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Ministry of Fisheries, the Kingdom of Tonga
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Growth of Fingerlings of Big-Belly Mullet, *Liza macrolepis*, Fed with Local Products

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Abstract

Effect on the growth of big-belly mullet, *Liza macrolepis*, was examined for three kinds of locally produced materials, namely, cassava, squash pumpkin and beer brewery residue, in a rearing experiment. All materials were processed to meal and mixed with formula feed for carp imported from Japan at 1:1 in weight before given to each batch of fish reared in separate tanks. For two other batches of fish, formula feed for carp and a test formula feed prepared by the senior author were given for the comparison. The fish of 2.6g in average body weight had grown to 4.4g, 4.5g and 4.2g in average body weight after 56 days of rearing for the batches fed with cassava, pumpkin and beer brewery residue mixed with formula feed, respectively. The fish fed with formula feed for carp and the test formula feed had grown to 5.4g and 5.6g in average body weight, respectively, in the same period. The difference in the growth between the fish fed with feed containing 50% of locally produced materials and those fed with formula feeds was statistically significant. Such difference seems to be caused by low protein content for cassava, pumpkin and beer brewery residue. The high fibre content of beer brewery residue might be another reason for the low growth rate.

Introduction

Big-belly mullet, *Liza macrolepis*, is the target fish of the fish-pen culture experiment conducted in the Aquaculture Research and Development Project, a technical cooperation project between Tongan Ministry of Fisheries and Japan International Cooperation Agency. One of the important problems to be solved in the experiment is the supply of

appropriate supplemental feed for the mullet to enhance the growth of the fish. The main component of the supplemental feed should be inexpensive local products to secure the economic viability of the culture. The present report deals with the results of the feeding experiment to examine the possibility of using locally produced cassava, squash pumpkin and beer brewery residue as a major ingredient of the feed for the rearing of juvenile big belly mullet.

Materials and Methods

Juveniles of big-belly mullet were collected at sandy littoral of Navutoka situated off the north eastern coast of Tongatapu Island. Average body weight was 2.6g. Twenty fish were placed in each of five 500l circular plastic tanks (Tanks 1-5). Continuous seawater supply at a rate of about 2.0l per minute and gentle aeration were provided to each tank. The following five kinds of feed were used in the experiment.

- Feed 1 : Cassava meal mixed with formula feed for carp at 1:1
- Feed 2 : Formula feed for carp
- Feed 3 : Squash pumpkin meal mixed with formula feed for carp at 1:1
- Feed 4 : Beer brewery residue mixed with formula feed for carp at 1:1
- Feed 5 : Experimental formula feed

Cassava, squash pumpkin and beer brewery residue were ground into fine meal after drying. The formula feed for carp was a product from Japan (Nippai Co., Ltd.) with the composition as shown in Table 1.

Table 1. Composition of formula feed for carp

Composition	%
Crude protein	>39.0
Crude fat	> 3.0
Crude fibre	< 5.0
Crude ash	<15.0
Calcium	> 1.5
Phosphorus	> 1.3

The formula feed was also ground into fine powder before being mixed with other ingredients. The quality of the formula feed seemed to have deteriorated to a certain extent since the feed had been stored under high temperature and high humidity conditions for more than two years. The experimental formula feed was prepared by the senior author during his training at Kinki University, Wakayama Japan. Ingredients and composition of the experimental formula feed are shown in Table 2.

Feeds 1-5 were supplied to Tanks 1-5, respectively. Daily amount of the feed supplied to each tank was 2.6g during the first 20 days of the experiment and 4.6g later on. Salinity, determined with a refractometer (Atago, Japan), ranged 33-42‰, water temperature 22-28° C and pH 7.9-8.5 during the experiment.

Table 2. Composition of experimental formula feed (Feed 5).

Ingredients (%)		Composition (%)	
Pumpkin meal	19.9	Crude protein	36.9
Sweet potato meal	53.1	Crude lipid	9.0
Fish meal	22.1	Crude carbohydrate	38.5
Pollack liver oil	1.1	Fibre	0.5
Vitamin mix	0.2	Crude ash	11.7
Mineral mix	2.2	Others	3.5
CMC*	1.3		

* Carboxymethyl cellulose sodium salt

Results

Table 3 shows the number of fish and their body weight measured on 56th day of the experiment, and Table 4 shows the results of analysis of variance conducted on the body weight data.

Table 3. Number and average body weight of big-belly mullet on 56th day of the rearing

Tank	Number of fish	Average body weight (g)
1	17	4.4
2	18	5.4
3	16	4.5
4	19	4.2
5	19	5.6

It can be said that the growth obtained by the feeds containing local products as a major ingredient was significantly smaller than that obtained by formula feed for carp and experimental formula feed. There is no significant difference in growth between formula feed for carp and the experimental formula feed, and among feeds containing local products.

Table 4. ANOVA table on the results of the feeding experiment

Source variation	d. f.	SS	MS	f
Between				
all Feeds	4	30.484	7.621	3.15*
Feeds (2,5) and (1,3,4)	1	29.465	29.465	12.18*
Feeds 2 and 5	1	0.324	0.324	0.13
Feeds 1, 3 and 4	2	0.695	0.348	0.14
Within Feed	84	203.152	2.418	
Total	88	233.636		

*: Significant at 5% level.

Discussion

Although the nutritional composition of local products used in this study has not been analyzed, crude protein content is estimated to be approximately 2.6% for cassava meal, 18.5% for pumpkin meal and 22.9% for beer brewery residue assuming moisture content being 12% (Agriculture, Forestry and Fisheries Research Council Secretariat, 1987). Applying these figures, the protein content is roughly estimated as 18.5% for Feed 1, 34.3% for Feed 2, 26.4% for Feed 3, 29.1% for Feed 4 and 32.4% for Feed 5. The smaller increase in body weight observed for Feeds 1, 3 and 4 seems to be explained by the low crude protein contents. Crude fibre content is as high as 14.4% for beer brewery residue and 13.8% for squash pumpkin meal (ditto), while it is lower than 5% for cassava meal and the formula feeds. This high content of crude fibre might also be responsible for the smaller body weight increase observed for Feeds 3 and 4.

The present experiment was conducted in the tanks placed in the laboratory and hence the condition was quite different from that of pen culture where many kinds of natural feeds are available for the fish other than the supplemental feed. An experiment conducted in India (Prasad and Kadir, 1988) showed that the supplementary feeding of rice bran and groundnut oil cake mixture (1:1 in weight) given to the mixed culture of *L. macrolepis*, *Mugil cephalus*, and some shrimps did not enhance growth of *L. macrolepis*. This may suggest that supplemental feed without appropriate nutritional composition is likely to have no growth enhancing effect. Further experiments should be conducted to establish an appropriate formula of supplemental feed before the establishment of the commercial pen culture technique of *L. macrolepis*.

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