# Response of Growing Pigs to Graded Levels of Flaxseed

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## Summary

A growth experiment was carried out in young pigs (25-30 kg) in order to evaluate the response to flax in their diet and to determine if the feeding of relatively high levels of flaxseed causes changes in performance not predicted by the nutrient profile. Five levels of flaxseed in the diet were tested: 0, 5, 10, 15 and 20%. Four other diets were formulated in order to contain the same amounts of fat as those of the flaxseed-based diets but in the form of canola oil (1.7, 3.3, 5.0 and 6.7% oil). Each diet was tested on 8 pigs (4 males, 4 females), fed ad libitum and kept in individual pens of 1.7 $m^2$. The experiment lasted 28 days. Average daily gain (ADG), feed intake and feed efficiency were measured. Although a slight decline in growth occurred when flaxseed was added to the diet (-2.7 g ADG/% flaxseed, compared to -1 g ADG/% canola oil), no statistically significant differences between treatments was observed for ADG or average daily feed ($P > 0.05$); however, there was a tendency for ADG to decline at the highest flax level ($P = 0.08$). Feed conversion tended to improve with increasing levels of flax in the diet ($P = 0.07$). A decrease in feed intake was observed in pigs fed the diet containing 6.7% canola oil, compared to the other diets ($P=0.03$). It is concluded that flaxseed can be incorporated at 10 to 15% of the diet for growing pigs without adverse effects on ADG, feed intake and feed efficiency.


## Introduction

The pork industry is continually seeking alternative ingredients for use in pig diets, either as a means of diversifying rations and thus reducing cost, or to achieve a final pork product that meets certain specifications, eg. omega-3 fatty acid enrichment. Thus, there is growing interest in the expanded use of flaxseed and related products by the pork industry. Flaxseed possesses properties that make it unique as a feed ingredient, not the least of which is a highly desirable fatty acid profile in the lipid fraction. Flax acreage is expected to increase substantially, thus expanding the quantity and consistency of supply. The pork industry has traditionally shunned, or heavily discounted, ingredients with an uncertain supply.

*"Balanced diets containing up to 15% flaxseed will not adversely affect average daily gain."*

However, whether or not flaxseed and related products will be viewed favourably by the pork industry will depend on a number of factors, the most important of which is a well-defined nutrient profile. There is also a need to determine how the pig will respond to increasing levels of flaxseed in its diet. By formulating diets based on the above-mentioned nutrients, nutritionists expect predictable performance. Because palatability and the impact of so-called anti-nutritional factors will not be determined in nutrient profiling, the only way to ensure that pigs perform as expected on diets containing flaxseed is to feed graded levels to the pig and evaluate performance compared to a known control. With a complete nutrient profile of flax in hand, and with objective information on the acceptability of flaxseed by the pig, a solid foundation is in place for future research on flaxseed in pig diets. Possible future uses for flax include the production of omega-3 fatty acid enriched pork, the development of alternatives to antimicrobial growth promoters and the enrichment of sow diets for essential fatty acids.

## Experimental Procedures

Rooms and Animals

This experiment was conducted in an intensive room at PSCI. These rooms contain 76 pens, measuring 0.91 x 1.83 m (1.67 m2). The 4 extreme corner pens were not used, leaving 72 pens for use on this experiment. Floors are fully slatted, pre-cast concrete. Penning is solid PVC planking, with a 7.5 cm opening between the back walls, allowing pig-to-pig contact. Feeders are single space, dry feeders located at the front of each pen. Water is delivered through a nipple drinker located on the center of the back wall of the pen.

**Table 1.** Dietary treatments and number of pigs which will receive each treatment.

| Treatment # | % Flaxseed | % Canola oil | # pigs | Flaxseed (kg)[a] |
|---|---|---|---|---|
| 1 | 0 | 0 | 8 | 0 |
| 2 | 5 | 0 | 8 | 30 |
| 3 | 10 | 0 | 8 | 60 |
| 4 | 15 | 0 | 8 | 90 |
| 5 | 20 | 0 | 8 | 120 |
| 6 | 0 | 1.7 | 8 | - |
| 7 | 0 | 3.3 | 8 | - |
| 8 | 0 | 5.0 | 8 | - |
| 9 | 0 | 6.7 | 8 | - |

[a] assuming 600kgs per diet

**Table 2.** Amount of Basal Diets and Blending Regimes for Intermediate Diets

| Percent | % Diet | 20% Flaxseed Diet | 8% Canola Oil Diet |
|---|---|---|---|
| **Flaxseed Diets** | | | |
| 0 | 600 | 0 | 0 |
| 5 | 450 | 150 | 0 |
| 10 | 300 | 300 | 0 |
| 15 | 150 | 450 | 0 |
| 20 | 0 | 600 | 0 |
| **Canola Oil Diets** | | | |
| 1.7 | 450 | 0 | 150 |
| 3.3 | 300 | 0 | 300 |
| 5.0 | 150 | 0 | 450 |
| 6.7 | 0 | 0 | 600 |
| Required Amount | 2,400 | 1,500 | 1,500 |

One room of pigs were weighed at nursery exit and again when the pigs reached approximately nine weeks of age. Pre-test average daily gain was calculated from these weights. The pre-test average daily gain, and body-weight was used when the pigs reached approximately 9 weeks of age (25-30 kg) to select 36 barrows and 36 gilts. Pigs were blocked according to gender and weight. Within each block, pigs were randomly assigned to one of 9 experimental diets. Therefore, there were 4 blocks of barrows and 4 blocks of gilts for a total of 8 pigs (4 barrows, 4 gilts) per treatment. Animals were on test for 28 d (expected final weight ~50 kg).

Treatments

The experiment was designed as a randomized, complete block with 4 blocks of barrows and 4 blocks of gilts and a total of 9 pigs per block. Treatments were designed to represent the range of added flaxseed that might be anticipated in commercial practice: 0%, 5%, 10%, 15%, or 20% whole ground flaxseed, supplying 0%, 1.7%, 3.3%, 5%, or 6.7% added oil. To provide comparative data, additional diets contained 1.7%, 3.3%, 5%, or 6.7% canola oil; the exact amount of canola oil used was based on the assay results of the flaxseed. Canola oil is low in polyunsaturated omega-3 fatty acids, and high in monounsaturated fatty acids.

The required flaxseed (600 kg) was sourced from one supplier who ensured that the product purchased was derived from a variety of suppliers. In this way, the flaxseed was more representative of "typical" flaxseed than would be the case of employing a single source. The flaxseed was submitted for assay of crude protein, calcium, phosphorous and fat, in support of more accurate formulation of the experimental diets.

The control, the 20% flaxseed diet and the 6.7% canola oil diet were formulated using Brill. The diets containing 5, 10, and 15 % flax were prepared by blending the required amounts of the 0 and 20% flaxseed diets. Similarly, the intermediate canola oil diets were prepared by blending the 0% and 8% canola oil diets.

Data Collection and Records

Pigs were weighed at experiment initiation (day 0) and weekly thereafter (d7, 14, 21, 28). All feed was weighed into the feeders and feeder weigh backs done on weigh days, for the calculation of weekly feed intake. Feed samples were obtained at the time of mixing and weekly thereafter. Samples were composite by treatment. Faecal grab samples were collected during week 2 from 3 randomly selected male and 3 randomly selected female pens per treatment. Samples were composite by gender and treatment. All data were entered into the computer on the day of collection and stored on the main server to ensure regular back-ups were performed.

Laboratory Analysis

Feed samples were ground and analyzed for moisture, energy and acid-insoluble ash. Faecal samples were freeze-dried at PSCI, ground and analyzed for moisture, energy and acid-insoluble ash. All AIA analyses were conducted in quadruplicate, on approximately a 2 g sample.

## Results and Discussion

Analysis of the ground flax seed indicated it contained (as fed basis) 33.3 % crude fat, 19.6 % crude protein and 8.6 % moisture. Analysis of the diets is described in Table 3. With the exception of treatment # 9, which contained more total fat than formulated, the basal diet and all the flaxseed diets contained more total fat than formulated and all the canola oil diets contained less total fat than formulated. The % difference between formulated and actual was greater in the canola oil diets than the corresponding flaxseed diets.

**Table 3.** Total fat, fibre, and protein composition of experimental diets.

| Trt # | Treatment Description | Average feed intake (g/d) | Average daily gain (g/d) | Feed efficiency |
|---|---|---|---|---|
| #1 | basal diet | 2,314 (211)a | 1,038 (081) | 0.450 (0.036) |
| #2 | 5 % flaxseed | 2,384 (248)a | 1,088 (106) | 0.464 (0.029) |
| #3 | 10 % flaxseed | 2,173 (196)ab | 1,034 (103) | 0.477 (0.031) |
| #4 | 15 % flaxseed | 2,226 (339)ab | 1,029 (110) | 0.466 (0.035) |
| #5 | 20 % flaxseed | 2,302 (377)a | 1,001 (076) | 0.441 (0.047) |
| #6 | 1.7 % canola oil | 2,304 (331)a | 1,069 (129) | 0.467 (0.045) |
| #7 | 3.3 % canola oil | 2,177 (236)ab | 1,067 (153) | 0.489 (0.030) |
| #8 | 5.0 % canola oil | 2,324 (227)a | 1,110 (023) | 0.481 (0.042) |
| #9 | 6.7 % canola oil | 2,035 (302)b | 1,012 (118) | 0.509 (0.030) |

a, b for average feed intake: means with different superscripts differ significantly (P = 0.032)

No difference was observed for average daily gain (P = 0.081) and feed efficiency (P = 0.07)

Pigs came off test September 14, 2005. Overall performance was excellent, and no pigs were removed from test during the 28-d experiment. Average initial weight was 27.5 and 27.4 kg for male and female pigs, respectively. The average initial weight and SD of blocks ranged from 24 ± 1.2 kg to 31.8 ± 2.3 kg. Average final weight was 63.01 and 63.12 for male and female pigs, respectively.

## Implications

Balanced diets containing up to 15% flaxseed will not adversely affect average daily gain, feed intake, feed efficiency of growing pigs (30-55kgs). Growing pigs can adapt to high levels, approximately 7%, of fat in the form of flaxseed better than equivalent levels of canola oil.

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