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Impact of supplemental feeding with mango leaf meal on the digestibility of common carp (*Cyprinus carpio*)

Meghraj Yadav and BK Sharma

Abstract
A feeding trial of 60 days was conducted to determine the effect of mango leaf meal on digestibility of *Cyprinus carpio* fingerlings. The fishes were collected from wild habitat and distributed homogenously at the rate of 10 fishes/tank in five treatment group each with four replicates. The five experimental diets (T_0 (control), T_1 (5%), T_2 (10%), T_3 (15%), and T_4 (20%) were made by adding mango leaf meal to the basal diet at five different levels. Each of these diets replaced an equivalent portion of the basal diet. Feeding 3% of body weight was administered to the fish once day. The highest crude protein content in fish carcasses was found to be 16.266±0.0260 in T_3, the highest moisture content in fish carcasses 71.176±0.0480 in T_3, the highest fat content in fish carcasses 5.340±0.2300 in T_3 and the highest carbohydrate content in fish carcasses 4.026±0.0260 in T_1. From the results mentioned above, it can be concluded that adding 15% mango leaf meal to fish diets can improve fish growth and aquaculture output.

Keywords: Mango leaf meal, *Cyprinus carpio* and digestibility

Introduction
The most promising industry now is aquaculture, which is essential to the world's food production. It is the area of the agriculture sector that is expanding the fastest. Climate change, financial and economic instability, and intensifying rivalry for natural resource exploitation make it increasingly difficult. 2020 saw a projected 178 million tonnes of aquatic animal output worldwide, a modest down from the record-breaking 179 million tonnes in 2018. (SOFIA 2022) [1].

The carp species that is most commonly cultivated is thought to be Cyprinus carpio. It is cultivated in more than 100 countries and is the third-largest aquaculture output in the world (Bostock *et al*., 2010 [2]; FAO 2016 [3]). *Cyprinus carpio* wide distribution and successful introduction are common due to its tolerance to changing environment condition and turbidity (Mills *et al*., 1993 [4]).

The mango, or *Mangifera indica*, is a tropical fruit crop that is highly valued both traditionally and economically. It belongs to the Anacardiaceae family. In addition to its highly popular fruits, the mango tree is an evergreen with numerous traditional medicinal uses. Vitamins A, B, E, and C, as well as minerals including calcium, magnesium, iron, sodium, potassium, phosphorus, and nitrogen are all possible found in mango leaves (MLs). In mango leaves, protein is a key biomolecule. 93.2 to 171.4 g/kg CP of dry matter can be found in mangos. In underdeveloped nations, milk leaves (MLs) can be used as a substitute source of animal feed to help with livestock food scarcity.

Materials and Methods
Site of experiment
This study was carried out in the wet lab of the Department of Aquaculture, College of Fisheries, Udaipur (Rajasthan), for sixty days, from August 2022 to September 2022. Twenty FRP tanks with a capacity of 225 liters were utilized for the experiment 200 (*Cyprinus carpio*) fingerlings in total were acquired from the Directorate of Research, Aquaculture Research and Seed Production Unit, MPUAT, Udaipur. Fish were transferred at a rate of ten per tank, to five treatments (including control) with four replicates for each after acclimation. The fingerlings were fed twice a day, in the morning and the evening, at a rate of 3% of their body weight. The two feedings each received an equal portion of the diet. Every two weeks, observations were

made on their periodic weight. Both feed utilization and growth performance were examined in the samples at the conclusion of the studies. In SPSS 16.0, the results were statistically examined for significant differences.

Experimental diet

To make the basal/control diet, fish meal, rice bran, wheat flour, groundnut oil cake, vitamins and minerals, and vegetable oil were combined in the following ratio: 60:15:16:5:2:2 (Table 1). Mango leaf meal was incorporated into the basic diet at four distinct levels: T_0 (control) (no mango leaf meal) and treatments (T_1 (5%), T_2 (10%), T_3 (15%), and T_4 (20%), which replaced an equivalent portion of the basal diet (Table 2).

Table 1: The details of the ingredients used for basal diets (%)

S. No.	Ingredients	Quantity (%)
1.	Fish meal	60
2.	Groundnut oil cake	15
3.	Rice bran	16
4.	Wheat flour	5
5.	Vitamin & mineral mixture	2
6.	Vegetable oil	2

Table 2: The details of experimental diet (%)

S. No.	Treatment	Basal diet (%)	Mango leaf meal (%)	Total (%)
1.	Control (T_0)	100	0	100
2.	T_1	95	5	100
3.	T_2	90	10	100
4.	T_3	85	15	100
5.	T_4	80	20	100

Results

Examining the experimental diet's digestibility and contrasting it with the control showed that all treatments had digestibility's that were noticeably higher than those of the control group. T_3 had the highest level of digestibility (72.905±0.0452), followed by T_2 (71.844±0.2702), T_1 (70.422±0.4015), T_4 (68.135±0.0315), and T_0 (67.528±0.2809), which had the lowest level (Table 3). Across all treatments, there was a significant difference ($p<0.05$) in the apparent protein digestibility.

Table 3: The Apparent Protein Digestibility of *Cyprinus carpio* under various treatments when fed varying amounts of supplemental mango leaf meal.

Treatments	Apparent Protein Digestibility				
	0-15 days	16-30 days	31-45 days	46-60 days	0-60 days
T_0 (Control)	67.605^{a}±0.0540	67.013^{a}±0.6164	67.179^{a}±0.1330	67.543^{a}±0.7213	67.528^{a}±0.2809
T_1	66.063^{a}±2.3700	70.426^{b}±0.1339	71.166^{b}±0.7322	72.419^{b}±0.7479	70.422^{b}±0.4015
T_2	71.350^{b}±0.1272	71.169^{b}±0.2463	72.148^{b}±0.6581	72.372^{b}±0.3469	71.844^{c}±0.2702
T_3	73.075^{b}±0.1350	72.906^{c}±0.0390	72.543^{b}±0.0263	72.852^{b}±0.0678	72.905^{d}±0.0452
T_4	67.736^{a}±0.0646	67.767^{a}±0.0672	67.980^{a}±0.2292	68.640^{a}±0.1672	68.135^{a}±0.0315

Discussion

A few of the many elements that significantly affect fish growth are fish species, feed quality, and environmental conditions. Fish were given different quantities of mango leaf meal as part of a current study to evaluate their growth and digestibility. At the 5% level of significance, the data demonstrated a substantial difference between the treatments.

The fish carcass results from the current experimental study demonstrate that the crude protein, fat, ash, carbohydrate, and moisture are considerably different ($p<0.05$). Fish carcasses included the amount of crude protein: 16.093±0.0088 to 16.266±0.0260, fat: 5.133±0.0088 to 5.340±0.2300, ash: 3.836±0.0176 to 4.136±0.0176, carbohydrates: 3.676±0.0120 to 4.026±0.0260 and moisture: 70.723±0.0491 to 71.176±0.0480. According to Alemu *et al*. (2013) [5], the Nile tilapia fillet has a moisture level of 79.5–80.9% and a crude protein content of 13.3–15.6. Fish fed banana peel powder had crude protein levels ranging from 15.76 to 16.47, fat levels from 3.2-4.02, ash levels from 3.3 to 3.6, and moisture levels from 70.40 to 73.15, according to Sanvriya (2021) [6]. These results are consistent with current research.

There were statistically significant variations ($p<0.05$) in the apparent protein digestibility values across the groups, with the treated groups having higher values than the control groups. The administration of mango leaf meal at 15% shows good outcomes when compared against other levels. The apparent protein digestibility was recorded as 67.528±0.2809 in T_0, 68.135±0.0315 in T_4, 70.422±0.4015 in T_1, 71.844±0.2702 in T_2, and 72.905±0.0452 in T_3, with T_3 reporting the highest apparent protein digestibility. Sharma (2021) [7] observed good protein digestibility on *Cyprinus carpio* when a large proportion of fenugreek seed meal was fed to the fish, which is consistent with results obtained here.

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