Dietary Omega-6 to Omega-3 Fatty Acid Ratios Affect Sow Reproduction and Piglet Performance

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SUMMARY

An experiment was conducted to determine the effects of altering the omega-6 (n-6) to omega-3 (n-3) fatty acid (FA) ratio in sow diets on their reproductive performances. Production in the farrowing room was optimal when sows consumed a plant oil based ratio of 5:1 n-6:n-3. The long term feeding of sows with varied dietary n-6 and n-3 fatty acids can affect her reproductive performances, and the performance of her offspring.

INTRODUCTION

In the hog industry the most critical stages of production are the breeding and the farrowing to weaning periods, as this is the time when pig flow through an entire barn can be affected. It is imperative that we maximize the reproductive performance of sows to optimize pig flow and thus improve the economics of pork production.

Over the years we have used many nutritional strategies to improve the performance of sows. Recently there has been a growing interest in the use of dietary polyunsaturated fatty acids, specifically the n-3 FA's α-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Omega-3 FA's can have positive effects on reproduction, however, there is direct competition between the n-3 and n-6 FA's within the body and thus the ratio may be important in maximizing the benefits of including n-3 FA's into sow diets. The type of n-3 FA may also be important, as the biological activity of ALA (found in plant sources such as flaxseed) differs from EPA and DHA (found in fish oils).

The objective of our experiment was to determine the effect of altering the ratio of dietary n-6 to n-3 FA's fed to sows on reproduction, piglet performance and immune parameters.

MATERIALS AND METHODS

This experiment used five dietary treatments, each divided into a gestation and lactation ration. The diets were formulated to have a constant total fat concentration (5% crude fat), but varied in the ratio of n-6 to n-3 FA's. The treatment groups consisted of a control (tallow), 3 diets with plant oil based n-6:n-3 ratios (10:1, 5:1, and 1:1) as well as a 5:1 fish oil diet.

Sows (n=150) were randomly assigned to one of five diets on d 80 of gestation. The sows remained on their diets through a first farrowing to weaning period (referred to as Cycle 1), followed by a subsequent breeding, gestation and farrowing to weaning period (referred to as Cycle 2). During both cycles performance data was collected. A subset of 12 sows/diet were used during Cycle 2 for colostrum collection at farrowing and piglet serum collection to measure IgG and IgA concentrations.

"The long term feeding of sows with varied dietary n-6 and n-3 fatty acids can affect reproductive performance"

RESULTS AND DISCUSSION

Results for Cycle 1 and Cycle 2 are shown in Table 1. There was no effect of diet on the total number of piglets born, born alive, or lit-

Table 1.: Production Results for Cycle 1 and Cycle 2

	Dietary Treatment					Statistics	
Production Parameter	Control	10:1P	5:1P	1:1P	5:1F	SEM	P-Value
Cycle1							
# Born Alive	12.8	12.6	12.4	13	130	0.50	0.919
# born total	13.7	13.6	13.7	14.3	14.4	0.54	0.729
Live litter birth weight (kg)	18.7	18.3	18.5	17.9	17.7	0.78	0.894
Birth weight (kg/piglet)	1.5	1.5	1.5	1.4	1.3	0.05	0.101
Weaning weight (kg/piglet)	8.2^{ab}	8.6^{a}	8.6^{a}	8.0^{b}	7.8^{b}	0.19	0.019
Cycle 2							
Sow feed intake (kg/d lact)	7.5^{a}	7.4^{a}	7.6^{a}	7.5^{a}	6.8^{b}	0.20	0.036
Sow weight change (kg/lact)	-5.6	-8.0	-5.6	-3.3	-11.7	2.63	0.291
Sow backfat change (mm/lact)	-0.8	-1.1	-0.7	-0.9	-0.7	0.22	0.712
Wean to estrus interval (d)	4.1	4.9	4.2	3.9	5.1	0.42	0.171
# born alive	12.5	12.5	11.5	12.3	13.0	0.60	0.538
# born total	13.3	14.0	12.9	14.0	14.4	0.63	0.464
Live litter birth weight (kg)	18.1	17.5	16.8	17.7	16.9	0.77	0.725
Weaning weight (kg/pirglet)	8.8^{a}	8.7^{ab}	9.2^{a}	8.7^{ab}	8.2^{b}	0.21	0.040

ter birth weights for either cycle, or on the IgA and IgG concentrations in colostrum or piglet serum (data not shown).

As shown in Table 1, average piglet weaning weight was higher for the 10:1 and 5:1 plant based groups when compared to the 1:1 and fish based groups during Cycle 1 ($P = 0.02$). During Cycle 2, fish oil sows consumed 10% less feed ($P = 0.04$), had reduced piglet birth weights ($P = 0.05$), and average piglet weaning weight was reduced by 0.8 kg/piglet ($P = 0.04$) when compared to control and 5:1 plant oil based sows.

CONCLUSION

The results from this study indicate that the long term feeding of decreased n-6:n-3 ratio diets to sows can affect reproductive performances. A plant oil based ratio of 5:1 (n-6:n-3) maximized piglet growth and sow feed intakes, and did not affect her return to estrus interval. Sows consuming the fish oil diet ate less feed and had reduced piglet birth and weaning weights when compared to the other treatment groups. This indicates that a plant based n-3 FA (such as those found in flaxseed) may be more beneficial for improving performance in the farrowing room than fish based n-3 FA's when included in sow diets.

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