Growth performance of tilapia (*Oreochromis niloticus*) fingerlings offered different levels of copra meal with local ingredients as tilapia feed

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ABSTRACT

A growth trial was carried out to study the performance of tilapia fingerlings (*Oreochromis niloticus*) using local feed ingredients containing four levels (0 %, 10 %, 20 %, and 30 %) of copra meal as tilapia feed. Body weight gain (g), body length gain (cm), feed intake (g), feed conversion ratio, and mortality rate were measured weekly as variables. Feed was calculated at 10 % body weight of the weekly average weight of the fingerlings. The copra meal was the main energy and protein ingredient in the diets. The feeding period was seven weeks. There were significant differences in the final weight and length gains of the tilapia fed with different levels of copra meal. The final body weights (g) for the four feed treatments (0 %, 10 %, 20 %, and 30 % copra meal) were 11.08, 13.54, 13.92 and 10.62, respectively, and the final body lengths (mean, cm) were 86.77, 93.15, 94.69 and 85.54, respectively. Both body weight and body length recorded showed that feed had an effect on the performance of the fingerlings. It was apparent that feeds containing 10 % and 20 % copra meal had significantly better performance ($P<0.001$) than those with 0 % and 30 %. There was also a trend in the performance, in that as the level of copra meal increased the performance decreased. It is recommended that 20 % copra meal inclusion can be used in the tilapia feed for the local farmers.

Key words: Copra meal, local ingredients, tilapia fingerlings, growth performance.

INTRODUCTION

The history of rural aquaculture in Papua New Guinea (PNG) can be traced back to 1954 when the Department of Agriculture, Livestock and Forestry established the Highlands Aqua-culture Development Centre (HAQDEC) and soon afterward constructed four fish ponds at Aiyura. The principle reason for introducing aquaculture was and is to increase protein consumption in the diet of the people in the highlands. The second reason is to provide a means for farmers to earn cash income and help develop a commercial industry.

Aquaculture in PNG is gaining popularity and is growing very rapidly with small farmers and commercial farmers (Coates, 1989). Globally, especially in the south Asian countries, this is a big industry both domestically and for export. The PNG aquaculture industry is still in its infancy but it has huge potential for growth. There are more and more farmers venturing into inland fish farming, but they face a big problem with fish feed as the fish feed cost is very high. One way of reducing the fish feed cost and fish feed problem is by making our own fish feed and using locally grown feed ingredients. This study was, therefore, undertaken to evaluate the growth performance of tilapia fingerlings using locally formulated fish feed and local feed ingredients.

MATERIALS AND METHODS

Experimental site

This study was conducted at the PNG University of Technology agriculture farm located about 9 km from Lae city. The average annual rainfall is about 3500-4000 mm and the average annual temperature ranges from 27-30 ^{o}C.

Experimental tanks and building

The experiment was conducted in an open-sided permanent building, and plastic tanks of size 0.65 m x 0.45 m x 0.58 m were used (volume = 0.17 m^3).

Experimental fish

Two hundred fingerlings (3 g) were purchased from Potsy Inland Fish Ltd. These

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fish were held in a 1000 litre tank and were acclimatized for one week before being used in the experiment. During the acclimatizing period, the fingerlings were fed a basal feed of 35 % CP. After one week, the fingerlings were weighed individually and those with a 4-5 grams body weight were selected and randomly distributed to four plastic tanks. The fish were fed twice daily at a rate of 10 % of the weekly body weight adjusted. Measurements made were weekly average live body weight and body length, over a seven week period.

Water management

Rain water was used and water was changed weekly.

Feed preparation

Four experimental diets containing 0 %, 10 %, 20 %, and 30 % copra meal (identified as CM0, CM10, CM20 and CM30) were formulated. The treatments feeds were copra meal base protein concentrate formulated using the feed formulation software of Thomson (2006). All the feed ingredients were purchased locally. The diets used, as well as the overall protein and metabolizable energy contents of the diets are shown in Table 1. Each diet was made by mixing the protein concentrates with the basal portion of the diets. The protein concentrates were made from the various portions of the fish meal and copra meal, while the basal portion was made from the calculated portion of copra meal, cassava meal, rice mill and mill run. Mill run and cassava meal were used solely to enhance the floatation and binding qualities of the diets, respectively. Wheat mill run consists of wheat bran, wheat shorts, wheat germ, and wheat flour, and offal from the tail of the mill; ground run of the mill screenings are also normally added to the mill run.

All diets contained a fixed 25 % crude protein but the metabolizable energy estimates ranged from 12.3-14.7 mJ/kg (Table 1). All other ingredients were milled using the hammer mill before combination. Afterward, warm water (60-65 ^{o}C) was added to the basal and the concentrates mixed, and the resulting dough was further passed through a 3 mm dye mincer to form pellets. The pellets were dried in an oven at 80 ^{o}C for 12 hr before feeding. Each diet was replicated 13 times and each replicate contained one fingerling of the GIFT variety (Dey & Gupta, 2000) in a 0.17 m^3 water tank containing rain water.

Experimental design

The experiment was carried out using the completely randomised design with 13 replicates per treatment. A total of 52 tilapia fingerlings were randomly distributed to the tanks located in a grid pattern under a shed. A compressor was used for aeration. The water was changed weekly.

Data analysis

Analysis of variance (ANOVA) was carried out to study the effect of diets on the body weight and body length of the fish. The data were analysed using the Genstat computer package. And for any treatment means that were significant, a mean separation test was carried out using t-test and Least Significant Difference (LSD).

RESULTS

The trends in the mean weekly body weight and body length of the tilapia fingerlings fed the different treatment diets are shown in Figures 1 and 2, respectively. The estimates of the final mean body weight and body lengths are shown in Table 2.

Differences in the final body weights were highly significant ($P<0.001$), showing that CM0 and CM40 body weights were similar but significantly lower than CM10 and CM20; CM10 and CM20 were statistically similar (Table 2). The same trend was observed for mean body lengths. Therefore, the results showed that the experimental feeds

Table 1. Composition of experimental diets for tilapia.

Diets	Composition of concentrate portion of the diet	Crude protein (%)	Metabolizable energy (mJ/kg)	Energy:protein ratio
CM0	0 % copra meal	25.5	14.7	0.58
CM10	10 % copra meal	25.0	14.0	0.56
CM20	20 % copra meal	25.5	12.3	0.48
CM30	30 % copra meal	25.8	13.0	0.50

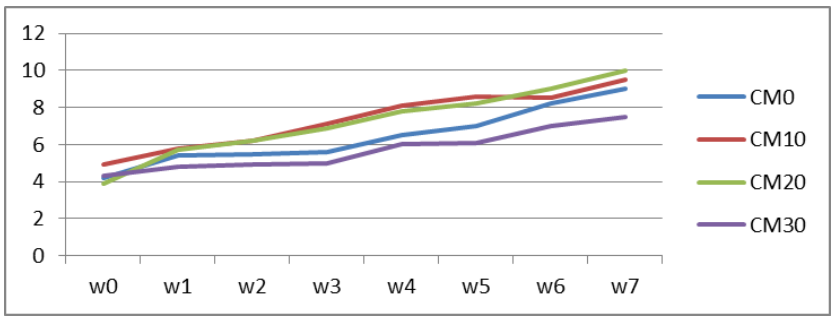

Figure 1. Average weekly body weights (g) of experimental tilapia.

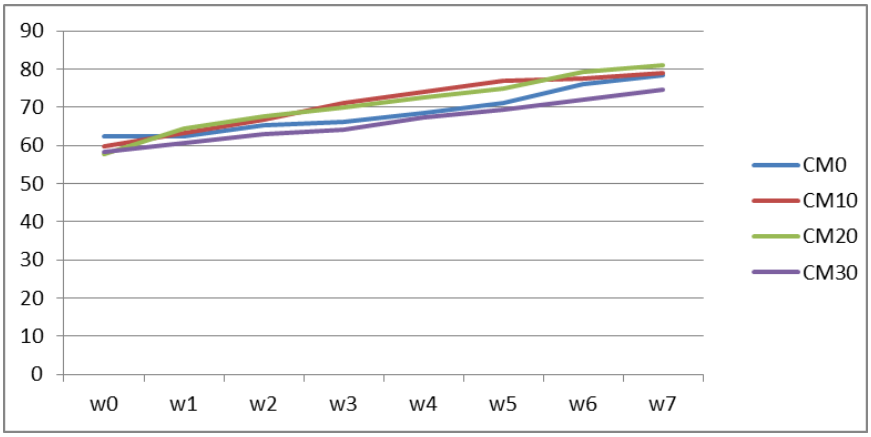

Figure 2. Average weekly body lengths (mm) of experimental tilapia.

Table 2. Estimated final mean body weights and body lengths of tilapia on the experimental diets.

Treatments diets	Mean body weights (g)	Mean body lengths (mm)
CM0	11.08_a	86.77_a
CM10	13.54_b	93.15_b
CM20	13.92_b	94.69_b
CM30	10.62_a	85.54_a

Within each column, values with different subscripts are significantly different from each other ($P<0.001$).

had significant effects on the growth of the tilapia fish.

DISCUSSION

The results of the findings from this study clearly show that growth of the tilapia fingerlings, in terms of body weights and body lengths, was highly influenced by the copra meal protein concentrate inclusions in the diets. The fingerlings on diets CM10 and CM20 had similar body weights and body lengths and significantly better growth performance than fingerlings on CM0 and CM40. This suggests that fingerling diets must have 10-20 % of copra meal; however, there is also an indicative trend of decline growth as copra meal increases beyond 30 %. The similar trends of body weight and body length performance are not surprising, as both of these variables are measures of growth in fish studies.

The generally better performance of the fingerlings fed CM10 and CM20 may be explained in quality and quantity of protein in the diets and also the energy:protein ratio of the diets. The amino acid profile of both fish meal and copra meal base concentrate used most closely meets the amino acid requirements of fish and also provide close energy:protein ratio in the diets. Tilapia, being monogastric and omnivores, would definitely perform better with diets considering these

facts.

One significant finding from this study is that 20 % or 10 % of fish meal can be replaced by copra meal in the diets for tilapia fingerlings. The main advantage of using copra meal by small scale farmers would be its relatively low cost and availability in even remote communities in the country compared to imported concentrates.

Some factors which need further investigation include the use of copra meal with other local sources of protein such as earthworm meal, snail meats and maggot meals. Digestibility studies of the diets can also be studied. Furthermore, the free choice feeding system use of the diets as protein concentrate base can be investigated because it is it well recognized that fish readily consume earthworm, snail flesh and maggot flesh, and this feeding system, if successful, will remove the need for processing and milling of protein ingredients.

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