Feeding strategies to increase sow colostrum quality and yield

Madie R. Wensley, MS; Mike D. Tokach, PhD; Jason C. Woodworth, PhD; Robert D. Goodband, PhD; Joel M. DeRouchey, PhD; Jordan T. Gebhardt, DVM, PhD

Summary

Effects of nutritional strategies on colostrum quality and yield are variable as influenced by sow colostrum production capacity, parity, farrowing induction protocol, and gestation length. The greatest opportunity to maximize colostrum yield and quality is through proper management of body condition in gestation such that sows are not in a negative energy balance when entering farrowing. Total colostrum fat percentage can be increased through the addition of dietary fat or oil. Colostrum fatty acid composition can also be changed by addition of dietary oil or increased branched chain amino acids. Colostrum protein and immunoglobulins are more challenging to influence.

Keywords: swine, colostrum yield, colostrum quality, feeding strategies, sow nutrition

Received: May 26, 2022
Accepted: November 15, 2022

Adequate colostrum intake (≥ 250 g is recommended) after birth is essential for piglet survival. As litter sizes have increased in recent years, the demand for colostrum proportionately increases to achieve this desired level of intake. The lactose and fat content of colostrum provides energy, which is needed to maintain piglet body temperature early in life. Additionally, colostrum protein includes immunoglobulins (Ig) for passive immunity, which is necessary for long-term survival. The concentration of these nutrients rapidly changes over the first 24 hours of lactation with the percentage of total solids and protein decreasing over time and the percentage of fat and lactose increasing (Figure 1). The ability for piglets to consume these nutrients is a balance between piglet demand (nursing interval, duration of nursing, and physical capacity to remove colostrum) and the sow’s capacity to produce colostrum. This practice tip will cover prefarrowing feeding strategies and potential nutritional interventions that can be used to increase colostrum quality and yield, while also briefly discussing common herd management practices that impact colostrum synthesis.

Prefarrowing feeding strategies that affect colostrum yield

The effect of sow nutrition on colostrum yield is not well understood. Likewise, the multi-faceted nature of colostrum yield and extreme variation between individual sows makes it challenging to consistently detect meaningful differences in the amount and composition of colostrum. Based on the formation of lipid droplets in mammary tissue and increased prolactin levels (due to...
Nutritional impacts on colostrum quality

Colostrum quality can be defined by the concentration of macronutrients, including carbohydrates (lactose), fat, and protein (specifically IgG) within a colostrum sample. Several experiments have been conducted to better understand the effects of sow nutrition on colostrum composition, however, the data lacks consistency. Of the macronutrients, colostral fat is the most easily changed through nutritional strategies.
energy density of gestation diets through the addition of fat, such as choice white grease, tallow, soybean oil, or corn oil, provides the greatest opportunity to increase total colostrum fat. 14-17 Oil inclusion has also been shown to alter the fatty acid profile of colostrum, 18,19 regardless of prefarrowing timing (day 107 vs 112). 20

Supplementing diets with high levels of leucine (Leu), valine (Val), and iso-leucine (Ile) while maintaining the Leu:Ile:Val ratio may be another option to change the fatty acid profile of colostrum. 21 Valine by itself has also been shown to increase colostrum fat and protein concentrations when fed above NRC requirements. 22,23 Furthermore, some studies suggest that prefarrowing feed allowance influences protein and Ig concentrations, but the results are variable. Decaluwé et al. 24 observed that increasing feed allowance from 1.5 to 4.5 kg/d starting on day 108 of gestation resulted in decreased colostrum protein percent, but not total protein. This also did not translate to differences in Ig content, which suggests that increased feed allowance did not change the nutrient composition of colostrum, but rather had a dilution effect. In contrast, Gourley et al. 10 observed that increasing feed allowance from 2.7 to 3.8 kg/d starting on day 113 of gestation resulted in increased colostrum IgG concentrations (107 vs 125 mg/mL for gilts; 114 vs 131 mg/mL for sows) but not total protein percent (14.8% vs 14.9% for gilts; 15.3% vs 14.9% for sows). Other data suggests that supplementing the diet with conjugated linoleic acid, beta-carotene, or high levels of vitamin D can increase Ig. 24-27 Additional data has been generated for other nutritional strategies, but results are generally variable and additional research is needed to understand further. Protein levels in colostrum appear to be negatively correlated with lactose level, 28 which suggest a greater emphasis should be put on total colostral protein rather than lactose because of the Ig fraction of protein and its role in passive immunity.

Management impacts on colostrum quality and yield

Parity structure, farrowing induction, and gestation length contribute to variations in colostrum yield. 29 Nutritional influences on colostrum are challenging to replicate for this reason, which suggests management strategies may provide a better influence on colostrum yield and quality. The sow farm parity structure will influence colostrum output, consequently impacting litter performance. More specifically, multiparous females tend to have greater colostral IgG concentration than primiparous females, whereas primiparous females tend to have higher colostral fat concentrations. 10,29-32 Likewise, colostrum yield is generally greater in parity 2 and 3 sows compared to parity 4 and higher. 12 In addition to parity, sows that are induced prior to their expected farrowing date often exhibit decreased colostral fat and Ig concentrations. If early induction protocols are in place, feeding increased dietary energy prefarrowing can help mitigate these negative effects. 33 More recent data also suggests that administering oxytocin early post farrowing (75 IU oxytocin given twice daily beginning 12 to 20 hours after farrowing the last piglet for a total of 4 injections) will delay the tightening of mammary tight junctions, thereby increasing the output of colostrum protein and Ig. 33 However, follow up research is needed to identify if these results are able to be replicated. Gestation length is another factor that should be taken into consideration when assessing colostrum outputs, although it is often confounded with induction protocols. Increasing the gestation length beyond a sow’s expected farrow date will likely result in decreased colostral IgG concentrations. 14,30

Acknowledgments

This work was supported by contribution No. 23-078-J from the Kansas Agricultural Experimental Station in Manhattan, Kansas.

Conflict of interest

None reported.

Disclaimer

Drs Gebhardt and Tokach, both members of this journal’s editorial board, were not involved in the editorial review of or decision to publish this article.

Scientific manuscripts published in the Journal of Swine Health and Production are peer reviewed. However, information on medications, feed, and management techniques may be specific to the research or commercial situation presented in the manuscript. It is the responsibility of the reader to use information responsibly and in accordance with the rules and regulations governing research or the practice of veterinary medicine in their country or region.

References


