January 2004

Update on Omega-3 Fatty Acids and Litter Size in Swine

Duane Reese
University of Nebraska-Lincoln, dreese1@unl.edu

Update on Omega-3 Fatty Acids and Litter Size in Swine

Duane E. Reese[1]

Summary and Implications

A literature review was conducted to examine the role that dietary omega-3 fatty acids may have in improving litter size in swine. Omega-3 fatty acids are not normally present to any great extent in practical swine diets, but they are increasingly believed to be important in human and pet health. In all but one of the studies reviewed the number of pigs born alive improved (0.2 to 0.7 pigs litter) when sows were provided diets that contained more omega-3 fatty acids. In all the studies that reported litter size at weaning, positive responses were observed (0.3 to 1.3 pigs/litter) with omega-3 fatty acid supplementation. The response is highly variable and probably due to the source, level and timing of feeding the omega-3 fatty acids. It seems possible for producers to improve the profitability of pork production by supplementing sow diets with omega-3 fatty acids.

Introduction

The role of fat and oil in sow diets received considerable attention by researchers 20 to 30 years ago. Interest was centered on improving piglet preweaning survival and reducing the nutrient drain experienced by lactating sows. Those investigations showed that supplemental fat provided to the sow prefarrowing generally improves preweaning survival, but its role in reducing nutrient drain during lactation is less meaningful. Fat and oil have basically served as sources of energy in swine diets.

Fats and oils consist of fatty acids. Each fat or oil source has a unique fatty acid profile that distinguishes one fat or oil source from another. Nutritionists have been examining the health benefits of specific fatty acids, especially omega-3 fatty acids, in pet and human health for several years. The omega-3 fatty acids are linolenic; eicosapentaenoic (EPA); and docosahexaenoic, (DHA). Linseed (flaxseed) is the most abundant source of linolenic acid; canola oil is the next best source, while negligible amounts are found in the other sources of fats and oils. In contrast, fish oils are the only sources of the other two omega-3 fatty acids (EPA and DHA).

The role that omega-3 fatty acids may have in swine reproduction has been investigated. A review of those research results were presented in the 2003 Nebraska Swine Report (available at http://ianrwww.unl.edu/pubs/swine/pigpdf.htm). Since that review was prepared research results from two experiments have been published. Therefore, a re-evaluation of the role of omega-3 fatty acids in sows diets is warranted.

New Research Results

Researchers at United Feeds Inc. fed 338 primiparous and multiparous sows either a corn-soybean control diet or the control diet top-dressed with Fertilium™, a protected omega-3 fatty acid source. Fertilium™ was top-dressed at the rate of 85 g/day beginning 5 $\pm$ 2 days before farrowing through to day 7 postweaning for a total of 35 days. Sows were mated at first estrus after weaning. All sows received a common diet throughout gestation until subsequent farrowing. Sows that received Fertilium™ farrowed significantly more total (11.6 vs 11.0) and live pigs (10.8 vs 10.3) than control sows.

University of Manitoba and Minnesota researchers fed 243 multiparous sows either a barley/wheat-canola meal control diet or the control diet with 5% flaxseeds (rich source of linolenic acid) from breeding to weaning. Litter size born alive was not significantly improved by feeding flaxseeds; however, sows fed flaxseeds weaned more pigs than those fed the control diet (10.4 vs 9.1). In addition, pigs from sows fed flaxseeds were significantly heavier at weaning than those from control sows (10.6 vs 9.5 lb).

Litter Size Summary

A summary of research results published to date on the effect of omega-3 fatty acids on litter size is presented in Table 1. In all but one of the studies reviewed, the number of pigs born alive improved (0.2 to 0.7 pigs litter) when sows were provided diets that contained more omega-3 fatty acids. In all the studies that reported litter size at weaning, positive responses were observed (0.3 to 1.3 pigs/litter) with omega - 3 fatty acid supplementation.

Previous research suggests that pigs cannot make sufficient quantities of EPA and DHA from linolenic acid to elicit certain biological effects. Therefore, to maximize benefits that EPA and DHA may impart on litter size, it would seem necessary to add them preformed to the diet. In practical feeding situations, that can be accomplished by adding fish oil or fish or marine products to the diet. However, the response observed from feeding flaxseed (study 5) suggests that linolenic acid may influence reproduction too and/or there is sufficient synthesis of EPA and DHA from linolenic acid to elicit a litter size response.

Table 1. A summary of the effect of providing additional omega-3 fatty acids in sow diets on litter size born alive.

Study[a]	Omega fatty acid source	Dietary level or amount	Feeding period	No. of litters	Live pigs born/litter			Pigs weaned/litter			Comments
					-[b]	+[b]	Change	-[b]	+[b]	Change	
1	Fishmeal	5.00%	Two reproductive cycles	NA[c]	10.4	10.9	+0.5	8.3	9.4	+1.1	First parity data; 200 gilts started experiment
1	Fishmeal	5.00%	Two reproductive cycles	NA	10.7	10.9	+0.2	9.3	9.6	+0.3	Second parity data
2	Salmon oil	1.75%	3 d post service to weaning	NA	11.9	11.7	-0.2	10.5	10.6	+0.1	216 sows started experiment; treatment and parity possibly confounded
3	Salmon oil	1.65%	3 d post service to weaning	198	11.6	11.8	+0.2	10.2	10.6	+0.4	
4	Fertilium™	85 g/d	d 109 gestation to d 7 postweaning	338	10.3	10.8	+0.5	NA	NA		P < 0.05
5	Flaxseeds	5.00%	d 1 post breeding to weaning	243	10.8	11.5	+0.7	9.1	10.4	+1.3	P > 0.05 for live pigs; P < 0.05 for weaned pigs

[a]1 = Edwards and Pike, 1997; 2 = Cordoba et al., 2000; 3 = Rooke et al., 2001; 4 = Webel et al., 2003; 5 = Baidoo et al., 2003.
[b]Without (-) or with (+) added omega- 3 fatty acids in the diet.
[c]Not available.

Table 2. Increase needed in the number of pigs weaned/litter to offset extra sow feed ingredient expense due to providing omega-3 fatty acids.[a]

	Value of a pig at weaning, $/pig			
Extra sow feed expense, $/sow/year	20	25	30	35
5	0.11	0.09	0.08	0.06
10	0.23	0.18	0.15	0.13
15	0.34	0.27	0.23	0.19
20	0.45	0.36	0.30	0.26
25	0.57	0.45	0.38	0.32

[a]Assumes 2.2 litters/sow/year.

Economics

An economic analysis was performed to estimate the extent that litter size weaned needs to improve to offset the extra sow feed ingredient expense incurred from adding omega-3 fatty acids to the diet (Table 2). Adding 5% fishmeal or flaxseed to gestation and lactation diets will increase annual sow feed expense by about $20 to 25/sow. To offset this extra expense, a producer would need to be reasonably sure that litter size at weaning would improve by 0.26 to 0.57 pigs/litter depending on pig value. Results so far with fishmeal and flaxseed show a litter size improvement at weaning of 0.3 to 1.3 pigs/litter (Table 1). In contrast, feeding Fertilium™ increases annual sow feed expense by about $10 and requires a litter size improvement at weaning between 0.13 and 0.23 pigs to breakeven. Fertilium™ has improved litter size born alive by 0.5 pigs/litter according to one report. While it is not certain that the extra pigs born alive from feeding Fertilium™ would survive to weaning, it is reasonable to expect they would. According a previous literature review on omega-3 fatty acids in swine (2003 Nebraska Swine Report, page 30), it appears piglet preweaning survival may be improved by omega - 3 fatty acid supplementation provided the sows are allowed to farrow naturally (without induction).

Conclusion

Increasing the omega-3 fatty acid content of sow diets appears to improve litter size, although the response is highly variable. The variable response appears to be due to the source, level and timing of feeding omega-3 fatty acids. It seems possible for producers to improve the profitability of pork production by supplementing sow diets with omega-3 fatty acids. However, producers are advised to use some caution before implementing this technology, because of its cost and lack of testing in multiple production systems.

[1]Duane E. Reese is an Extension swine specialist in the Department of Animal Sciences. References are available from the author at dreese1@unl.edu by request.