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## EFFECT OF FISH MEAL QUALITY ON THE GROWTH PERFORMANCE OF WEANLING PIGS

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### Summary

The objective of this experiment was to evaluate three fish meal sources added to diets for the early-weaned pig. Fish meal sources were analyzed for total volatile nitrogen (TVN), which is an indicator of protein degradation of the raw material. Regardless of TVN content, pigs fed diets containing fish meal had better average daily gain (ADG) and average daily feed intake (ADFI) than pigs fed a diet without added fish meal. However, TVN content and chemical digestibility estimates of fish meal were associated with growth performance of starter pigs. Feed intake increased as TVN content increased. Although ADG was not influenced by TVN, feed conversion was less efficient, and thus, the cost of gain was increased as TVN content increased. Conversely, the cost of gain decreased as the chemical digestibility increased. The results of this study suggest that chemical digestibility and TVN content of different fish meal samples are indicative of their relative quality. However, maximum TVN content and minimum chemical digestibility values to indicate a high quality fish meal have not been determined.

(Key Words: Pig, Fish Meal, Performance, Early Weaning.)

### Introduction

The variation in growth response to fish meal in starter diets for pigs has been linked to differences in fish meal quality. Several factors affecting the nutritional value of fish meal have been identified. Among these, the freshness of the raw material and processing procedures have the greatest impact on quality. Freshness is measured by tactile evaluation and chemical analysis of the raw material for total volatile nitrogen (TVN). The TVN content of the raw material is indicative of the extent of protein degradation that has occurred prior to processing. During processing, cooking and drying temperatures can influence fish meal quality, with excessive heat resulting in reduced amino acid availability. However, raw material freshness and/or possible overcooking are not easily quantified in the finished meal. Thus, it is very difficult to verify the quality of fish meal. This study was designed to investigate the potential of using TVN content and chemical digestibility of the finished fish meal as criteria for evaluating fish meal quality.

### Experimental Procedures

One hundred forty-four pigs averaging 23 days of age and 15.6 lbs were moved from a total confinement, environmentally controlled, farrowing facility into an environmentally controlled nursery. Pigs were not given a creep feed prior to weaning. Pigs were housed in

pens (4 ft × 5 ft) with woven wire floors over a Y-flush gutter with one nipple waterer and one four-hold, self-feeder per pen.

Dietary treatments (Table 1) were formulated using three fish meals with different TVN content and chemically determined digestibility (modified pepsin digestibility). Compositions of the experimental diets are given in Table 2. Fish meal contributed 25 percent of the protein in each experimental diet. A fourth diet containing no fish meal was included as a control. Diets were formulated to contain 20% crude protein, 1.4% lysine, 1640 kcal/lb digestible energy, 1.0% calcium, and .9% phosphorus.

Table 1. Fish Meal Analysis

Item	SMFM <sup>a</sup> ,%	FM <sup>b</sup> B,%	FM <sup>b</sup> C,%
Fat	11.74	12.44	11.41
Crude protein	61.05	61.47	62.73
Lysine	4.82	4.83	4.88
Calcium	4.30	4.99	4.67
Phosphorus	2.74	3.18	2.97
TVN <sup>c</sup>	.12	.46	.16
Chemical digestibility <sup>d</sup>	91.47	89.03	83.70

<sup>a</sup>Select menhaden fish meal.

<sup>b</sup>Fish meal.

<sup>c</sup>Total volatile nitrogen.

<sup>d</sup>Modified pepsin digestibility.

Pigs were blocked by weight and randomly assigned to pens with 6 pigs/pen and 6 pens/treatment. Each pen was randomly assigned to treatment. The study was conducted for 5 weeks. Criteria measured were avg daily gain (ADG), avg daily feed intake (ADFI), and feed efficiency (F/G). Pigs were fed ad libitum. Feeders were checked twice daily, and feed was weighed out and added or weighed back and recorded as necessary. Individual pig weights and feeder weights were recorded weekly.

### Results and Discussion

Pigs receiving select menhaden fish meal (SMFM) gained faster ( $P < .05$ ) than pigs receiving fish meal C or the control diet for the first two weeks postweaning (Table 3). The ADG of pigs on fish meal B was intermediate through the end of wk 2. Although by the end of wk 5, pigs on the SMFM diet tended to gain faster ( $P < .10$ ) than pigs on the fish meal C diet, there was no difference ( $P > .10$ ) in ADG between pigs on either SMFM or fish meal B. By the end of the trial, pigs on the fish meal diets were gaining faster ( $P < .05$ ) than pigs on the control diet.

**Table 2. Percentage Diet Composition**

Ingredient	Control	Fish meal source		
		SMFM <sup>a</sup>	FM <sup>b</sup> B	FM <sup>b</sup> C
Corn	51.75	57.99	58.30	58.11
Soybean meal (48.5)	29.20	17.80	17.80	17.80
Dried whey <sup>c</sup>	10.00	10.00	10.00	10.00
Fish meal	--	8.20	8.10	7.80
Soy oil	3.86	2.10	2.10	2.42
Dicalcium phosphate	2.73	1.82	1.66	1.76
Limestone	.68	.36	.31	.37
Lysine	.28	.23	.23	.24
Selenium premix <sup>d</sup>	.05	.05	.05	.05
Copper sulfate	.10	.10	.10	.10
Vitamin premix <sup>e</sup>	.25	.25	.25	.25
Trace mineral premix <sup>f</sup>	.10	.10	.10	.10
Antibiotic	1.00	1.00	1.00	1.00
<u>Calculated Analysis</u>				
Crude protein	20.02	19.97	19.76	19.81
Lysine	1.41	1.39	1.39	1.41

<sup>a</sup>Select menhaden fish meal.

<sup>b</sup>Fish meal.

<sup>c</sup>Edible grade, extra grade.

<sup>d</sup>Each pound of selenium premix contains 90.9 mg Se.

<sup>e</sup>Each pound of premix contains: vitamin A, 1,000,000 IU; vitamin D<sub>3</sub>, 100,000 IU; vitamin E, 4,000 IU; menadione, 400 mg; riboflavin, 1,000 mg; pantothenic acid, 2500 mg; niacin, 5,500 mg; choline, 100,000 mg; and vitamin B<sub>12</sub>, 5 mg.

<sup>f</sup>Containing 10% Mn, 10% Fe, 10% Zn, 4% Ca, 1% Cu, .4% K, .3% I, .2% Na, and .1% Co.

There were no differences ( $P > .10$ ) in ADFI by the end of wk 2. By the end of wk 5, pigs on the fish meal B diet exhibited higher ADFI ( $P < .05$ ) than pigs on the SMFM diet. Feed intake on the fish meal C diet was intermediate. The ADFI on all three fish meal diets was higher ( $P < .05$ ) than that on the control diet.

The SMFM improved F/G through the end of wk 2 compared to either fish meal B or fish meal C. The F/G of pigs on fish meal B and fish meal C was similar to the F/G of pigs on the control diet. By the end of the trial, SMFM inclusion improved F/G ( $P < .05$ ) compared to the other three diets.

**Table 3. Effect of Fish Meal Quality on the Growth Performance of Weanling Pigs**

Item	Period	Fish meal source				SE
		Control	SMFM <sup>a</sup>	FM <sup>b</sup> B	FM <sup>b</sup> C	
ADG, lb	wk 0-wk 2	.59 <sup>g</sup>	.73 <sup>h</sup>	.65 <sup>gh</sup>	.60 <sup>g</sup>	.03
	wk 0-wk 5 <sup>cd</sup>	.87 <sup>g</sup>	1.04 <sup>h</sup>	1.00 <sup>h</sup>	.97 <sup>h</sup>	.03
ADFI, lb	wk 0-wk 2	.79	.81	.86	.82	.01
	wk 0-wk 5 <sup>ef</sup>	1.25 <sup>g</sup>	1.35 <sup>h</sup>	1.45 <sup>i</sup>	1.37 <sup>hi</sup>	.03
F/G	wk 0-wk 2	1.35 <sup>g</sup>	1.14 <sup>h</sup>	1.33 <sup>g</sup>	1.37 <sup>g</sup>	.05
	wk 0-wk 5 <sup>cdef</sup>	1.44 <sup>g</sup>	1.30 <sup>h</sup>	1.45 <sup>g</sup>	1.41 <sup>g</sup>	.03

<sup>a</sup>Select menhaden fish meal.

<sup>b</sup>Fish meal.

<sup>c</sup>Chemical digestibility effect linear (P<.10).

<sup>d</sup>Chemical digestibility effect quadratic (P<.05).

<sup>e</sup>Total volatile nitrogen effect linear (P<.05).

<sup>f</sup>Total volatile nitrogen effect quadratic (P<.05).

<sup>ghi</sup>Means with unlike superscripts are different (P<.05).

The data from the three fish meal diets were analyzed for linear and quadratic effects associated with TVN content of each fish meal. Total volatile nitrogen content of the fish meal had linear and quadratic effects (P<.05) on ADFI and F/G by the end of wk 5. Average daily feed intake increased and F/G was poorer with increasing TVN content. The TVN content had no effect (P>.10) on ADG.

In addition, the data for the three fish meal diets were analyzed for linear and quadratic effects associated with chemical digestibility estimates of each fish meal. Average daily gain and F/G were both related to the chemical digestibility estimates of each fish meal in a quadratic fashion (P<.05) with a linear tendency (P<.10). There was no relationship (P>.10) between ADFI and the fish meal digestibility estimates.