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# REPLACEMENT OF FISH MEAL WITH SHRIMP WASTE MEAL IN WEANER PIG RATION

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**Target audience**: Nutritionists, farmers, feedmillers.

## ABSTRACT

**The replacement value of shrimp waste meal (SWM) for fish meal (FM) at four replacement levels (0, 33, 66 and 100 %) was tested in a feeding trial with sixteen Large White x Duroc pigs with initial live weight of 10.00 ± 0.34 kg. The diets were iso-nitrogenous and iso-caloric with 20 5 crude protein and 2,700 kcal ME/kg diet. SWM at 100 % replacement level in the diet depressed ($P < 0.05$) the average final live weight, daily weight gain and feed efficiency ratio. There were no significant differences in the measured parameters among 0, 33 and 66 % SWM diets. No mortality was recorded. This study suggests that SWM could replace FM up to 66 % (on weight basis) in weaner pig rations without any adverse effect on performance.**

**Key words:** Shrimp waste meal; weaner pig; performance

## DESCRIPTION OF PROBLEM

Nigeria's livestock industry still makes use of an appreciable quantity of imported protein feedstuffs especially fish meal (FM). There is however a growing awareness among animal production scientists of the need to evaluate locally available feeding stuffs as substitute for imported ingredients. Shrimp waste is one of such alternatives. Shrimp waste meal (SWM) is a potential source of protein for animal feed and contains mainly the head, gut and exoskeleton of shrimps being processed for export and local consumption. It is particularly rich in lysine which makes it an ideal supplement for cereal (1). The production of shrimps both in off-shore and Lagos Lagoon amounted to 637,000 metric tonnes in 1990 (2). Not less than 3,000 metric tonnes of SWM is produced annually in south western Nigeria only (3).

SWM is of high nutritional value, palatable and of pleasant aroma. It has an average of 46.7 % protein, 27.8 % mineral matter (4) and 27 % ash. Of major concern with SWM is the chemical nature of the exoskeleton of the shrimp, which is mainly composed of chitin, an N-acetylated glycosamine polysaccharide that forms part of the protein complex and is considered to have low digestibility when fed to animals (6). It was reported that SWM

can partially or totally replace soyabean meal in broiler diets (7) while another study (1) revealed that SWM in broiler rations can replace up to 66 % of the protein contributed by FM without significantly affecting the performance. There is, however, some paucity of information on SWM utilization in swine feeding. This study was designed to evaluate the performance of weaner pigs fed diets in which FM was replaced with SWM.

## MATERIALS AND METHODS

The test ingredient (shrimp waste) was obtained from Ocean Fisheries, Ikorodu, Lagos. This was oven-dried and then ground in a hammer mill. Samples of this dried SWM were analysed for proximate composition (8) and mineral content (9). Based the results of this chemical analyses (Table 1), four experimental diets were formulated such that 0, 33, 66 and 100 % of FM were replaced, weight for weight (w/w), with SWM. The diets were iso-nitrogenous and iso-caloric with about 20.0 % crude protein and 2,700 kcal ME/kg diet (Table 2).

Sixteen Large White x Duroc pigs with initial live weight of 10.0 ± 0.34 kg, eight of each sex, were randomly allotted to the four dietary treatments on the basis of weight and sex with two replicates per treatment. All the pigs were housed in concrete floored pens equipped with feeding and watering troughs. They had feed and water *ad libitum*. Pigs were weighed weekly and feed consumption was recorded daily. Performance was monitored in terms of weight gain, feed intake and feed/gain ratio. Diets were analysed for their proximate constituents (8). The experiment lasted for seven weeks with two weeks of adaptation.

Experimental data were subjected to analysis of variance (10). Where there was any significance, the means were further compared using Duncan's Multiple Range Test (11).

## RESULTS AND DISCUSSION

(a) ***Proximate and mineral composition***. Composition of the SWM used in this study is shown in Table 1. The value for crude protein is lower than those reported for many conventional animal protein sources but similar to the values reported by some other workers (4, 5). This could be due to the high proportion of the non-proteinaceous parts of the shrimp, mainly the exoskeleton, which is reflected in the apparently high ash content. The SWM is high in calcium and phosphorus. Calcium carbonate is responsible for the scleratization of the exoskeleton and represents most of the mineral matter in SWM (7). The energy value of 2,500 kcal ME/kg and the value for ether extractives seem to be moderate for an animal protein source.

(b) ***Performance characteristics*** : Performance characteristics of pigs fed the experimental diets are shown in Table 3. The inclusion of SWM in the

Table 1: Proximate composition of Shrimp Waste Meal

| | g/100g DM |
|---|---|
| Crude protein | 46.3 |
| Crude fibre | 4.3 |
| Ether extract | 9.04 |
| Ash | 17.04 |
| Chitin | 9.82 |
| Calcium | 7.0 |
| Phosphorus | 3.03 |
| Energy (ME kcal/kg DM) | 2500 |

DM = Dry matter

Table 2: Composition of Experimental diets (g/100g)

| | Replacement levels of SWM(%) | | | |
|---|---|---|---|---|
| | 0 | 33 | 66 | 100 |
| Maize | 45.0 | 35.0 | 30.0 | 25.0 |
| Dry brewers' grain | 34.5 | 40.0 | 40.0 | 25.0 |
| Full-fat soyabean | 8.0 | 12.5 | 17.5 | 43.0 |
| Fish meal | 10.0 | 6.67 | 3.33 | 19.5 |
| Shrimp waste meal | 0.0 | 3.33 | 6.67 | 0.0 |
| Bone meal | 1.0 | 1.0 | 1.0 | 1.0 |
| Oyster shell | 0.5 | 0.5 | 0.5 | 0.5 |
| Salt | 0.5 | 0.5 | 0.5 | 0.5 |
| *Premix | 0.5 | 0.5 | 0.5 | 0.5 |
| Calculated | | | | |
| Lysine | 1.82 | 1.36 | 1.43 | 1.45 |
| Methionine | 1.90 | 1.94 | 1.40 | 1.21 |
| Determined | | | | |
| Energy (ME) kcal/kg | 2777.50 | 2674.37 | 2631.07 | 2659.00 |
| Crude protein | 19.72 | 19.79 | 19.47 | 19.15 |
| Crude fibre | 8.34 | 9.60 | 9.88 | 11.00 |
| Calcium | 1.26 | 1.30 | 1.35 | 1.40 |
| Phosphorous | 0.67 | 0.70 | 0.73 | 0.74 |

SWM = Shrimp waste meal

* Provide per kg diet: 5000 IU Vitamin A; 1000 IU Vitamin D; 0.8mg Vitamin E; 0.4mg menadione $K_3$; 1.2 mg riboflavin; 1.0 mg pantothenic acid; 0.004mg Vitamin $B_{12}$; 3mg niacin; 4mg Vitamin C; 112mg choline; 24 mg manganese; 8 mg iron; 0.048mg selenium; 5mg antioxidant (BHT).

Table 3: Perfomance characteristics of weaner pigs fed the experimental diets

| Parameters | Replacement level of SWM* (%) | | | | SEM |
|---|---|---|---|---|---|
| | 0 | 33 | 66 | 100 | |
| Number of animals | 4 | 4 | 4 | 4 | - |
| Average initial live weight (kg) | 10.12 | 10.00 | 9.89 | 10.35 | 0.09 |
| Average final live weight (kg) | 29.33$^{a}$ | 30.58$^{a}$ | 29.49$^{a}$ | 24.56$^{b}$ | 0.54 |
| Average daily weight gain (kg) | 0.39$^{a}$ | 0.42$^{a}$ | 0.40$^{a}$ | 0.29$^{b}$ | 0.33 |
| Average daily feed intake (kg) | 1.18 | 1.22 | 1.25 | 1.07 | 0.12 |
| Average feed efficiency ratio | 3.09$^{b}$ | 3.32$^{b}$ | 3.15$^{b}$ | 3.74$^{b}$ | 0.06 |

a, b : Means in rows with no common superscript differ significantly ($P<0.05$)
*SWM = Shrimp waste meal
SEM = Standard error of mean

diets had no significant effect on feed intake. However, the final live weight, weight gain and feed efficiency of the pigs were lowered ($P < 0.05$) at 100 % level of replacing FM with SWM. Reduction in growth rate observed at the said level could not be due to feed intake, as the differences observed for feed intake were not significant. It seems conclusive that the reduction in growth rate could have resulted from the quality of protein mixture in the diet, where SWM was the only animal protein source. Because of high mineral level, SWM is usually used in combination with other protein supplements (12). The nutritional value of SWM depends on the amount of shell, and thus, chitin present, which has low digestibility when fed to animals (7). It is likely that the protein mixture in the diet with total replacement of FM with SWM could not satisfy the requirement of weaner pigs for methionine and lysine because of the low digestibility of chitin which formed part of the protein in SWM. Methionine deficiency in the ration of pigs could cause an amino acid imbalance with consequent adverse effects on performance (13). Pigs are more sensitive to amino acids at the early age. Supplementation of this diet (100 % SWM) with synthetic methionine and lysine may improve the utilization of dietary protein.

## CONCLUSION AND APPLICATION

The result of this study suggest that SWM could replace FM up to 66 % (w/w) in weaner pig diets without any adverse effects on performance.

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