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CONTENTS

Effect of plant-based feed additives (*Ficus racemosa*) on growth performance and blood parameters of Indian major carps fingerlings

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ABSTRACT: The present study was conducted to understand the effect of *Ficus racemosa* (gular) as a feed additive on the Indian major carps IMCs(*Labeo catla, Labeo rohita* and *Cirrhinus mrigala*)fingerlings growth and blood parameters.The experimental feed was prepared with different concentrations of *Ficus racemosa* per kg Feed i.e., 0 (C0), 100g (G1), 200g (G2) and 300g (G3) per Kg feed. Fingerlings of IMCs were maintained in four different groups (n=60) for 90 days to conduct the experiment. All three species groups showed good condition factor (K) >1 and the specific growth rate was significantly greater ($p<0.05$) in the G3 group of all three species than in other groups (C0, G1 and G2). Haemoglobin and haematocrit values showed a linear increasing trend with the increase inthe concentration of gular in feed for all the IMCs. The other blood parameters like TEC, TLC, and MCHC showed higher values in groups fed in G3 feed except for MCH. From the present study, it could be concluded that*Ficus racemosa* could be a great option as a feed additive that promotesthe growth of Indian major carps, which will help to increase aquaculture production.

Key words: Blood parameters, Catla, Gular, growth, Mrigal, Rohu

World's population keeps on expanding and so is the demand for food hence its dependence on farmed fish production will also increase (Naylor*et al*., 2000).To meet this growing demand of the worldthere is a need for appropriate natural and herbal feed additives in aqua feed, which enhances the feed utilization efficiency, and digestibility of feed and fulfils the requirement of nutrients. Moreover, plant-based feed additives are eco-friendly and cost-effective also to meet the requirement of fish farmers(Paul and Giri, 2015). World health organization also supports the use of medicinal plants to limit or substitute the use of chemicals through the global trend to go back to nature and these feeds are a great option to enhance feed utilization and animal productive performance (Levic *et al*., 2008).

Medicinal plants, since times immemorial, have been used in virtually all cultures as a source of medicine one such plant is *Ficus racemosa* Linn. *Ficus racemosa* commonly known as cluster fig is an evergreen, moderate to a large-sized deciduous tree reaching a height of 15-18 m, without prominent aerial roots (Ahmed and Urooj, 2011). *F. racemosa* is commonly known as 'gular', in India and ismedicinally important (Kirtikarand and Basu, 1975; Ahmed and Urooj, 2011). Richness in phosphorus and iron makes it good in combating anaemia and there is a presence of a good amount of carotene and ascorbic acid in *Ficus racemose* (Bhogaonkar *et al*., 2014)

Indian major carps (IMCs) or Gangetic carps *Labeo catla* (catla), *Labeo rohita* (rohu), and *Cirrhinus mrigala* (mrigal) belong to the family Cyprinidae. IMCs arethe most common potential candidate species and mainstay of Indian aquaculture and contribute about 87% of the total freshwater aquaculture production of the nation (Bais, 2018). Very little emphasis has been given to the use of plant-based products inculcation in the fish diet though it is trending nowadays, as these are cheap, easily available and high in fibre content options.Hence, the present study was carried out on the fingerlings of IMCs *Catla catla, Labeo rohita* and *Cirrhinus mrigala.*

MATERIALS AND METHODS

Experimental site and fish

The study was carried out at the College of Fisheries, G B Pant UniversityAgriculture& Technology,

Pantnagar, Uttarakhand located at 29° N latitude, 79.3° E longitude and an altitude of 243.3 above mean sea level (MSL). The experiment was conducted in cemented tanks of the Instructional fish farm of the College of fisheries, Pantnagar.

Experimental Fish

Fingerlings of three fishes were taken for this research work i.e., *Labeo catla, Labeo rohita,* and *Cirrhinus mrigala*. A total of 1500 fingerlings were taken and divided into four groups of 50 fingerlings in each group. The carp species selected for the experiment had almost the same length and weight, and before being selected for the study. The fish were acclimatized for 7 days before conducting the experiment.

Experimental feed

A feed was formulated using all the plant-based ingredients viz. mustard oil cake, rice bran and soybean meal. Four experimental diets viz. control (C0), and three additional experimental diets (G1, G2,and G3) were prepared by adding gular powder as an antioxidant in feed 100 g, 200 g and 300 g respectively.

All To form a dough, all ingredients were emulsified with starch (wheat flour as a binder) dough was then passed through a dry pelleting machine. Proximate values of ingredients per 100 g of experimental diets are depicted in Table 1. Feed's moisture, crude protein, lipid (fat) and ash contents were analysed following standard methods described by the Association of Official Analytical Chemists (AOAC, 1998).

Table 1: **Proximate composition of different feeds**

Parameter	Control feed	Gular feed
Moisture (%)	70.25	83.20
Protein (%)	5.66	2.81
Fat (%)	5.49	1.58
Carbohydrate (%)	18.60	12.41
Ash (%)	3.00	4.00

Fish management

The collected fingerlings were stocked in cemented tanksin triplicates for each experiment (n=60) for each species. The study was conducted in three repetitions in three groups, and a total of 540 fish were used (60 for each repetition). Therefore, the experimental fish were fed with test diets twice a day throughout the 90 days experiment.

Condition factor (K) and Specific growth rate (SGR)

Condition Factor (K): The condition factor (Hile, 1936) was calculated using the following formula

$$\text{Condition factor (K)} = W/L^3 \times 100$$

Where, W is body weight (g), L is the total length (cm)

The condition factor (K) was calculated for fingerlings of all three species upto 90 days on fortnightly basis.

Specific Growth Rate (SGR): The specific growth rate was calculated by using the following formula

$$\text{Specific growth rate} = \ln(\text{final weight}) - \ln(\text{initial weight})/\text{Time (days)} \times 100$$

Blood sampling of fish and analysis

The blood samples were collected from the caudal vein of fish samples in anti-coagulant vials for haematological studies at an interval of 15 days. Haemoglobin concentration (Hb), Total Erythrocyte Count (TEC), and Total Leucocyte Count (TLC)were assessed following (Blaxhall and Daisley, 1973). Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were also evaluated following Acar *et al*., 2018.

MCH was calculated by the following formula and expressed in pictograms (pg)

$$\text{MCH} = \text{Haemoglobin (g / dl)} \times 10 / \text{RBC count}$$

MCHC was obtained by the following formula and expressed in terms of percentage

$$\text{MCHC} = \text{Haemoglobin (g / dl)} \times 100 / \text{Haematocrit}$$

RESULTS AND DISCUSSION

Condition factor for *Labeo catla* varied between 1.55 ± 0.05 to 1.69 ± 0.13, for *Labeo rohita* fingerlings it ranged from 1.31 ± 0.6 to 1.32 ± 0.11and highest K was observed for *Cirrhinus mrigala* fingerlings ranging between 1.85 ± 0.20 to1.88 ± 0.05 (Table 1). For all three species fingerlings were observed to have K>1 which represents their good condition as K is an indicator of fish well-being (Hile, 1936).

Table 1: Growth and blood parameters of IMCs fed with different concentration of *Ficus racemose* for 90 days

Days	*Catla catla*				*Labeo rohita*				*Cirrhinus mrigala*			
	C0	G1	G2	G3	C0	G1	G2	G3	C0	G1	G2	G3
K	1.49± 0.05	1.60± 0.18	1.56± 0.14	1.69± 0.13	1.31± 0.66	1.32± 0.11	1.47± 0.17	1.77± 0.23	1.85± 0.02	1.82± 0.17	1.78± 0.09	1.88± 0.05
SGR	0.40± 0.16	0.40± 0.35	0.44± 0.39	0.44± 0.47	0.36± 0.18	0.43± 0.31	0.47± 0.44	0.55± 0.56	0.28± 0.09	0.36± 0.19	0.41± 0.22	0.46± 0.24
Hb	8.90± 0.87	8.98± 0.88	9.02± 0.94	9.16± 1.05	9.04± 0.87	9.07± 0.86	9.11± 0.91	9.14± 0.93	8.77± 0.86	8.79± 0.90	8.84± 0.95	8.98± 1.01
Hematocrit (%)	31.21± 0.70	31.32± 10.26	31.42± 1.05	31.31± 1.00	29.08± 1.64	29.70± 10.44	30.63± 0.96	30.06± 1.46	29.73± 0.97	31.60± 1.79	31.73± 2.06	32.14± 1.20
TEC	2.00± 0.26	2.05± 0.29	2.14± 0.33	2.20± 0.35	1.94 ± 0.23	2.04± 0.28	2.08± 0.29	2.13± 0.33	1.6± 0.26	2.00± 0.35	2.05± 0.40	2.16± 0.47
TLC	8.11± 0.49	8.14± 0.48	8.16± 0.48	8.19± 0.49	8.10± 0.45	8.07± 0.43	8.07± 0.45	8.21± 0.50	7.99± 0.57	8.02± 0.57	7.97± 0.63	7.22± 0.69
MCH	44.51± 0.01	45.74± 3.48	42.43± 2.59	42.18± 2.53	47.03± 2.08	45.08± 1.70	43.95± 2.26	43.21± 2.85	46.09± 1.91	44.19± 3.71	43.73± 4.00	42.41± 4.64
MCHC	28.51± 2.55	28.64± 2.33	28.72± 3.03	29.24± 2.85	30.63± 2.58	30.44± 2.86	30.64± 1.75	30.84± 3.10	29.47± 2.62	29.78± 1.90	28.97± 2.93	29.51± 2.81

Also, a higher K value was observed in the groups fed with feed G3, containing a higher concentration of gular.Similar results of higher K-value (>1) showing good growth and well-beingwere reported in IMCs from Jaisamand lake, Rajasthan (Balai *et al.,* 2017)

Similarly, the specific growth rate (SGR %) was also observed to be greater in the group of fingerlings fed with feed G3 in all three species (Table 1), which depicts that a high concentration of *Ficus racemosa* (gular) in feed can be helpful to enhancethe growth of IMCs. Similar results of high SGR with other plant-based diets were observed in IMCs and other carps (Khan *et al*., 2012; Yao *et al*., 2019).

An increasing trend of Hb with the increase in gular concentration in the dietwas observed in all three species and this was lowest in the control group whilea higher value was recorded in the G3 group (Table 1). Also, a high concentration of Hb was observed in rohu *Labeo rohita* fingerlings as compared to the other two species.Haematocrit percentage also showed an increase with increasing concentration of gular in feed, while no significant variation was observed in *Labeo catla*, the other two species showed a remarkable difference ($p<0.05$) in haematocrit percentagei.e., higher in the groups fed with the G3 feed. The concentration of plant dietaffected the Hb concentration in IMCs similar results of feed diet levels influencing different growth and haematological parameters were reported in IMCs fed with a diet containing different plant ingredients (Pradhan *et al*., 2020).

All the other blood parameters like TEC, TLC, and MCHC showed higher values in groups fed with the G3 feed, in all three species (Table 1). While, MCH did not follow the trend and even showed higher values in the control group in *Labeo rohita* and *Cirrhinus mrigala* while, the G1 group in *Labeo catla.*

CONCLUSION

The present study revealed a positive impact of Gular feed on growth as well as blood parameters of all the Indian major carps. The highest concentration of Gular (G3) showed higher growth as well as optimum condition (K>1) and also higher blood parameter levels in all three species. So, the results of this work depict that gular can be used as a fish feed additive as it contains a good amount of moisture, and carbohydrates and it is also a great source of vitamin C.

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