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Effect of *Trigonella foenum* Gracum (Fenugreek Seed) on Growth and Survival of *Labeo Rohita*

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Abstract: A 60-day feeding trial was evaluated to assess the effects of fenugreek (*Trigonella foenum-graecum*) on the growth, and survival of Rohu (*Labeo rohita*). There were five treatment groups, with three replications. The fish were fed five different inclusion levels of Fenugreek seed (FS) in their diet i.e., without fenugreek seed and with 0.5, 1, 1.5 and 2% Fenugreek seed). The protein level in all the diets was consistently maintained at approximately 30%. *Labeo rohita* were stocked at 10 nos. /tank density in all experiment tanks. There were significant difference in growth parameters among treatment groups. Highest weight gain , specific growth rate , protein efficiency ratio and a lower feed conversion ratio was observed 1% fenugreek seed treatment and also recorded better survival rates than the control. The study recommends including 1%fFenugreek seed in *L. rohita* diets for enhanced growth and survival.

Keywords: *Trogonella foenum graecum*, *Labeo rohita*, Growth parameters, Fenugreek seed

The fisheries sector is crucial in the global food economy, providing essential food and nutritional security, especially for developing and underdeveloped countries. Aquaculture is rapidly evolving into a key sector in the agricultural economy, propelled by the growing need for affordable, high-quality animal protein, particularly as the global population continues to rise (Rathore and Swain 2024). Aquaculture is one of the fastest-growing sectors within India's fisheries industry, with an annual growth rate exceeding 7%. Freshwater aquaculture accounts for nearly 80% of the country's inland fish production. Focusing on juvenile and exotic carp species, India has become the second-largest producer of farmed fish globally (FAO 2024).

In India, carp culture is the cornerstone of freshwater aquaculture and aligns well with other farming systems. Its compatibility with diverse agricultural practices makes it crucial for sustainable aquaculture, supporting food security and rural livelihoods across the country. *Labeo rohita*, a species that is extensively distributed across India and South Asia, plays a crucial role in enhancing overall productivity in aquaculture. Its adaptability to various environmental conditions and compatibility with other species make it an essential component of polyculture systems, where it helps optimize resource utilization and improve the economic viability of aquaculture operations across the region. Rohu is economically significant due to substantially higher muscle protein content compared to other carp species and strong consumer demand (Shakir et al., 2013). *Trigonella foenum-graecum*, commonly known as fenugreek have high protein and additionally, fenugreek seeds contain a variety of bioactive compounds, including flavonoids such as quercetin, apigenin, and kaempferol, as well as saponins like graecunin, fenugrin B and fenugreekine. This study was designed to investigate the effects of natural feed additives fenugreek seed (*Trigonella foenum-graecum*) on growth performance and survival rates of *Labeo rohita*.

MATERIAL AND METHODS

Experiment setup: The research was carried out on *Labeo rohita* as the experimental animal at College of Fisheries Science, Kamdhenu University, Veraval. (20° 93' 92.54" N, 70° 35' 26.79" E). The seeds of *L. rohita* were transported from the nearby fish commercial hatchery in an oxygenated polythene bag. Upon the arrival of the seeds, they were acclimated in a 500 L capacity fiber-reinforced plastic (FRP) tank for 15 days. Continuous aeration and feeding were provided during the acclimatization period. A total of 200 fish were used in the experiment. They were fed at the rate of 5-7% of their body weight, and optimum water quality and adequate oxygen levels were maintained during the experimental period.

Twenty tanks were used, each with a capacity of 50 litters and dimensions of 2×1×1 feet. The experimental design was completely randomized design (CRD). The tanks were divided into five different treatment groups, with each treatment being replicated three times. After a period of acclimatization, the fish were introduced into the plastic aquaria tanks, where they were kept for 60 days. Each tank was stocked with 10 fish and supplied with sufficient aeration.

Experimental diet: For this experiment, fenugreek seed were collected from a local market of the Veraval. The seed were ground into a fine powder and stored in a dry place.

Additional ingredients like fish meal, soya bean meal, wheat flour, tapioca flour, and plant oil were sourced from local markets to maintain quality and accessibility. All ingredients were ground and sieved for uniformity, stored in polythene bags at room temperature.

Five experimental diets were prepared, each containing 30% protein. The control diet, labelled T0, did not include fenugreek seed. The diets, labelled T1, T2, T3, and T4, included fenugreek seed (FS) at concentrations of 0.5, 1, 1.5, and 2%, respectively. The ingredients were weighed, ground, sieved, and thoroughly mixed. Prepared feed was carefully stored in airtight containers (Table 1).

Measurement of growth and survival: At the end of the 60-day experimental period weight and survival rate were recorded. The growth parameters such as mean weight gain, specific growth rate (SGR), feed conversion ratio (FCR), and protein efficiency ratio (PER) were calculated.

Mean weight gain = Final average body weight - initial average body weight

Specific growth rate (%) = [(ln final weight – ln initial weight) / Experimental period (day)] × 100

Feed conversion ratio = Feed intake (g) / wet weight gain (g)

Protein efficiency ratio = Weight gain (g) / protein intake (g)

Survival (%) = (No. of fish survival at the end of the experiment/no. of fish stocked) ×100

Analysis of physic-chemical water quality parameters: Throughout the experiment period, physio-chemical parameters including temperature, dissolved oxygen (DO), pH and alkalinity were monitored weekly. The DO levels in the water samples were determined using the Winkler method (Fi et al., 2014). Alkalinity was measured using the EDTA method (Summerfelt 2000). Temperature was recorded by thermometer and pH was measured using a standard digital pH meter and pH indicator solution (Chun et al., 2018).

Statistical analysis: The statistical analysis was performed using SPSS software and excel with descriptive values Duncan's Multiple Range Test (DMRT) was used to compare the mean value.

RESULTS AND DISCUSSION

Mean weight and mean weight gain: The initial average weights of Rohu varied from 1.40 to 1.42 g with non-significant differences. At the end of the trial, the final mean weights of Rohu in the was significantly higher in 1% fenugreek seed followed by 0.5, 1.5 and 2% incorporation level (Table 2). Survival rates were recorded 95, 92.50, 91.25, 90.00 and 88.75% for treatments T2, T1, T3, T4, and T0 (Table 2). Mehboob et al., (2017) observed maximum survival rates in the diet containing 1% fenugreek seed compared to the control group. Similar results were reported by Rathore et al., (2018), Moustafa et al., (2020), and Roohi et al., (2015). Survival is crucial in fish production, influenced by feed availability, water quality and other environmental factors. Fish survival rates were consistently high between 88.75% to 95.00%. Higher survival was observed in T1 which had 1% Fenugreek seed. Syeed et al., (2018) observed that the diet of common carp containing 1% fenugreek had higher survival rate.

Specific growth rate: Specific growth rate (SGR) in control treatment T0, which lacked fenugreek, exhibited the lowest SGR among all treatments. The highest SGR was in T2 (2.01%) treatment. Rathore et al. (2018). Kumar et al. (2017) and Moustafa et al. (2020) also observed similar result in 1% inclusion level.

Feed conversion ratio: The lowest FCR was observed in treatment T2 (2.087), followed by T1, T3, T4 and T0 (2.336) (Table 3). There was a significant difference in the FCR across the different treatments performed. Treatment T2 demonstrated a significantly better feed conversion ratio when compared to all other treatments as well as the control group. Mehboob et al. (2017) reported that FCR decreased in

Table 1. Ingredients and their proportion in experimental diets

Ingredients (%)	Diets (30% protein)				
	T0 (0 %)	T1 (0.5 %)	T2 (1 %)	T3 (1.5 %)	T4 (2%)
Fenugreek seed	0g/kg	5g/kg	10g/kg	15g/kg	20g/kg
Fish meal	30	30	30	30	30
Soybean meal	22	19	15	14	13
Wheat flour	25	23	22	18	14
Tapioca flour	12	12	12	12	12
Plant oil	2	2	2	2	2
Fish oil	2	2	2	2	2
Vitamins and minerals	2	2	2	2	2

Table 2. Growth performance and survival of *Labeo rohita* during the experiment (Mean ± standard error)

Treatment	Mean weight (g)				Survival (%)
	Initial	30th Day	45th Day	60th Day	
T0	1.40[a]	2.58±0.014[c]	3.17±0.010[d]	3.83±0.011[d]	88.75±1.250[b]
T1	1.42[a]	2.86±0.017[b]	3.64±0.020[b]	4.45±0.023[b]	92.50±1.443[ab]
T2	1.41[a]	2.97±0.019[a]	3.81±0.013[a]	4.70±0.011[a]	95.00±2.041[a]
T3	1.41[a]	2.84±0.013[b]	3.62±0.015[b]	4.43±0.033[b]	91.25±1.250[ab]
T4	1.40[a]	2.60±0.015[c]	3.34±0.012[c]	4.05±0.015[c]	90.00±2.041[ab]

Figures with same letter in column indicate non-significant differences

Table 3. Specific growth rate, food conversion ratio and protein efficiency ratio of *Labro rohita* (Mean ± standard error)

Treatment	Specific growth rate (SGR)	Feed conversion ratio (FCR)	Protein efficiency ratio (PER)
T0	1.67±0.014[d]	2.692±0.086[c]	1.064±0.068[c]
T1	1.91±0.017[b]	2.285±0.036[ab]	1.251±0.039[b]
T2	2.01±0.026[a]	2.087±0.019[a]	1.369±0.024[a]
T3	1.90±0.017[b]	2.336±0.069[ab]	1.226±0.069[b]
T4	1.77±0.015[c]	2.485±0.134[bc]	1.160±0.127[bc]

Figures with same letter in column indicate non-significant differences

the diet containing 1% FS in striped catfish, *Pangasius hypophthalmus*. Roohi et al., (2015) also reported similar findings in *Cyprinus carpio*.

Protein efficiency ratio: The maximum PER was 1.369 in T2 followed by T1, T3, T4 and minimum in control (1.064) (Table 3). There was no significant difference in the protein efficiency ratio between the treatment T1 and T3 compared to treatments T4 and T0 but were to be at par with T2. The PER of was investigated by Rathore et al. (2018) observed that a diet containing 1% FS had a good PER in *Nile tilapia*. Similar trend was observed by Syeed et al. (2018), Mehboob et al. (2017) and Moustafa et al. (2020).

Specific growth rate: The specific growth rate (SGR) was significantly higher in T2 ((2.01%- 1% fenugreek), while treatment T0 showed the lowest SGR. There was no significant differences between treatments T1 and T3. Treatment T4 had a higher SGR than T0 but lower than treatment T1 and T3. Syeed et al., (2018), found that the highest growth performance was observed in the group, fed a diet with 1% fenugreek, while the control group had the lowest growth. Mehboob et al. (2017) observed a significant difference among the three treatments. In 1% FS group had a significantly higher mean weight as compared to T1 (0.5% FS) and the control. Roohi et al. (2015) also found similar trend in *Cyprinus carpio*. The fish-fed diets with fenugreek had significantly more weight gain compared to the control group diosgenin, a compound commonly used in steroid production, this may increase weight gain.

In the present investigation, treatment T2 (2.08) exhibited the best feed conversion ratio, followed by treatment T1, T3, and T4. Fish fed a diet containing 1% fenugreek seed indicated best feed conversion ratio. This means they needed less food to gain weight compared to other groups. Fenugreek seeds are particularly high in protein and are also a significant source of diosgenin, which might increase the growth of fish. Fenugreek seeds are rich in non-starch polysaccharide (NSP) fibers, with the major NSPs being tannins, saponins, hemicelluloses, mucilages, and galactomannans. These non-starch polysaccharides promote bowel movements, aid in smooth digestion and help to reduce blood cholesterol levels by binding to it (Riaz et al., 2020).

CONCLUSION

A 60-day feeding trial was conducted to evaluate the effects of fenugreek (*Trigonella foenum-graecum*) seed on the growth and survival of *Labeo rohita*. Five treatment diets with varying fenugreek seed levels (0 to 2%) were formulated, maintaining a protein level of 30%. The diet with 1% fenugreek seed showed the highest growth performance, including mean weight gain , specific growth rate, protein efficiency ratio and lowest feed conversion ratio along with the highest survival rate. The study recommends incorporating 1% fenugreek seed in *L. rohita* diets to enhance growth and survival, supporting sustainable aquaculture practices.

AUTHOR'S CONTRIBUTION

Honey J. Tandel and Rajesh V. Chudasama conducted the data collection, performed the analysis, and wrote the

manuscript. Hitesh V. Parmar reviewed the manuscript and provided guidance throughout the study. Binal Tandel contributed to the manuscript by making corrections and ensuring clarity.

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