to improve these first rations consumed by the piglet, which can improve performance during the traditional nursery period. However, nutrition is only part of the plan for optimal nursery performance and cost of production. One nutrition program does not work for everyone. Feeding programs and delivery mechanisms must be adjusted to specific management and disease pressures in order to optimize performance and economic returns.

- Introduction

Swine nutrition research has traditionally evaluated alterations in nutrient delivery to the specific animal, or phase of production, being fed in the nutritional experiment. Little to no research has evaluated how nutritional changes in one phase of production (gestation/lactation for example) impact the downstream phases of pork production. This lack of information is primarily due to the difficulty and expense of this type of research since it can take a full year to complete a single trial and major investments in research facilities are required to track large groups of animals throughout the production chain. Our industry has made tremendous strides in understanding how genetics, disease, and management impact downstream pork production efficiencies, so it seems foolish that nutritional research, and hence nutritional programs, haven’t kept pace. Understanding how all these phases of production are nutritionally linked together provide tremendous
opportunities to rethink traditional nursery feeding programs. Also, understanding the link between nursery nutrition and nursery management strategies will allow nutritionists to provide key nutrients to key populations of piglets. This integrated approach to nutrition provides opportunities to drastically change feeding programs; especially in the traditional nursery phase.

- Feeding the Sow Differently to Improve Nursery Performance

Examples of nutrients that can have an impact on offspring performance are:

- Specific protected n-3 fatty acids (DHA and EPA)
- Organic Selenium

Many of the proximate components in sow milk cannot be altered nutritionally. However the fat content, specifically the fatty acid composition, of sow milk can be modified dramatically when sow diets are fortified with different fatty acids. Recent research has shown that when sow diets are fortified with protected n-3 polyunsaturated fatty acids, the intestinal transport of glucose and glutamine are enhanced in the offspring at the time of weaning (Figure 1; Gabler et al., 2007), resulting in improved energy stores (glycogen) in piglet liver and muscle. When energy intake is lower during the weaning period, piglets with improved nutrient utilization and energy stores will have improved viability. Additionally, the enrichment of piglet tissues with omega-3 fatty acids prior to weaning will help to reduce inflammation that may further suppress feed intake. Evaluations by the University of Alberta and Iowa State University have reported improvements in post weaning performance when sow diets have been supplemented with these protected n-3 fatty acids (Figures 2 & 3). The estimated cost to enrich piglets with these essential fatty acids prior to weaning is approximately $0.35 to $0.50/pig.

One should also attempt to elevate the antioxidant content of the sow’s milk to help reduce oxidation of tissues during periods of stress. Selenium yeast can significantly increase the selenium content of milk and improve the antioxidant status of piglets; however, there are considerable differences between selenium yeast sources in their ability to increase milk selenium concentrations (Figure 4). The cost to increase the Se content in milk by supplementing organic Se during lactation usually costs less than $0.02/pig.
Figure 1. Active glucose uptake\(^1\) in weaned pigs from sows fed a control diet or a control diet plus protected n-3 fatty acids during gestation and lactation (P < 0.05). (Gabler et al., 2007)

\(^1\)as measured by short circuit current change (\(\mu A/cm^2\)) in Ussing chambers; 5 pigs/treatment

Figures 2a & b. Wean to finish performance of pigs from sows fed either control diets or control diets supplemented with protected n-3 fatty acids during gestation and lactation (P < 0.05). (Gabler et al., Iowa State University, unpublished research).

Figure 3. Nursery body weights of pigs from primiparous sows fed control or control plus protected n-3 fatty acids from d-60 of gestation to weaning. (Smit et al., 2010)
Figure 4. Day 14 of lactation milk selenium (Se) content from sows fed no supplemental Se (Basal) or supplemented 0.30 ppm Se from different sources.

- **Bottom Line – Feed the sow to change what the pig consumes first.**

The main opportunity described here is to manipulate the piglet’s energy stores, improve their ability to utilize nutrients, and improve the antioxidant status in the nursery period by altering the sow’s diet. New developments in this area will continue to reshape nursery feeding programs, as trying to implement these technologies at weaning may be too late, and/or more costly.

**Timed Nutrient Delivery in the Nursery**

- Plasma proteins at weaning via water
- Impact of vaccination – Don’t change diets at vaccination

Stimulating early feed intake in pigs is critical. Each hour that elapses without dry matter intake reduces the piglet’s intestinal integrity and increases the opportunity for:

- pathogenic bacteria
- reduced nutrient utilization
- allergic reactions to dietary components.

All three of these consequences will reduce the ability of the weaned pig to perform optimally. When intake post weaning is rapid, intestinal allergic reactions and pathogens such as E. coli are less of an issue.
A common strategy in pre-starter diets is to include animal plasma to stimulate feed intake and promote improvements in weight gain. Plasma provides immunoglobulins and functional proteins that improve nutrient utilization and promote intestinal growth. Recently, a new liquid supplement (Liquitein™, TechMix, Stewart, MN, 55385 USA) has been developed that can be fed through the water line with a traditional 1:128 medicator. This product allows producers to provide these functional plasma proteins immediately at weaning through the water line, and more importantly, in an easy to use form that provides opportunities for a targeted approach.

Recent research has characterized the response to this water supplementation method of providing plasma proteins. Provision of Liquitein™ immediately post weaning has improved immediate dry feed intake and growth rate the first two days post weaning; resulting in reduced nursery variation, improved growth rates, and reduced number of pigs that fall behind. Further research found that supplementing Liquitein™ at a 1:128 induction ratio for two days achieved most of the benefit of Liquitein™, and still dramatically reduced the number of antibiotic injections (Figure 5). Other liquid supplements have improved the weight gain of piglets, but most of this gain is from water intake. Many times, the pigs then need to get weaned off the supplement. To discover a water supplement that stimulates dry feed intake out of the feeder is very unique. While water wastage and the type of waterer will influence the cost of Liquitein™ supplementation via the water line, it usually costs less than $0.10/pig to supplement for 2-d at a 1:128 induction ratio.

Figure 5. Effect of Liquitein™ supplementation (1:128) for either two or seven days immediately post weaning on the number of antibiotic injections given during a 39 day nursery period

Values represent the number of individual injections given per treatment (n=12 pens/treatment with 27 pigs/pen).
The nursery pig is also very sensitive to periods of feed withdrawal during the nursery phase. Intestinal health can diminish rapidly when pigs rapidly reduce their feed intake. Pathogenic bacteria can flourish and nutrient absorption can be compromised, resulting in scours and higher medication costs. Vaccination protocols during the nursery phase can have a dramatic impact on feed intake (Figure 6). Many times a nursery feeding program may call for a dietary change at the same time a vaccination is given. This puts multiple stressors and adjustments on the pig at the same time, which may provide enough opportunity for bacteria to take hold. It is suggested that a dietary change occur 48 hours prior to a vaccination, or 48 hours afterward. This will help the pig to recover from vaccine reactions and transition easily.

Figure 6. Impact of vaccination timing on nursery feed intake post vaccination.\(^1\)

![Figure 6](image)

1 Pigs were vaccinated for PCV and Mycoplasma with a two shot vaccine program either on day 1 and 14 (Immediate vaccination) or day 9 and 23 (Delayed vaccination). Vaccine given was 1 ml of MycoSilencer Once combined with 1 ml of Circumvent PCV vaccine from Intervet Schering-Plough. This 2 ml dose injection was given twice.

- **Bottom line – Timing of Nutrient Delivery**

The use of Liquitein\(^\text{TM}\) immediately post weaning gets functional nutrients into the pig much faster than conventional feeding programs. This quick nutrient delivery via the water line stimulates feed intake out of the feeder, resulting in reduced exit weight variation and mortality/morbidity. Using technologies to get nutrients into the pig’s gut quicker provides opportunities to reduce the costs of nursery diets, and improve overall nursery performance.
mindful to not disrupt feed intake patterns with a dietary change at the time of vaccination is extremely important. Communication among managers, veterinary staff, and nutritionists is important to make sure total nursery performance is optimal.

## Conclusion

Nursery programs will continue to develop traditionally by testing new concepts and products through the dry feeder in this phase of production. Thinking creatively about providing nutrients through other mechanisms (sow, water line) will have to be exploited so that we take full advantage of the pig’s genetic potential. This concept will allow nutrients to be “ready to use” during the weaning process, and at other targeted periods during the nursery period. Integrating a weaned pig feeding program with these technologies, along with management strategies (vaccination protocols or double stocking pens for example) will be necessary to optimize returns.

## References
