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Protein requirement of the carps, *Catla catla* (Hamilton) and *Labeo rohita* (Hamilton)*

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Abstract. In order to determine the optimum protein requirement in the feeds for *Catla catla* (Hamilton) and *Labeo rohita* (Hamilton), isocaloric pelleted feeds containing 20%, 30%, 40% and 45% protein were formulated using casein as the main source of protein. The best growth of catla and rohu was observed when fed on feeds containing 30% and 40% protein. The growth was poorer when fed on the diet containing 20% protein and poorest when fed on the feed containing 45% protein. The results revealed that the protein requirement of both catla and rohu was around 30%. It also indicated that more than the optimum level of protein in feeds has an adverse effect on the growth of the species investigated.

Keywords. Protein requirement; *Catla catla*; *Labeo rohita*.

1. Introduction

Protein is the most important nutrient promoting growth in animals. As protein is the costliest among the various ingredients used for the preparation of fish feeds, it is necessary to ascertain the quantitative requirement of dietary protein in order to reduce the cost of feeds. A few reports are available on the protein requirement of fishes like Plaice (Cowey *et al* 1972), rainbow trout (Delong *et al* 1958; Zeitoun *et al* 1973), grass carp (Dabrowski 1977), Tilapia (Davis and Stickney 1978), milk fish (Lim *et al* 1978) and common carp (Varghese *et al* 1976). Delong *et al* (1958) were the first to use Casein-gelatin diets in studies on optimal protein level of fish feeds. Varghese *et al* (1976) and Dabrowski (1977) reported the protein requirement of common carp and grass carp to be 31% and 41–43% respectively. Information on the protein requirements of Indian major carps is very meagre. The only information available on this aspect is from the experiments of Sen *et al* (1978) and Srikrishnadhas *et al* (1980). In view of this, it was felt necessary to investigate the protein requirement of commonly cultivated carps of India. As a part of this programme, protein requirement of catla and rohu was studied in the present experiment.

2. Material and methods

2.1 *Feed*

Four experimental feeds containing 20%, 30%, 40% and 45% protein were used in this study. The major ingredients used for the formulation of the feeds were ricebran,

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groundnut oil cake, tapioca powder and casein, which served as the main source of protein. Cellulose and the standard mineral mixture prepared in the laboratory were also added to the experimental diets. Table 1 gives the proportion of various ingredients used for the formulation of different experimental diets, their protein content and calorie values. The ingredients purchased in powder form were sieved through ISI standard mesh No. 1 to get particles of uniform size, hand kneaded with sufficient quantity of water and made into a dough. The dough was then autoclaved in a closed aluminium container at 105°C for 30 min. Afterwards, the dough was cooled rapidly and extruded in the form of noodles, using a mechanical noodle making machine having a perforation diameter of 3 mm in the die. The noodles were sundried till the moisture content was reduced to less than 10% and were broken manually to a size of about 1 cm. The dried pellets were packed in heavy duty plastic bags and stored in a wooden shelf. The four feeds used were designated as follows for convenience.

(i) Pellet A (PA) (with approximately 20% protein content).
(ii) Pellet B (PB) (with approximately 30% protein content).
(iii) Pellet C (PC) (with approximately 40% protein content).
(iv) Pellet D (PD) (with approximately 45% protein content).

2.2 *Growth studies*

2.2.1 *Rearing facility and preparation of cisterns:* Twelve similar cisterns located in the fish farm of College of Fisheries were used for the experiment. Each cistern measuring 25 m^2 (5 × 5 m) had a soil bed of about 10 cm thickness. The cisterns were drained completely and dried prior to the beginning of the experiment. The cisterns were filled with water to a depth of 65 ± 5 cm. This level was maintained throughout the experimental period.

2.2.2 *Stocking and rearing:* Fingerlings of catla and rohu, raised from spawn obtained through hypophysation, were used for the experiment. All the 12 cisterns were uniformly stocked on 29th October 1982 with 8 fingerlings each of catla and rohu. Care was taken to ensure uniformity with regard to size of fingerlings. The total weight of each species stocked in different experimental cisterns was kept uniform. Fishes were fed once daily in the morning at the rate of 5% body weight.

Table 1. Proportion of various ingredients used in the formulation of different pelleted feeds.

Type of Pellet \ Feed ingredients	Casein (%)	Groundnut oil cake (%)	Rice bran (%)	Tapioca (%)	Minerals (%)	Cellulose (%)	Total	Energy value (Kcal)
Pellet A	6·30	24·00	40·00	28·70	1·00	—	100·00	316·05
Pellet B	17·00	24·00	40·00	18·00	1·00	—	100·00	316·08
Pellet C	28·10	24·00	40·00	6·70	1·00	0·20	100·00	316·08
Pellet D	33·50	24·00	40·00	0·78	1·00	0·72	100·00	316·07

2.2.3 *Sampling:* Growth data was obtained by sampling the stocked fishes every week. On the sampling days, water pH, atmospheric temperature and water temperature were recorded. Plankton and water samples were also collected from the cisterns and brought to the laboratory for analysis.

2.2.4 *Measurement and analysis—Fish growth:* A minimum of four specimens of each species were collected at random from each cistern and total weight of fishes recorded during every sampling, from which the average weight of each individual was calculated. On the day of termination (4 February 1983), all the surviving fishes were collected by dewatering the cisterns and their total weight recorded.

2.2.5 *Water analysis:* Water samples collected on sampling days were analysed for various physico-chemical parameters and the water quality was found to be suitable for fish life throughout the experimental period.

Since the plankton collected from the cisterns was negligible in quantity, the same was not considered for the study. The growth response of catla and rohu to feeds having different levels of protein was tested statistically by the analysis of variance technique (Snedecor and Cochran 1968).

3. Results and discussions

The growth in weight of catla and rohu fed on the 4 experimental diets is shown in figures 1 and 2 respectively. From the figures it is seen that the growth pattern of both catla and rohu were more or less similar even though the growth rate of the latter was slower. Rohu is known to grow slower than catla under identical conditions (Alikunhi

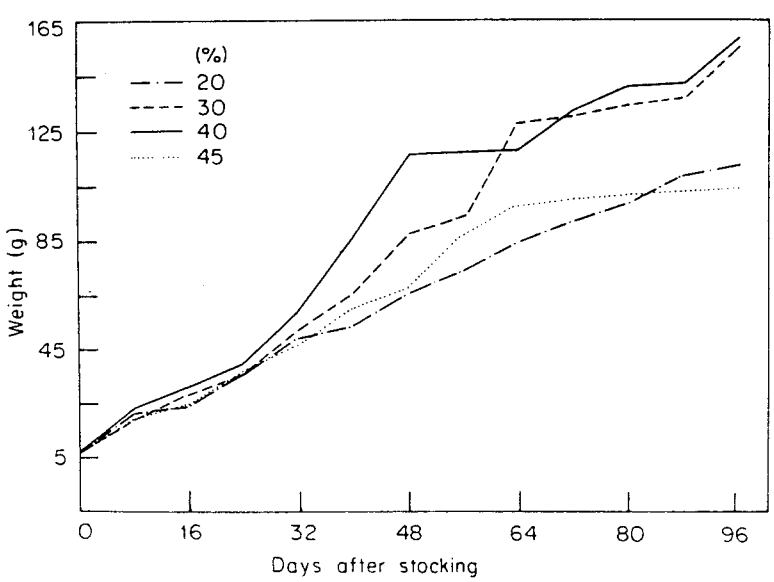

Figure 1. Average weight attained by catla in different treatments.

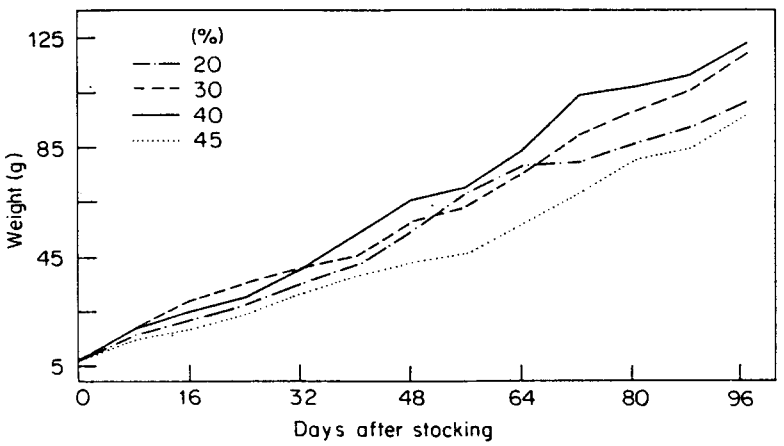

Figure 2. Average weight attained by rohu in different treatments.

1957). The daily average growth rate of catla in terms of weight was the highest and more or less similar when fed on PB containing 30% protein as well as PC containing 40% protein (1·58 and 1·59 g/day respectively), while the growth rate was minimum with PD having 45% protein (1·002 g/day) and slightly better (1·104 g/day) with PA containing 20% protein. In case of rohu, the best growth was recorded when fed on PC followed by PB. As in the case of catla, the difference in growth of rohu when fed with PC and PB was not significant. In rohu also the poorest growth was obtained when fed on PD containing 45% protein, while the growth was slightly better when fed on PA.

Results of the present study revealed that the growth in weight of both catla and rohu was the best and more or less similar when fed on PB and PC, containing 30% and 40% protein respectively. The difference in growth observed between PB and PC was not significant in both the species. Jayaram (1978) reported the best growth of catla and rohu when fed on diets containing 34% and 35% protein respectively. On the other hand, Sen *et al* (1978) observed that the optimum protein level required in diet for spawn, fry and fingerlings of common carp and rohu was 45%. This finding is not in agreement with the results obtained in the present study, where fingerlings were reared over 90 days till they became advanced fingerlings. It is known that the protein requirement of fishes varies with the size (Halver 1976) and water temperature (Delong *et al* 1958). As the fish grow in size, the protein requirement decreases. Therefore, the difference in protein requirement observed by Sen *et al* (1978) and in the present study could be due to the difference in size of the experimental fish. Teshima *et al* (1978) found that the optimum level of protein for *Tilapia zilli* is 30–40%. Jauncey (1982) while working on *Sarotherodon mossambicus*, observed that the optimum protein requirement of the species was 40%. Thus, the protein requirement of *T. zilli* and *S. mossambicus* seems to be greater than that of the Indian major carps studied in the present experiment. The poorest growth of catla and rohu fed on PD containing 45% protein suggest that excess protein content in the diet has an adverse effect on the growth of both the species. The reasons for this growth depression are not understood. Similar observations have been reported by Lim *et al* (1981) in the case of milk fish fed on diets containing higher protein content than the optimum level of 40%. Data on

survival rate indicates a better survival of both the species in cisterns where pellets containing 30% and 40% protein are used.

Based on the results of the present study, it can be concluded that both catla and rohu require around 30% dietary protein. Also, it is seen that protein in excess of the optimum level has an adverse effect on the growth of the species investigated. Further, experiments using feeds with only 3–4% variation in protein levels, conducted in flow-through tanks should give more accurate information on the dietary protein requirement of both catla and rohu.

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