Pertanika, 2(1), 43–46 (1979)

Observations on the Growth of Young Tinfoil Barb, *Puntius schwanenfeldii* (Bleeker) Fed with Pellet Feeds

A. K. M. MOHSIN and ANG KOK-JEE.
Faculty of Fisheries and Marine Science, Universiti Pertanian Malaysia

Key words: Pellet feeds; Fish Fry; Nutrition; Tinfoil Barb, *Puntius schwanenfeldii* (Bleeker).

RINGKASAN

Satu kajian telah dijalankan untuk menguji kesesuaian empat jenis gizi dibuat dari bahan-bahan pertanian untuk anak ikan Lampam Sungai (tinfoil barb). Makanan 1, 2, 3 dan 4 masing-masing mengandungi zat protein kasar 14.5, 18.6, 16.9 dan 13.1%. Anak ikan diberi gizi 2 mencapai tumbesar yang terbaik dan terpanjang ($P < 0.05$) jika dibandingkan dengan anak-anak ikan yang diberi makanan-makanan lain.

SUMMARY

A study was conducted to test the suitability of four feeds formulated from agricultural by-products for tinfoil barb fry. The crude protein levels in feeds 1, 2, 3 and 4 were 14.5, 18.6, 16.9 and 13.1 per cent respectively. Fish fed diet 2 attained maximum growth compared to fishes fed other diets ($P < 0.05$).

INTRODUCTION

One of the main problems in fish culture is the availability of supplementary feed. In Malaysia herbivorous freshwater fish are fed mainly with various aquatic weeds, fodder and grasses that are available to fish farmers. The feeds sometimes consist of various mixtures of both plant and animal origin which are mixed and then fed to the fish. This type of feed preparation is not ideal as the feed which is often in a wet state tends to deteriorate in quality after a period of time. To overcome the problems of feed deterioration and storage, the use of dry pelleted feeds appears more desirable in fish culture operation.

In recent years attempts to develop pelleted dry feeds have had some success in the United States and Japan (Venkataramiah *et al.* 1975). In Malaysia feed development for fish culture is still in the experimental stage. Many agricultural by-products such as soybean waste, rice bran and cassava can be utilized as sources of feeds for fish. With the Government of Malaysia planning for an accelerated development in aquaculture (Pathansali and Zainol, 1975) popular food fishes will be target species for culture, and *Puntius schwanenfeldii* (Bleeker) locally known as "Lampan Sungai", seems to have good potential for exploitation. However, one of the major constraints in the development of aquaculture, specially in Malaysia, is the absence of suitable feeds for the cultured species (IDRC, 1973).

Literature concerning the nutritional requirements of "Lampan Sungai" is scanty. Much work has been done on the nutritional aspects of cyprinids specially on common carp. This has been sufficiently covered in the bibliography prepared by Hepher and Gaudet (1975).

Available evidence indicates that "Lampan Sungai" is omnivorous in feeding habit (Ong, 1968). In order to formulate a suitable diet for the fry of this species, ingredients of agricultural by-products from plant and animal origins were used. The following experiments were undertaken to test the suitability of three formulated pelletized feeds. Rice bran was used as control because it is usually used by fish culturists.

MATERIAL AND METHODS

Fry of "Lampan Sungai" were bought from a local aquarium fish dealer. The experiment was started on 23 June 1978 and terminated on 25 September 1978. The range of average standard length and weight of the fry were 32.6 mm to 34.0 mm and 1.1 g to 1.6 g respectively. The

Key to authors' names: Mohsin, A. K. M. and Ang, K. J.

fry were acclimatised in small tanks for about a week during which time they were fed with rice bran.

TABLE 1

Percentage Composition of Experimental Feeds

Ingredients	Feeds			
	1	2	3	4
Soyabean	30	10	–	–
Rice bran	40	50	20	100
Cassava	30	–	50	–
Fish meal	–	20	15	–
Sago meal	–	20	–	–
Ground nut	–	–	15	–

1 gm of Lactozyme added to every kg of diet.

The ingredients of the different feeds (Table 1) were bought from the local market and finely ground. According to the composition of the crude protein in each of the ingredients, the percentage composition of the different ingredients was adjusted accordingly as shown in Table 2. Lactozyme, a non-antibiotic feed additive known to improve feed conversion and hence growth rate, was added to all diets at a rate of 1 g per kg of feed. Feeds 1, 2, 3 and 4 were formulated to contain approximately 14.5, 18.6, 17.0 and 13.1% of crude protein (Table 2).

TABLE 2

Chemical Composition (%) of experimental feeds

	Feeds			
	1	2	3	4
Crude Protein (N × 6.25)	14.5	18.6	16.9	13.1
Moisture	11.1	12.0	9.0	8.1
Ash	11.1	13.1	16.3	10.9
Fat	2.9	4.5	1.8	6.8*
Fibre	6.8	6.2	6.8	6.1

*Data taken from Hickling (1971)

All feeds were soaked before they were ground in a meat grinder and then passed through a sieve with 3 mm mesh. They were then broken by hand into lengths of 10 to 15 mm, distributed evenly in trays, and sun dried for three days. The pellets were further broken into smaller pieces (1-5 mm particle size) for easy feeding of the fry. The fry were fed twice at 0900 hrs and 1530 hrs daily at an average level of 5% of the total body weight. Left over food was siphoned out; the aquaria were cleaned and partially filled with rain water daily at 0830 hrs.

Twelve glass aquaria of equal size (61.2 cm × 30.6 cm × 31.3 cm) were used. Each aquarium contained 30.4 l of rain water which came from an accumulated supply throughout the year in a concrete tank with a capacity of 136,300 l and which had been covered with mosquito net wire to prevent entry of leaf litter. The rain water used in this study had a pH of 7.5-8.1, a total alkalinity of 60 mg/l as $CaCo_2$ and specific conductance of 70 micro MHOS/cm. The water temperature in the experimental tanks varied between 24°C and 28°C. The twelve aquaria were divided into four groups. Each group consisted of three replicates. Groups 1, 2, 3 and 4 consisting of 25 fish fry in each aquarium, and selected at random, were given feeds 1, 2, 3 and 4 respectively. The experiments were conducted in the Aquarium Room of the Division of Fisheries and Marine Science, Universiti Pertanian Malaysia, Serdang, Selangor.

The length and weight measurements of the fish were taken at fortnightly intervals. The final average gains of fish length of the different groups were treated statistically by Analysis of Variance and Orthogonal Comparisons were made (Snedecor, 1961) and the length and weight of the replicates of each group were then subjected to a t-test.

Crude protein was analyzed according to A.O.A.C. (1965) while fibre, ash and moisture were determined by the Goering and Soest (1970) method. K-factor was determined by the formula $K = 100W/L3$ where L = standard length in cm, and W = weight in gms (Bennett, 1962).

RESULTS AND DISCUSSION

Fry required a week to get used to eating the feed. Sometimes after a few bites they rejected the feed but kept on checking very often. When soaked with water and after becoming soft, all feeds, except feed 1, were consumed. Feed 2 was found to be most acceptable followed by feeds 3 and 4. At the end of the experiment the fry given feed 1 appeared to have bulging eyes and became emaciated. The average standard length and weight, average gain in length, weight and K-factor are given in Tables 3 and 4. It is evident from Table 4 that the maximum average gain in length and weight was observed in fry from feed 2 and was found to be significantly

TABLE 3

Average standard length (mm) and weight (g, in parenthesis) of fry during experiment
(Each value is a mean of 3 replicates)

Date	Diet 1	Diet 2	Diet 3	Diet 4
	Aquarium I	Aquarium II	Aquarium III	Aquarium IV
June, 23, 78	33.6 ± 0.65 (1.2 ± 0.09)	34.0 ± 0.31 (1.1 ± 0.04)	33.8 ± 0.85 (1.1 ± 0.08)	32.6 ± 0.68 (1.6 ± 0.06)
July, 11, 78	33.2 ± 0.88 (1.4 ± 0.04)	36.5 ± 0.37 (1.6 ± 0.05)	35.7 ± 0.72 (1.4 ± 0.07)	34.9 ± 0.57 (1.3 ± 0.13)
July, 28, 78	37.6 ± 0.39 (1.6 ± 0.06)	40.2 ± 0.38 (1.9 ± 0.06)	38.1 ± 0.62 (1.8 ± 0.04)	37.4 ± 0.35 (1.6 ± 0.04)
Aug., 11, 78	38.2 ± 0.35 (2.0 ± 0.06)	40.8 ± 0.39 (2.6 ± 0.07)	38.4 ± 0.33 (1.8 ± 0.04)	37.0 ± 0.40 (1.7 ± 0.05)
Aug., 29, 78	38.5 ± 0.40 (2.0 ± 0.07)	44.1 ± 0.46 (2.9 ± 0.08)	40.1 ± 0.35 (2.0 ± 0.05)	39.4 ± 0.41 (2.0 ± 0.06)
Sept., 12, 78	40.0 ± 0.61 (1.5 ± 0.82)	45.7 ± 0.52 (2.6 ± 0.10)	41.6 ± 0.35 (2.2 ± 0.06)	41.3 ± 0.39 (2.2 ± 0.06)
Sept., 25, 78	40.0 ± 0.59 (1.7 ± 0.09)	46.1 ± 0.53 (2.9 ± 0.10)	42.9 ± 0.40 (2.4 ± 0.07)	43.3 ± 0.40 (2.6 ± 0.08)

different ($P < 0.05$) from that of other fishes. Length and weight attained by fishes fed feeds 3 and 4 were found to be statistically insignificant ($P > 0.05$). Length and weight gain attained by the replicates in each group were also found to be insignificant ($P > 0.05$) by the t-test.

Soybean used in our experiment was not ground well enough to be consumed by fry; and represented a high percentage (30%) in feed 1. When soybean was mixed with cassava and rice bran and dried in the sun the pellets became rough and hard. This feed was usually avoided by the fry. The crude protein content in feed 1 was also one of the lowest and hence might have accounted for the poor growth (Table 3).

Feed 2 consisted of crude protein from plant and animal sources. Soybean formed only 10% of the feed and the other three ingredients were finely ground. This feed contained the highest amount of crude protein and a fairly high amount of fat (Table 2). Table 4 shows that fishes fed feed 2 attained the highest K-factor, average length and weight gain; and these gains were significantly greater ($P < 0.05$) than those attained by the other fishes.

Feed 3 also consisted of crude protein from plant and animal sources but were devoid of soybean (Table 1). This feed showed a higher percentage of crude protein than feeds 1 and 4 but was lowest in fat content (Table 2). The growth rate of fry fed feed 3 was higher than those fed feed 1 (Table 3). However, the growth rate of fry was not significantly different ($P > 0.05$) between feeds 3 and 4.

In general, the growth rate of the fishes was poor. The final standard length attained at the end of the expimerent were 40, 46, 43 and 43 mm for feeds 1, 2, 3 and 4 respectively (Table 3). This may be due to low percentage of crude protein in all the feeds. Shiloh and Viola (1973) reported that minimum crude protein requirement for common carp was 25%. The crude protein of the experimental feeds was below this level (Table 2). Earlier studies (Chervinski *et al.*, 1968; Hepher and Chervinski, 1965; Ang and Mohsin, 1978) showed that fish fed higher protein attained better growth. Though the protein level in all feeds was much lower than the required level, yet the fish fed feed 2 which contained highest protein, attained maximum growth.

TABLE 4

Average gain in length and increase or decrease in weight and 'K' factor of "Lampam Sungai" during Experiment

Diet	Length (mm)	Weight (g)	'K' factor
1	+ 6.82	+0.62	0.00030
2	+12.38	+1.79	+0.00010
3	+ 9.00	+1.22	+0.00010
4 (Control)	+10.64	+1.48	+0.00007

Usually fish needs a fairly high amount of fat in its diet. According to Halver (1976) fish require 20-30% of fat on a dry matter basis provided that the feed contains a sufficient amount of choline, methionine and vitamin E in the ration. Shiloh and Viola (1973) added soybean oil to the pellets and found an increased growth rate in carps. Viola (1978) added soapstocks or oils in carp pellet and found an increased growth from 20 to 50% and improved feed conversion and protein utilization in carp fry. In our study none of the feed contained fat to this level (Table 2). Thus the poor growth may be attributed to the factors mentioned above.

Our preliminary study showed that feed 2 is the most suitable feed for "Lampam Sungai". Further studies should be conducted in order to find the optimum protein and fat requirements for juvenile and adult fish. Such a study should also include the monitoring of the water quality parameters in the experimental tanks.

ACKNOWLEDGEMENTS

This study was supported by the funds from the Division of Fisheries and Marine Science, University of Agriculture Malaysia. We are indebted to Dr. Baharin Kassim for his support in the project. Help rendered by the technical staff is duly acknowledged.

REFERENCES

ANG KOK JEE and MOHSIN, A. K. M. (1978): Suitability of agricultural by-products as feed of common carp fry, *Cyprinus carpio* L. in net cages. *Mal. Appl. Biol.* **7:** 19–25.

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMIST (1965): *Methods of Analysis*. Washington, D.C. Assoc. Offic. Agric. Chem. 957 p.

BENNETT, G. W. (1962): *Management of artificial lakes and ponds*. New York Reinhold Publishing Corporation. 283 p.

CHERVINSKI, J., HEPHER, B., and TAGARI, H. (1968): Studies on carp nutrition II. Effect of a protein rich diet on fish yield in farm ponds. *Bamidgeh*, **20:** 6–15.

GOERING, H. K. and VAN SOEST, P. J. (1970): *Forage Fibre Analysis* (Apparatus, reagent, procedure and application). A.R.S.U.S. Dept. of Agriculture handbook No. 379. Washington, D.C. Superintendent of Document, U.S. Government Printing Office.

HALVER, J. E. (1976): The nutritional requirements of cultivated warmwater and coldwater fish species. FAO Technical Conference on Aquaculture. Kyoto. Japan, 26 May – 2 June, 9 p.

HEPHER, B. and CHERVINSKI, J. (1965): Studies on carp nutrition-The influence of protein-rich diet on growth. *Bamidgeh*, **17:** 31–46.

HEPHER, B., CHERVINSKI, J. and TAGARI, H. (1971): Studies on carp nutrition – III. Experiments on the affect of fish yield of dietary source and concentration. *Bamidgeh*, **23:** 11–37.

HEPHER, B. and GAUDET, JEAN-LOUIS (1975): Bibliography on nutritional requirements of warm water fishes. EIFAC Occasional paper No. 10, 87 p.

HICKLING, C. F. (1971): *Fish Culture*. London. Faber and Faber, 317 p.

IDRC 1973: Aquaculture in Southeast Asia (Report on a seminar at the Freshwater Fishery Research Station, Malacca, West Malaysia, 17–25 April 1973).

ONG KEE BIAN (1968): *Fish Culture*. Borneo Literature Bureau. 80 p.

PATHANSALI, D. and ZAINOL, S. (1975): *National plan for development of aquaculture in Malaysia*. Aquaculture planning in Asia. FAO report of the regional workshop on aquaculture planning in Asia. Bangkok, Thailand, 1–17 Oct., 1975, 77–82 p.

SHILOH, S. and VIOLA, S. (1973): Experiments in the nutrition of carp growing in cages. *Bamidgeh*, **25:** 17–31.

SNEDECOR, G. W. (1961): *Statistical Methods*. Ames, Iowa. The Iowa State University Press, 534 p.

VENKATARAMIAH, A., LAKSHMI, G. J. and GORDON GUNTHER (1975): Effect of protein level and vegetable matter on growth and food conversion efficiency of brown shrimp. *Aquaculture* **6:** 115–125.

VIOLA, S. (1978): Experiments in nutrition of carp fry in cages and ponds, III. Increasing energy density of pellet by oils. *Bamidgeh*, **30:** 67–79.

(Received 22 March 1979)