

Use of Fermented Ensilage Based Diet in Enhancing the Growth of Common Carp (*Cyprinus carpio* var *communis*)

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Three isoprotein feeds containing 25% protein, namely, rice bran and groundnut oil cake (control), rice bran and fish meal, rice bran, fish meal and fermented fish ensilage were used in the feeding experiments. After 45 days of feeding trial in water recirculatory system, growth was considerably higher in fishes fed with ensilage based diet than the control and diet based on fish meal.

Fish meal is a good and cheap source for the formulation of high protein diet for fish. Fish ensilage is another good source and maintains its nutritional value during long term storage (Nilson & Rydin, 1963; Komiang *et al.*, 1980) and prevents rancidity during drying (Wirahadikusumah, 1968). Further, the lactic acid and the antioxidants generated in ensilage preparation help to increase the storage period (Raa *et al.*, 1983). Ensilaging of fish does not require any costly chemical and equipments. It provides a means for preserving trash fishes and fishery waste and can be utilized for the formulation of high protein content fish diet. Fish silage has equal nutritional value as that of the fresh raw material (Austrong, 1982). Further, Raa & Gildberg (1982) emphasised that fermented silages showed better nutritional value with less degradation of essential amino acids. Among the various fermented silages, silage prepared using pre-fermented cabbage as a source of lactic acid bacteria is simple, cheap and easy to adopt on commercial basis (Neethiselvan, 1988). Attempts have also been made to prepare fish feeds using fermented fish silages (Srinivasan, *et al.*, 1985; Brown & Sumner, 1985; Wee, *et al.* 1986). However the studies are yet in its infancy and require further investigation.

Materials and Methods

The iced leionathids collected from Tuticorin fishing harbour was minced and

mixed with 30% w/w of water, 15% w/w of mollasses and 3% w/w of sodium chloride. The mix was boiled for 30 min and then cooled to room temperature. To this, two days old pre-fermented cabbage was added as a lactic acid bacterial source and thoroughly mixed. This ensilage mix was packed in airtight polythene cans till the completion of fermentation. The fermentation was completed within 72 h which was indicated by the constant low pH of 4.4 in the silage. Pleasant fruity odour was noticed at the end of the fermentation period (Neethiselvan, 1988). The protein content of all the ingredients were estimated (AOAC, 1985).

Three feeds A, B and C with the protein content of 25% were prepared adopting square method (Ali, 1982). The amount of ingredients used are given in the Table 2. 250 fries of common carp from the same parents were used for this experiment. The dimension of the trough used was 2 x 1 x 1 metres and water level was maintained to a height of 1/2 meter. The water was continuously circulated using water recirculatory system. Each trough was stocked with 25 fries of 0.8 g after giving a dip treatment in a dilute solution of KMnO_4 . The fries in the first series of trough were fed with feed A, second series with feed B and third series with feed C at the rate of 6%

of the body weight, 3% in the morning and 3% in the evening. The water in the recirculatory system was completely changed once in 15 days and the fecal matter was removed daily using a siphon tube. The experiment was conducted for 45 days and the average final weight of fishes in each trough was recorded.

Results and Discussion

Table 1 shows the proximate composition of various feed ingredients and Table 2 shows the amount of various ingredients used in different feeds. Table 3 shows the average weight of fish after 45 days of feeding with different feeds. The proximate composition of the test diets are given Table 4.

Table 1. *Proximate composition of the feed ingredients (on dry matter basis)*

Ingredient	Crude Protein	Ether extract	Crude fibre	Ash	Nitrogen free extract
	%	%	%	%	%
Rice bran	7.0	4.9	20.2	28.5	49.4
Ground nut oil cake	30.0	11.2	17.9	10.3	30.6
Fish meal	60.0	10.8	2.7	19.0	7.5
Ensilage	17.0	7.8	11.4	16.8	47.0

Table 2. *The amount of various ingredients used in different feeds (g/100g diet)*

Ingredient	Feed A	Feed B	Feed C
Rice bran	22.0	66.1	23.0
Ground nut oil cake	78.0	-	-
Fish meal	-	33.9	23.4
Fish ensilage	-	-	54.6

Table 3. *The average weight of fishes in different troughs*

Type of feed	Weight, g
Feed A	24.13
Feed B	33.73
Feed C	39.28

Table 4. *Proximate composition of the test diets*

Type of feed	Crude protein, %	Ether extract %	Nitrogen-free extract, %
Feed A	24.94	9.81	34.74
Feed B	24.97	6.90	35.20
Feed C	24.93	7.91	38.78

From the beginning of the experiment itself, comparatively better consumption was noticed for the feed C than feed A. Poor growth was recorded in fishes fed with feed A. Fishes fed with feed B and C showed almost similar growth. However weight increment in fishes fed with feed C was significantly higher than feed B. (Table 5). The average initial weight of the fishes in all the troughs were about 0.8 g and after 45 days of experiment, the fishes fed with feed A had an average weight of 24.13 g. The daily weight gain observed in feed A, B and C was 0.318, 0.732 and 0.855 g respectively.

Table 5. *Anova table*

Source	df	ss	ms	F
Blocks	2	1.289	0.6445	0.6161
Treatment	2	352.209	176.1045	168.3439*
Error	4	4.1844	1.0461	

* Significant at 1% level

Feeding of carp spawn with finely powdered mixture of oil cake and rice bran had been suggested by Sen (1974). Lakshman *et al.* (1967) emphasised the requirement of animal protein to get better yields of carps. The present findings supported their observation.

Nose (1967) observed that the increment of carbohydrate content of the feed between 10 to 80 percent affected the digestibility of the feed. This may probably be one of the reasons for the lower growth observed in feed containing higher level of carbohydrate in the form of rice bran and ground nut oil cake (feed A). Nose & Toyama (1966) found that low protein digestibility of various fish meals will be attributed to mostly the reaction between protein and oxidised oil during the drying process. This may be the cause for comparatively lesser growth in fishes fed with fish meal and rice bran than ensilage incorporated feed. Das (1958) reported better growth of fishes fed with feeds having a combination of hydrolysed proteins and carbohydrates, than complex proteins and carbohydrates. Fish ensilage contains a good amount of hydrolysed protein than fish meal.

Das (1965) observed that yeast being a rich source of Vitamin B complex and amino acids enhanced the survival and growth of carps. Fermented ensilage prepared without yeast inhibitor also can serve as good source of yeast and in turn can contribute for better growth. Thus ensilage can not only be used as a protein supplement in fish feeds, but can also act as partial substitute for rice bran and ground nut oil cake and as a source of yeast.

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