Nutrition requirements of the modern sow

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Introduction

Litter size of the domesticated sow has been increasing over the last decade. According to Nielsen et al. (2018), the Danish sow has had an increase of 3.4 piglets per litter over the period of 2004 through 2016; however, sow body dimension has not changed. Thus, the ability to meet the amino acid and energy requirements of the hyperprolific lactating sow while not causing a loss of maternal stores are a significant concern (Aherne, 2007; Dourmad et al., 1994; Noblet, et al., 1990).

Fiber

While fiber has been well documented in gestating sows to improve satiety, control weight gain and improve future lactation feed intake, few studies discuss the benefit of fiber throughout lactation. Li et al. (2021) reported that feeding high fiber diets (inulin and cellulose) resulted in a shorter parturition duration and higher total born across three parities. It is important to note that different fiber sources can create differences in the lactating sow. Feyera et al. (2021) demonstrated that feeding palm kernel expellers compared to mixed fiber, soybean hull or sugar beet pulp had a reduction in colostral dry matter and increased farrowing assistance. However, inclusion levels of high fiber products such as sugar beet pulp can reduce feed intake during peak of lactation and potentially reduce milk yield (Krogh et al., 2017).

Amino acid requirements in lactation

With the current lean genetic maternal lines, there maintains a focus on protein levels in sow lactation diets. Recent studies indicate that hyperprolific sows require a minimum intake of 135 g of SID crude protein daily (Strathe et al., 2020). Furthermore, just as with grow-finish pigs, lactating sows appear to have specific amino acid requirements within the crude protein intake. According to the NRC (2012) recommendations, estimates of amino acids for lactation can be predicted based on individual pig ADG and litter size.

Lysine

Estimates of total daily lysine(Lys) requirements can be based on litter growth rate ((0.0266*LGR(g/d))-7.549) (Pettigrew et al.,1993; Boyd et al., 1993; Boyd et al., 2000). These values are slightly lower slightly lower than that of the review conducted by Tokach et al. (2019) which indicates that sows require 27 g of SID Lys per day per kg of litter growth rate without sow body weight catabolism. Lysine requirement by parity does not appear to be different with the estimated SID lysine requirement between 60 to 63 g/d (Srichana, 2006; Greiner et al., 2009; Graham, 2018); however, ration formulation between parities differ based upon lower daily feed intake present in first parity females.

Threonine

Research demonstrated that total threonine(Thr) requirement of 37 - 40 g/d for sow growth and 36 - 39 g/d for litter growth and subsequent reproduction metrics (Cooper et al., 2001; Greiner et al., 2017). Sow performance measured either as litter growth rate or subsequent reproductive performance appeared to be optimized at either 57% or 68% Thr:Lys ratio, respectively (Schneider et al., 2005; Greiner et al., 2017).

Total sulfur amino acid

Very little research is available to determine the requirements of the lactating sow, yet total sulfur amino acids (TSAA) decrease as less soybean meal is used. Previous research indicated that the SID TSAA:Lys ratio could be below 50% for the lactating sow; however, no additional studies have been conducted to determine the requirement (Schneider et al., 2005 and 2006).

Tryptophan

Tryptophan(Trp) is involved in satiety and appetite and has been documented in various studies in grow-finish pigs to improve feed intake as the Trp:Lys ratio increases (Goncalves, 2015; Goncalves, 2018; Sterndale et al., 2020). The impact of feeding different tryptophan levels to lactating sows has not been widely researched. Feed intake for primiparous sows is typically 0.5 to 1 kg lower than multiparous sows (Greiner, unpublished). Feeding SID Trp:Lys ratio of 22 increased feed intake and 25 reduced primiparous sow weight loss (Fan et al., 2017). Furthermore, Greiner et al. (2017) showed that a SID Trp:Lys ratio of 17.6 optimized multiparous sow average daily feed intake.

Branched chain amino acids

Branched chain amino acid research for lactating sows is limited. While studies have evaluated individual amino acids to estimate the lactation requirements, there are no documented studies that evaluate the total branched chain amino acid:lysine ratio. Carter et al. (2000) and Strathe et al. (2016) reported no differences in sow reproductive performance or litter growth rate when the Val:Lys ratios ranged from 76-122%. Other studies demonstrate that litter growth rate and sow reproduction are optimized at a total Val:Lys ratio of 73 and 86% (Boyd et al.,1999 and Gaines et al., 2006).

Energy

As milk production utilizes 95% of the nutrients consumed by the sow, maximizing feed intake and energy intake to reduce weight loss is critical. Xue et al. (2012) demonstrated that when sows consumed 13.4 MJ ME/kg of diet, weight loss was minimized. While estimates can be made on the energy requirement to support milk production and body maintenance based on NRC (2012) equations, practical considerations on the type of fat used to support the energy needs should be considered. Higher inclusion levels of fat are included in lactation during periods of anticipated reduced feed intake such as heat stress (Rosero et al., 2012). Both animal-vegetable blend and choice white grease improved subsequent total born; however only animal-vegetable blend fat reduced feed efficiency (Rosero et al., 2012). In a review by Rosero et al., 2016, farrowing rate improvements could be improved based on linoleic acid intake ([(-1.5 X 10-3 x linoleic acid intake (g/d)2 + (0.52 x linoleic acid intake (g/d)) + (45.2)]) and subsequent total born increased as linoleic acid increased ([(9.4 x 10-5 x linoleic acid intake (g/d)2) + (0.04 x linoleic acid intake (g/d)) + (10.94)]) with optimal performance at a consumption of 10 g/d of α-linolenic acid and 125 g/d of linoleic acid.

Conclusions

The sow's lysine requirement is dependent upon litter growth rate and average daily feed intake.
Further research needs to be conducted on certain amino acids during lactation as well as the impact of feeding branched chain amino acids in lactation. Careful consideration should be made in lactation to ensure that sow's are receiving appropriate levels of linoleic acid and fiber to improve lactation and reproductive performance.

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