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Supplementation of sow diets with essential fatty acids reviewed

THERE are many reasons why adding fat to sow diets is advisable, but most often, fat sources are added for their energy content and not necessarily for the fatty acid profile of the specific fat source.

Why are particular fatty acids important in sow and pig metabolism?

Linoleic (18:2n-6) and alpha-linolenic (18:3n-3) acids are nutritionally essential to many animals, because most cannot insert a double bond past the delta-9 position of fatty acids. Mammals lack the delta-12 desaturase enzyme necessary to generate the formation of linoleic or linolenic acid, rendering them indispensable in pig diets.

Vegetable oils are a rich source of essential fatty acids; oils derived from corn, soy and sunflower seeds all contain high concentrations of linoleic acid, while flaxseed oil is the most notable source of alpha-linolenic acid. Moreover, fish oils are the most concentrated source of longer-chain fatty acids, particularly eicosapentaenoic acid (20:5n-3) and docosahexaenoic acid (22:6n-3).

The essentiality of linoleic and linolenic acids derives from their functions as eicosanoid precursors. Eicosanoids, which refer to a group of 20-carbon polyunsaturated fatty acids (PUFAs), include prostaglandins, thromboxanes, leukotrienes and lipoxins. These molecules play key roles in inflammatory processes and reproduction.

Why and when would we feed these feed fatty acids to pigs?

Weaning is perhaps the most drastic event in a pig's life cycle, and it takes huge tolls on intestinal integrity and health. Long-chain PUFAs, as precursors of prostaglandins, have been shown to improve intestinal barrier function and recovery following intestinal injury (Jacobi et al., 2012). Additionally, malnourished pigs demonstrated improved recovery from lesions induced by dietary restriction in the small intestine when fed long-chain PUFAs (Lopez-Pedrosa et al., 1999).

Much like the fatty acid profile in backfat and the fatty tissue of pigs reflects the fatty acid component of their diets, many studies support the fact that sow colostrum and sow milk can be enriched with essential fatty acids through dietary supplementation, which, in turn, increases concentrations in piglet serum and tissues (Mateo et al., 2009; Tanghe et al., 2013; Chang et al., 2017; Lavery et al., 2019).

Bottom Line

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Hence, there is interest in exploring sow supplementation of essential fatty acids and its impact on reproductive and litter performance when sows are fed these specific fatty acids above their requirements.

In a study by Rosero et al. (2016), feeding sows a 3.3% linoleic acid diet improved subsequent litter size, while other studies found little to no response. Linoleic acid is a precursor of prostaglandins that have important roles in reproduction, such as prostaglandin F2 alpha and prostaglandin E2, and it is abundant in corn oil. Therefore, higher concentrations of linoleic acid in the diet can be achieved by supplementing corn oil at around 4% of the diet.

Other authors have explored the effects on reproductive performance of sows fed fish oils, which are rich in omega-3 (n-3) fatty acids. Smits et al. (2011) found that feeding lactating sows 0.3% fish oil had positive effects on subsequent litter size without affecting other reproductive performance traits.

Mateo et al. (2009) fed sows 1% fish oil from day 60 of gestation throughout lactation and reported improved piglet average daily gain throughout lactation in the first and subsequent cycles of sows but did not observe an increase in resultant litter size.

My team conducted a short lactation study using fish oil (up to 2% of the diet) and did not find differences during lactation and after weaning (Chang et al., 2017).

Others also reported a lack of differences in piglet performance until weaning (Tanghe et al., 2013; Lavery et al., 2019) when sows were fed fish oil from gestation throughout lactation. A couple of studies address the possibility of n-6:n-3 ratios interfering with results observed when feeding diets rich in n-3 fatty acids, but an optimal ratio has yet to be determined (Eastwood et al., 2014; Upadhaya et al., 2018).

The Bottom Line

Essential fatty acids and long-chain PUFAs play important roles in many aspects of the pig metabolism. Collectively, the few large studies that have investigated the use of essential fatty acids and PUFAs in sow diets still provide conflicting results. This may be due to the variability in feeding levels, n-6:n-3 ratios, the time of supplementation or the source among these studies.

Most recent studies seem to be more focused toward the mode of action of these fatty acids, using a low number of

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animals and replicates. In order to validate the effects on performance, further and larger studies should be conducted.

It is also important to consider that, while increasing levels of linoleic acid may be economically viable by use of readily available corn oil, other essential and long-chain fatty acids may require the addition of more expensive ingredients, such as flaxseed or fish oil, which are considerably more expensive than corn oil ($1.55/lb. versus 30 cents/lb.).

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