Impact of Dietary Duckweed (*Lemna minor*) on Growth performance of Grass Carp (*Ctenopharyngodon idella*) fingerlings

Abstract

An attempted has been made to assess the impact of duckweed (*L. minor*) on growth parameters of grass carp (*Ctenopharyngodon idella*). A 60-day trial was conducted using one control (C) and 3 different level of duckweed *i.e* 5 percent, 10 percent and 20 percent and considered as T1, T2 and T3.Two hundred fingerlings were stocked in four pond and fed at the rate of 5 percent of body weight twice a day (10:00 am and 17:00 pm hours) for 60 days. The weight gain (g), per cent weight gain and specific growth rate were significantly higher in treatment T2 (79.00 and 0.70) followed by T3. Significantly the improved feed conversion ratio also T2 and T3 showed similar trend. Present study use of the duckweed (*L. minor)* in basal diet promotes growth, with the highest growth enhancement in treatment T2. It is concluded that duckweed can be used as a feed supplement to grass carp (*C. idella*) for superior growth performance.

Keywords: Supplementation, Nutraceutical, Dietary, Diet and Probiotic.

Introduction

World fisheries and aquaculture production around 223.2 MMT, with aquatic animal production 185.4 MMT with India fish production is 17.55 MMT in 2024 according to **Anonymous, 2024.** Grass carp are widely farmed worldwide and have the largest annual output of any fish, grass carp account for more than 10% of the total global aquaculture output, and the amount of farmed grass carp continues to increase. Grass carp have included in top 3 growing fish in world (**FAO, 2024**). Duckweed has been stated to have decent equilibrium of amino acids comparable to milk (**Leng *et al,* 1995**). Duckweed (*L. minor*) is a decent quality when it was collected from ponds and other nearby the houses due to the obtainability of nutrients. Duckweed (*L. minor*) grown-up unsurprisingly in ponds and canals with underprivileged nutrients grow unhurriedly with long root systems and has poor protein content (**Goopy and Murray, 2003**). The purpose of the present study is to investigate the supplement of the duckweed on the growth performance of

grass carp fingerlings in the ponds. Duckweed plants comprise very little quantity of fiber, consequently level monogastric creatures can resume it and numerous fishes, specifically herbivorous guzzle duckweed eagerly as the cell wall of this plant has truncated lignin **Chaturvedi *et al.*, 2003.** Accordingly, duckweed demonstrations improved digestibility and is measured as an idyllic protein foundation of fish feed **Bornali, 2004; Tao *et al.*, 2013.**

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2. Materials and Methods:

2.1 Experimental site

The study was conducted in 12 earthen ponds of Kunjapur, Chatur bhuj Khejuri, Purba Medinipur, West Bengal.

2.2 Experimental details

The experimental diet was prepared by adding different levels of duckweed in the basal diet. Treatment groups were incorporated with different levels of duckweeds *i.e* 5 percent, 10 percent and 20 percent and considered as T1, T2 and T3.Two hundred fingerlings were stocked in four ponds and fed at the rate of 5 percent of body weight twice a day (10:00 am and 17:00 pm hours) for 60 days. The initial average weight of experimental fish (Grass carp) was 66 g and average length was 13.45cm. The experimental diet was prepared by using different ingredients like rice bran, mustered oil cake, wheat flour, fish meal and vitamin premature in accurate amount and the basal diet details presented in table no. 1.

2.3 Water quality sampling:

The water quality parameters of experiment (i.e. temperature, pH, dissolved oxygen and alkalinity,) were checked on the first day of experiment and subsequently after every 15 days and water quality parameters were analyzed succeeding the standard methods of **APHA (2005)**.

2.4 Growth parameters

At the end of trial, all the fishes from investigational pond were collected with a drag net. Fishes final weight was measure by help of weighing machine. The growth parameters were calculated by using this formula:

2.4.1 Weight gain (g) = Final weight (g) – Initial weight (g)

2.4.2 Percent weight gain = (Final Weight - Initial Weight) / Initial Weight) x 100%

2.4.3 Specific growth rate % =100 x (Ln final weight-Ln initial weight)/days.

Ln= Log

2.4.4 Feed Conversion Ratio= Feed given (g)/Weight Gain (g)

2.5 Statistical analysis

The data were statistically analyzed by using SPSS 16.0.

3.0 Results and Discussion

Duckweed (*L. minor*) based diet significantly effect on fish growth and water quality criteria measured over the 60 days of the experiment, were presented at Table 1 and 2 respectively. Experimental water temperature, dissolved oxygen (D.O) and pH ranged between 24.20–22.00°C, 6.50–7.0 mg/L and 8.34–8.4, respectively. Fish fed the pelleted diet containing 10 percent (T2) duckweed had the maximum weight gain and did not vary from fish in the different treatments (P>0.05) except for the group fed 20 percent duckweed (*L. minor*), with respect to weight gain and specific growth rate (SGR). The maximum net weight gain (15g), per cent weight gain (23.4%), SGR (0.75) was found in treatment T2, whereas maximum FCR was found in control and minimum (1.2) was found in treatment T2. It is presented in table 2 and fig. 1. Similarly, there were not at all differences between the treatments with respect to feed conversion ratios (FCR) at the end of the research (P>0.05). Live weight gain of fish fed the control diet decreased more dramatically than that of the fish fed diets containing different amount of duckweed (*L. minor*) (Figure 1). Overall maximum net weight gain, per cent weight gain and SGR was maximum found in treatment T2, whereas minimum FCR was found in treatment T2, T3, T1 and (C) control respectively. There is a significant difference was observed between the treatment groups and control group.

As we know in aquaculture for getting the maximum production, we need to maintain optimum water quality parameters for fish growth and well. In contrast, in the current experiment, Grass carp fingerlings (5% of body weight) fed diets containing different amounts of duckweed show a significant difference in contrast to growth and feed utilization. These findings backing the view that duckweed has a higher nutritive value than both mucuna and sesbania feed (**Makkar and Becker, 1999; Shanthanna *et al.*, 2024**), particularly seeing the circumstance that the fish used in the present experimental were slighter than persons used in the two earlier studies and thus were more vulnerable to the inhibitory properties. Consequently, duckweed feed offers an easy, applied and inexpensive fish feedstuff because it requires no processing to destroy any antinutrients factor. It was stimulating to note that fish fed the control diet (commercial carp diet) less weight in compare to treatment diets. Similar trends were observed by **Yadav *et al.*, 2024; Debbarma *et al.*, 2024 and Halder *et al.*, 2024,** they concluded that the herbs significantly affect the fish growth and other parameters.

Conclusion

This study suggested that 10 percent (T2) duckweed (*L. minor*) is beneficial for fish growth and management. It suggested that 10 percent duckweed (*L. minor*) include in fish diet, it will provide good growth and development. However, further field studies on different species and testing of different levels are also recommended.

Highlights

- The study was carried out on the duckweed (*L. minor*) and its potential in Aquaculture.
- Duckweed (*L. minor*) has good amount of nutrients (Protein) for fish growth.
- This study provides the knowledge about duckweed (*L. minor*) inclusion percent in fish diet and its growth.

Disclaimer (Artificial Intelligence)

Authors hereby declare that no generative AI technologies such as large language models (Chat GPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Table: 1.0 Experimental Diet Ingredients composition

S.No	Ingredients (g)	Treatments			
		C	T1 (5%)	T2 (10%)	T3 (20%)
1.	**Rice Bran**	276	264	251	226
2.	**MOC**	223	210	198	173
3.	**Wheat Flour**	276	264	251	226
4.	**Fish meal**	223	210	198	173
5.	**Vitamin Premix**	2	2	2	2
6.	**Duckweed**	0	50	100	200
7.	**Total (g)**	1000	1000	1000	1000

Table: 2.0 Growth Performances of Experimental Fish

S.No	Treatment	Initial Weight	Final Weight	Percent weight gain	Net weight Gain	SGR	FCR
1.0	**C**	65	74	13.8	9.0	0.59	1.8
2.0	**T1**	66	76	15.2	10.0	0.64	1.7
3.0	**T2**	64	79	23.4	15.0	0.75	1.2
4.0	**T3**	68	82	20.6	14.0	0.61	1.3

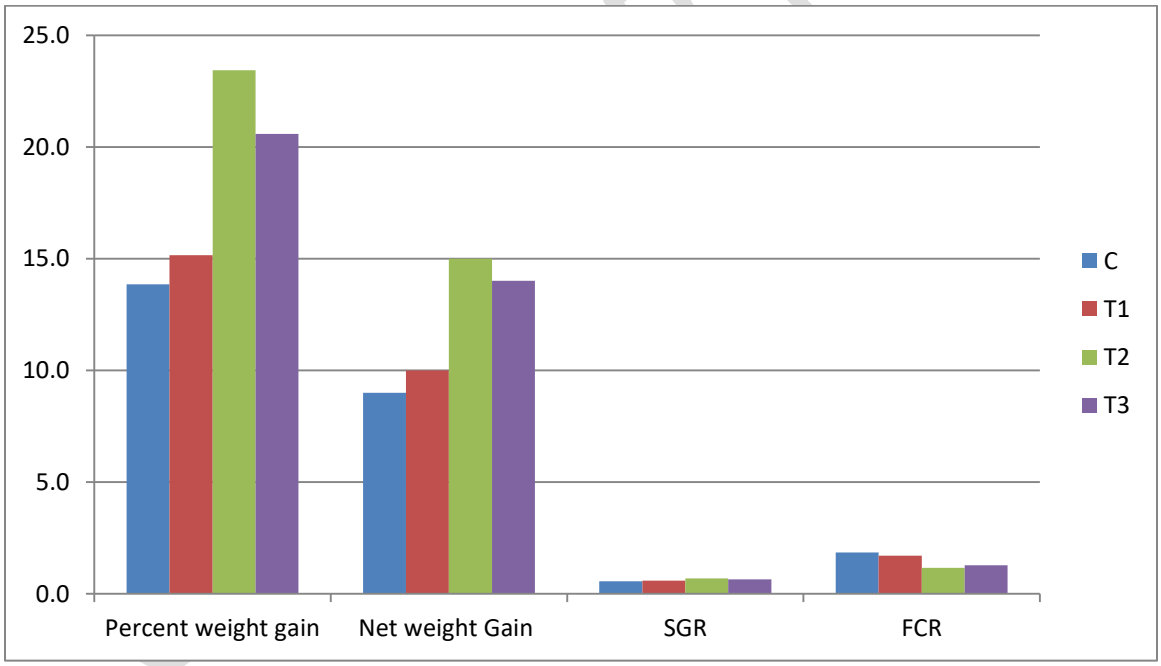

Fig. 1.0 Growth Parameters of different treatment