Research Note

FERMENTED TUNA FISH SLUDGE IN DIETS FOR GROWING PIGS[1]

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Fermented tuna fish sludge (FTFS) as a constituent (0, 5, 10%) of diets for growing pigs was evaluated. Nine groups (two pigs per group) of six-week-old crossbred (Yorkshire-Landrace) pigs were fed daily 6% (first three weeks) and 7% (last four weeks) of their body weight of a commercial compound feed. No significant differences ($P > 0.05$) were found in the pigs on the diets of 5 and 10% levels of FTFS when compared to the pigs of the control group as to weight gain, feed intake, and feed efficiency. No adverse effects on health were observed in pigs fed diets containing FTFS. It was concluded that FTFS could be incorporated at levels up to 10% in commercial diets without having any detrimental effects on the performance of growing pigs.

Feed represents 55 to 85% of the total cost of commercial swine production, depending mainly on the relative costs of feed stuffs, labor and housing in a particular situation (Pond and Maner, 1984). In Puerto Rico, feed constitutes about 80% of the total cost of swine production because most of the ingredients are imported. Presently available sources of energy and high quality protein in pig diets, such as ground corn, soybean meal and fish meal, have a relatively high production cost or are not very palatable (Hassan and Heath, 1986). Therefore, there is an urgent need to reduce the use of these ingredients.

The major liquid waste resulting from the commercial processing of fish, and production of fish meal and oil from low-grade fish and fish offal, is the flume water used to transport whole fish, offal and water from such operations as descaling, filleting, trimming and cleaning (Beszeditz, cited by Valle and Aguilera, 1990). This water is a major pollutant and the industries producing it in their operations must pay for its disposal. The Star Kist Caribe Inc., a tuna processing plant located in Mayagüez, P.R., produces around 45,600 liters per day of this water, the disposal of which adds a considerable expense to production cost. In previous studies, ensiling of this sludge has yielded a protein source suitable for use in diets of freshwater fish (Sanjuan et al., 1999). However, the potential use of FTFS in diets for domestic animals has not been researched.

In this experiment, the use of FTFS as a partial substitute for a commercial diet for growing pigs was evaluated. The study was conducted in the Experimental Swine Farm, University of Puerto Rico, in Lajas. Eighteen crossbred (Yorkshire-Landrace) growing pigs (two pigs per pen), female and castrated males approximately 40 days old, were used. Experimental treatments (three repetitions per treatment) consisted of the substitution at 0% (control group), 5% and 10% of the basal diet (commercial grower diet, 16% protein) with FTFS. In order to obtain the FTFS, sludge from the tuna processing plant

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TABLE 1.—*Chemical composition of diets offered during the experiment.*

Item	Levels of FTFS substitution (%)		
	0	5	10
Dry matter, %	89.59	83.16	78.11
Organic matter[1], %	93.86	93.77	93.23
Inorganic matter[1], %	6.14	6.24	6.52
Crude fat[1], %	3.76	4.92	5.90
Crude protein[1], %	15.81	15.05	14.61
Gross energy[1], Mcal/kg	3,950	4,009	4,038

[1]Dry matter basis.

was mixed with sugar cane molasses (70:30), inoculated with lactic acid-producing bacteria (10^{-6} CFU), and fermented during a 14-day period in a 1,520-liter drum. The amount of feed (dry basis) offered daily was calculated on the basis of 6% of the pig's body weight (BW) during the first three weeks and 7% for the last four weeks until the animals reached a final weight of 36 kg. During the whole experiment, water was freely available to all pigs from nipple waterers.

At the beginning of the experiment the pigs were weighed individually to calculate the quantity of feed offered and substitution of FTFS on a dry matter basis. Pigs were fed daily at 10:00 a.m. and weighed once a week. Each week the new body weight was used to calculate the amount of feed to be supplied. To estimate feed consumption, feed residue was collected and weighed daily. Samples of the feed and orts were taken weekly and were analyzed for dry matter, organic matter, ether extract, crude protein, and gross energy according to standard methods (AOAC, 1991). Observations of the possible detrimental effects of the FTFS on pig health were recorded during the experiment.

The data was analyzed as a completely randomized block (initial pig weight) design according to the General Linear Model (GLM) procedure using SAS (SAS Institute, 1989). The variables measured were: days required to reach the final average weight of 36 kg, weight gain per pen, average daily gain (ADG), total feed intake, and feed efficiency. The pen was included in the model as part of the analysis to correct for initial pig weight differences.

TABLE 2.—*Least square means (LSM) for days in the experiment, weight gain, and total feed intake in growing pigs fed with different levels of FTFS during the experimental period*[1].

Item	Levels of FTFS substitution (%)		
	0	5	10
Days in the experiment	47.36 ± 2.56	48.30 ± 2.56	44.33 ± 2.43
Weight gain (kg/pen)	62.27 ± 2.98	61.02 ± 2.98	65.70 ± 2.83
Total feed intake (kg/pen)	135.00 ± 12.03	128.74 ± 12.03	130.89 ± 11.42

[1]$P > 0.05$.

TABLE 3.—*Least square means (LSM) for the average daily gain, average daily feed intake, feed efficiency and feed:gain ratio for the experimental period.*[1]

Item	Levels of FTFS substitution (%)		
	0	5	10
ADG (kg/d)	0.60 ± 0.02	0.59 ± 0.03	0.62 ± 0.03
Feed Intake (kg/d)	1.39 ± 0.02	1.30 ± 0.03	1.47 ± 0.03
Feed Efficiency	0.42 ± 0.02	0.42 ± 0.03	0.40 ± 0.03
Feed:Gain	2.59 ± 0.17	2.32 ± 0.22	2.66 ± 0.21

[1]$P > 0.05$.

The diets offered throughout the experiment differed slightly in their chemical composition. The dry matter and crude protein percentage decreased, but the inorganic matter and gross energy content was greater as percentage of FTFS was increased in the rations (Table 1).

Days in the experiment, weight gain, and total feed intake were similar ($P > 0.05$) for all experimental levels (Table 2). Even though there were no significant differences, pigs consuming the diets containing 10% FTFS reached the final weight earlier, ate less and gained more weight than the control group. These results were probably due to the higher caloric content, which decreased the voluntary intake in animals offered diets containing FTFS, as compared to that of the control group.

No differences in ADG, feed intake, feed efficiency and feed:gain ratio were found associated with dietary FTFS levels ($P > 0.05$) (Table 3). In related studies, Fransen et al. (1995) found no differences in the average daily gain, daily feed intake and gain to feed ratio in growing-finishing pigs fed with a commercial diet supplemented with fermented poultry sludge. In pig diets, the use of FTFS at 0, 2, and 5% of the total dry matter consumption did not affect weight gain, back fat thickness or feed efficiency (unpublished data).

Although the feces of the pigs eating the FTFS—containing diets were slightly darker and more viscous than that of the control pigs, no clinical symptoms were apparent in these animals. The darker color of the feces can be attributed to the dark color (gray) of the sludge.

On the basis of this study we conclude that FTFS could be incorporated at levels of up to 10% substitution in commercial diets without detrimental effects on the performance and health of growing pigs. However, economic consideration will determine its practical utilization. Future research, such as back fat thickness and carcass characteristics, should be evaluated because of the present demand for animals with reduced fat deposits. Also a study is needed on the performance of pigs consuming diets replacing energy (corn) and protein (soybean meal and fishmeal) ingredients with FTFS.

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