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Effect of *Cassia tora* Leaves on Growth Performance of *Labeo rohita*

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Abstract:- Conventional fish feed ingredients like fishmeal and plant proteins are not only expensive but also face supply challenges due to increasing demand. This study aimed to address this issue by exploring alternative, cost-effective protein sources to enhance the income of fish farmers. In this research, *Cassia tora* leaf meal was investigated as a potential protein source for the growth and survival of *Labeo rohita* fingerlings. Three experimental diets were formulated, containing *Cassia tora* leaf meal at 50%, 75%, and 100% of the total dietary protein, with one diet serving as the control. All diets maintained a consistent crude protein content of 27%. Parameters such as Feed Conversion Ratio (FCR), Specific Growth Rate (SGR), and weight gain were evaluated while feeding *Labeo rohita* fingerlings with the *Cassia tora* leaf meal-based diets. The results demonstrated that the performance of the fish was influenced by the concentration of *Cassia tora* leaf meal in their diet, with FCR values fluctuating with varying levels of inclusion. Notably, the study revealed that as the inclusion level of *Cassia tora* leaf meal increased, the overall performance of the fingerlings decreased. Specifically, the supplementation of *Cassia tora* leaf meal at 50% and 75% in the diet positively impacted the growth and survivability of Rohu fish. The research also highlighted a significant increase in size, weight gain, and growth from the beginning to the end of the study. This suggests that incorporating *Cassia tora* leaves as a partial replacement for fishmeal can be economically advantageous for fish farmers and the aquaculture industry, offering a sustainable and cost-effective solution to their protein needs.

I. INTRODUCTION

A quaculture, the rapidly expanding sector of global food production, has emerged as a promising solution for addressing food security and enhancing nutrition, particularly in developing regions. It now represents a substantial portion of the world's fish production, offering nutritional advantages that can alleviate poverty and improve food security. Fish, with its abundance of vitamins, minerals, high-quality protein, and beneficial unsaturated fatty acids, plays a vital role in nutrition. To meet the increasing demand for fish while alleviating the strain on declining wild fisheries, the aquaculture industry faces key challenges, such as the high cost and limited availability of fish meal, a traditional protein source in aqua feeds. Escalating prices of fish oil and fish meal have raised concerns for commercial aquaculture ventures. Therefore, there is a growing focus on exploring alternative protein sources. Traditional plant-based protein sources like soybean, groundnut, cottonseed, and rapeseed meal have been considered but encounter competition from other sectors, making them less cost-effective for fish farmers. The potential for plant-based ingredients in aquaculture feeds is promising, with the possibility of using seeds, leaves, and various agricultural by-products as alternative protein sources. These alternatives must meet specific nutritional criteria, including low levels of starch, fibres, and anti-nutrients, high protein content, good digestibility, and palatability, as well as a favourable amino acid profile. *Cassia tora*, a leguminous plant, is one such alternative protein source. It is recognized for its potential in traditional medicine and possesses antibacterial, antiallergic, antimutagenic, and antiviral properties. The leaves of *Cassia tora* are rich in essential nutrients and minerals, making them a valuable contribution to nutrition. *Labeo rohita*, a commonly cultured major carp species, is often raised in semi-intensive culture systems. Local fish farmers, who lack cost-effective feeds, rely on various basic formulations to boost fish production. This research aims to investigate the use of *Cassia tora* leaves as a cost-effective protein source for *Labeo rohita*, with the objective of enhancing fish production and reducing feed costs in aquaculture. The utilization of such alternative protein sources has the potential to make aquaculture more sustainable and efficient, addressing the growing demand for fish in a world that seeks innovative solutions for food security and nutrition.

II. MATERIALS AND METHODS

This study aimed to investigate the different concentrations of diets based on *Cassia tora* leaf meal influenced the growth performance of *Labeo rohita* fingerlings.

- *Fish and the testing environment*

Labeo rohita fingerlings were acquired from a fish farm. Prior to commencing the feeding trial, these fingerlings underwent a treatment with NaCl (5g L^{-1}) as a preventive measure against fungal infections, following the protocol established by Rowland and Ingram, 1991.

- *Experimental design*

Cassia tora leaf meal (CTLM) served as a test component, and the test diets were created with different levels of substitution. Fishmeal was gradually substituted with CTLM at rates of 0%, 50%, 75%, and 100% in the diet formulations.

- *Feed ingredients and formulation of experimental diets*

Feed components were procured from a commercial feed mill and underwent chemical composition analysis as

per the AOAC (1995) guidelines before crafting the test diets. A foundational diet containing the necessary nutrients for the typical growth of fish was prepared (refer to Table I).

Table I: Ingredients and Composition of Isonitrogenous Experimental Diets-

Ingredients	D1 (0%)	D2 (50%)	D3 (75%)	D4 (100%)
CTLM	-	11.6	17.4	23.2
Fish Meal	23.23	11.6	5.8	-
Mustard Oil Cake	23.23	46.70	58.39	63.82
Rice bran	21.77	10.05	4.21	1.49
Wheat Bran	21.77	10.05	4.21	1.49
Fish Oil	5	5	5	5
Vitamin mixture	2	2	2	2
Mineral mixture	3	3	3	3
Total	**100**	**100**	**100**	**100**
Crude Protein (%)	**27**	**27**	**27**	**27**

**CTLM- Cassia tora leaf meal*

➢ *Feeding Procedure and Sample Collection*

Labeo rohita fingerlings were provided their designated diets, amounting to 5% of their live wet weight, and were fed twice daily. Every 15 days throughout the experiment, the fish in each tank were weighed to assess the growth of *Labeo rohita* fingerlings.

➢ *Growth study*

Throughout the experiment, all the fish in each tank were collectively weighed every 15 days to assess the growth performance of *Labeo rohita* fingerlings. Growth was evaluated by calculating Weight Gain, Specific Growth Rate, and FCR using established formulas.

➢ *Statistical analysis*

A sample size of three (n = 3) was employed as genuine statistical replicates for the statistical analysis. All statistical analyses were conducted using the R statistical program (version 4.0.2) as provided by the R Core Team (2002). The data is presented as mean ± SEM, and statistical significance was determined at $p < 0.05$.

III. RESULTS

The growth performance of *Labeo rohita* fingerlings was assessed while being fed with CTLM-based test diets, with fishmeal substitution levels of 0%, 50%, 75%, and 100%. Notably, a significant increase in weight gain ($P<0.05$) was observed up to the 50% replacement level, after which further increases in the replacement level resulted in decreased fish weight gain. The results indicated that the weight gain of fish on the control diet, the 50% CTLM, and the 70% CTLM-based diets exhibited no significant statistical differences. These findings demonstrate that replacing 50% of fishmeal with CTLM led to increased weight gain compared to the control diet. Additionally, it was observed that at the 75% and 100% CTLM replacement levels, there was no significant improvement in the growth performance of *Labeo rohita* fingerlings compared to those fed the control diet (0% CTLM). This suggests that CTLM-based diets performed effectively and were efficiently converted into flesh. The study revealed that *Labeo rohita* fingerlings exhibited the most favourable growth performance, characterized by weight gain, weight gain percentage, and Feed Conversion Ratio (FCR), when they were fed with a CTLM-based diet at a 50% replacement level. These findings suggest that CTLM could serve as a promising and cost-effective alternative protein source for fish diets, outperforming the expensive fish meal traditionally used.

Table II: Growth performance of *L. rohita* fingerlings fed varying levels of CTLM based diets

Growth parameters	Diets			
	Control diet	Treatment 1	Treatment 2	Treatment 3
Initial body weight (g)	4.27±0.5	4.28±0.5	4.27±0.5	4.27±0.5
Final body weight (g)	10.17±0.5	11.80±0.45	10.38±0.36	9.77±0.78
Specific growth rate (%)	6.54±0.32	8.35±0.46	6.78±0.23	6.14±0.15
Feed conversion ratio	1.89±0.06	1.70±0.04	1.82±0.05	2.09±0.00

IV. DISCUSSION

Recent research has predominantly focused on exploring unconventional feed sources like *M. oleifera* as a potential substitute for fish meal in fish feeds (Richter *et al*., 2003; Abo-State *et al*., 2014). Among the treatments, fish in T1 (with a 50% CTLM replacement) exhibited the highest weight gain at 175.91% compared to the control diet (0% CTLM), which registered a weight gain of 137.65%. These results are in accordance with Richter *et al.* (2003), who noted positive effects on growth performance when fish were fed diets containing another unconventional plant, MOLM, at a 10% replacement level. The reduced growth performance of fish fed higher levels of CTLM can be attributed to factors such as diminished mineral bioavailability, impaired protein digestibility due to phytic

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acid-protein complex formation, and reduced nutrient absorption, as reported by Francis *et al*. (2001). T3, with 100% *Cassia tora* leaf meal, exhibited the highest FCR at 2.09±0.00, indicating that this group consumed more feed to gain 1 kg of body weight compared to other treatments. It was followed by T2 with a 75% concentration and the Control group with 0% *Cassia tora* leaf meal. Conversely, the lowest FCR was observed in T1 with a 50% concentration of CTLM. Previous studies have suggested that incorporating a combination of protein sources in fish diets can be more advantageous than relying on a single protein source (Ugwumba *et al*., 2001; Sogbesan *et al*., 2005). Additionally, Fagbenro *et al*. (2005) propose that fish may possess a physiological mechanism to counter the presence of lower levels of anti-nutrients, thus mitigating their adverse effects.

V. CONCLUSION

The findings suggest that expensive fish meal can be substituted with the cost-effective plant by-product, *Cassia tora* leaf meal, up to a 50% replacement level without negatively impacting fish growth performance. It's noteworthy that as the inclusion level of *Cassia tora* leaf meal increases, there is a decline in performance. However, it's important to consider that despite *Cassia tora* leaf meal showing improved growth and yield, its seasonality and availability may present limitations to its sustainable use. Nevertheless, *Cassia tora* leaves hold promise as a viable component of fish feed in the aquaculture sector.

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