



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2021; 9(1): 618-621

© 2021 JEZS

Received: 15-10-2020

Accepted: 13-12-2020

RD Solanki

Department of Aquaculture,
College of Fisheries,
Junagadh Agricultural
University, Veraval. Gujarat.
India

NH Joshi

Department of Aquaculture,
College of Fisheries,
Junagadh Agricultural
University, Veraval. Gujarat.
India

Effect of seaweed *Caulerpa* spp. as dietary ingredient on growth performance and survival of *Labeo rohita* (Hamilton, 1822) fry

RD Solanki and NH Joshi

Abstract

The study was conducted to evaluate the efficacy of seaweed (*Caulerpa* spp.) as feed additive on specific growth rate, weight gain, survival and some biochemical parameters in Rohu (*Labeo rohita*) fry for 60 days. The five experimental diets were prepared by adding *Caulerpa* spp. at 0% (control diet), 3% (T1), 6% (T2), 9% (T3) and 12% (T3) inclusion level. Total 150 numbers of rohu (*Labeo rohita*) fry were randomly distributed into five treatments (control + treatment), each in three replicate. Sampling was carried out at every 15 days to monitor growth performance and to adjust rations. The water quality parameters viz. DO, alkalinity, pH and temperature was found in the permissible range during entire experimental period.

Based on the results, there was a significant difference ($P > 0.05$) reported in weight and length gain of fry fed with the different feeds during a period of 60 days. Fishes fed with T2 (Treatment) diet showed the highest mean weight gain, specific growth rate (SGR) and protein efficiency ratio (PER) than those fed with other diets. Lowest feed conversion ratio (FCR) and highest specific growth rate (SGR) SGR was obtained in T2. In the proximate analyses of the fish carcass the protein content was significantly highest in T2 compared to other treatments. The fat content was significantly higher in T4. From the findings of this study it can be concluded that seaweed *Caulerpa* spp. is a potential protein rich basal ingredient and can be used to as good feed additive if used 6% level in the diets of rohu (*Labeo rohita*) fry without compromising its growth performance.

Keywords: *Caulerpa* spp., dietary ingredient, rohu, *Labeo rohita*

Introduction

Fisheries and aquaculture remain important sources of food, nutrition, income and livelihoods for hundreds of millions of people around the world. Fisheries in marine and inland waters provided 87.2 and 12.8 percent of the total global production, respectively. World total marine catch was 79.3 million tonnes in 2016, representing a decrease of almost 2 million tonnes from the 81.2 million tonnes in 2015 (Anon., 2018). In India, the Indian major carps (IMC) are the most preferable farm fishes because of their fast growth and higher acceptability to consumers. Carp are a major source of animal protein for millions of people in India. Annual Indian production of the three Indian major carps in 2016, namely, Catla comprised 27,00,000 tonnes; Rohu 90,000 tonnes and Mrigal 1,90,000 tonnes [1]. Rohu, *Labeo rohita* is one of the most cultured indigenous fishes in Indian subcontinent with maximum market demand and acceptability to the consumers due to their taste and flesh. Proper nutrition of this cultured fish is most important for high survival and rapid growth [3]. The distribution of Rohu in India to be freshwaters of East Punjab, Uttar Pradesh, Bihar, Darjeeling district, West Bengal, Assam, Orissa and Madhya Pradesh; Pakistan, freshwaters of West Punjab; Bangladesh and Burma [2]. Seaweed genus, *Caulerpa* is almost extensively available during the all month of seaweed growing season at Veraval coast. It can provide dietary alternatives due to their nutritional values. It contains higher mineral nutrients and antioxidants, potential source of plant food proteins and balanced amino acids. In this context utilization of *Caulerpa* as dietary ingredient for formulating nutritionally balanced mixture of feedstuffs of *L. rohita* will be helpful for acceptable production, flesh quality, and a positive nutritive effect on growth, survival and overall health. Hence, investigation of proximate composition of seaweed will be beneficial for evaluating their nutritional value as food additive. Looking to the above aspects, the present study was undertaken to evaluate effect of seaweed *Caulerpa* spp. as dietary ingredients on growth performance, survival, feed utilization and body composition of *L. rohita* fry.

Corresponding Author:**RD Solanki**

Department of Aquaculture,
College of Fisheries,
Junagadh Agricultural
University, Veraval. Gujarat.
India

Materials and Methods

The experiment was conducted in the wet laboratory of aquaculture department at college of fisheries science, JAU. Veraval. The experimental set-up consisted of 15 plastic tanks (40 L capacity). The tanks were thoroughly washed with potassium permanganate solution (4mg/L) and cleaned with fresh water. Fifteen glass aquaria (size 2 x 1 x 1 feet) were filled with filtered and disinfected freshwater. One hundred fifty (150) fishes were distributed in five distinct experimental groups. Each group was consisted three replicates. Each plastic tank containing 30 L chlorine free water was stocked with 10 numbers of fishes.

Ingredients such as fish meal, GNOC, wheat flour, tapioca, fish oil, sunflower oil, vitamin and mineral mixture, and seaweed powder were used for feed formulation. Seaweed was collected from Veraval coast (20° 54'33.83" N 70° 20' 51.18" E), during low tides. After the collection, the seaweed was immediately washed with freshwater to remove extraneous materials associated with them. Then seaweed was allowed to dry under the shed for 2 days and stored in polythene bags for further use. Proximate composition of ingredients was determined by the standard methods (AOAC, 1995) (Table-1).

Table 1: Proximate composition of ingredients used for preparation of treatments diets (%)

Ingredients	Crude Protein	Crude Fat	Ash	Moisture
Fish meal	51	5.07	7.97	6.3
GNOC	38.15	8.07	8.78	5.9
Wheat flour	8.7	1.99	1.7	11.57
Tapioca	0.19	0.10	0.06	10.6
Seaweed	12.21	2.12	22.22	13.25

The experimental diet was formulated with 35% protein level using locally available ingredients. The required quantity of ingredients were weighed accurately as per feed formula as shown in Table-2. In five experimental diets, the seaweed *Caulerpa* sp. was added at the rate of 3%, 6%, 9% and 12% ingredients of control diet. Then prepared dough and then mixture of feed was thermally processed at 121°C and 15 lbs pressure for 10-15 minutes. After steam cooking of feed mixture, vitamin and mineral mixture was mixed. The feed mixture was pelletized by using hand pelletizer. The pellets were spread on a plastic sheet, exposed to sunlight. Then pellets feed was packed in marked plastic jars.

Table 2: Composition of experimental diets (g)

Ingredients	Treatments				
	T0 (Control)	T1 (3% <i>Caulerpa</i>)	T2 (6% <i>Caulerpa</i>)	T3 (9% <i>Caulerpa</i>)	T4 (12% <i>Caulerpa</i>)
Fish meal	171.55	171.55	171.55	171.55	171.55
GNOC	230.25	230.25	230.25	230.25	230.25
Tapioca	24.1	24.1	24.1	24.1	24.1
Wheat flour	24.1	24.1	24.1	24.1	24.1
Fish oil	20	20	20	20	20
Sunflower oil	20	20	20	20	20
Vitamin mix	10	10	10	10	10
<i>Caulerpa</i> spp	0	15	30	45	60

The proximate analysis of the control and treatment diets was carried out for moisture, protein, total lipids and total ash

according to the standard methods (AOAC, 1995) Table- 3.

Table 3: Proximate analysis of experimental diets (%)

Proximate	Treatments				
	T0 (Control)	T1 (3% <i>Caulerpa</i>)	T2 (6% <i>Caulerpa</i>)	T3 (9% <i>Caulerpa</i>)	T4 (12% <i>Caulerpa</i>)
Crude Protein	34.20	34.90	35.10	34.92	34.78
Crude Fat	8.54	8.32	7.76	8.13	7.87
Moisture	6.81	7.72	8.56	8.30	8.21
Ash	15.71	15.78	16.15	16.54	16.88

Results and Discussion

The experiment was carried out to find the effect of *Caulerpa* spp. supplemented diet on growth and survival of *L. rohita* fry for 60 days of experimental period. The results of mean weight gain, mean length gain, specific growth rate (SGR) and survival rate obtained in the present experiment are discussed below.

Wet weight (g)

The average wet weight (g) of *L. rohita* observed at periodical intervals is shown in Table 4. The final average wet weight recorded were 2.63±0.06g, 2.93±0.09g, 3.43±0.06g, 2.88±0.04g and 2.73±0.13g in treatment T0 (Control), T1, T2,

T3 and T4 respectively. The final wet weight gain was significantly highest in T2 (3.43±0.06g) and lowest in T0 (control) (2.63±0.06g) treatments. Significant difference was found between the treatment for wet weight of fish ($p < 0.05$). While, the Percentage of body weight gain of fishes fed with different diets is listed in Table 4.2. The final percentage of weight gain recorded were 203.67±7.35%, 242.49±9.71%, 298.43±5.15%, 233.02±2.83% and 215.62±12.54% in treatment T0, T1, T2, T3 and T4 respectively at the end of 60 days. The percentage of weight gain was significantly higher in treatment T2 (298.43±5.15%), whereas lower in T0 (control) diet (203.67±7.35%). Significant difference among all the treatments ($p < 0.05$) was observed.

Table 4: Total weight (g) of *L. rohita* fry recorded in different treatments during culture period (Mean \pm SE)

Duration (Days)	Treatment					Mean
	T0 (Control)	T1	T2	T3	T4	
0	0.87 \pm 0.01	0.86 \pm 0.01	0.86 \pm 0.01	0.86 \pm 0.01	0.86 \pm 0.01	0.86
15 th	1.18 \pm 0.04	1.21 \pm 0.04	1.29 \pm 0.05	1.26 \pm 0.08	1.21 \pm 0.04	1.23
30 th	1.5 \pm 0.03	1.72 \pm 0.04	1.85 \pm 0.03	1.69 \pm 0.05	1.62 \pm 0.06	1.68
45 th	2.08 \pm 0.04	2.2 \pm 0.05	2.57 \pm 0.07	2.13 \pm 0.05	2.11 \pm 0.05	2.22
60 th	2.63 \pm 0.06	2.93 \pm 0.09	3.43 \pm 0.06	2.88 \pm 0.04	2.73 \pm 0.13	2.92
Mean	1.65	1.79	2.00	1.76	1.71	
Treatment	S.Em. \pm		C.D. at 5%		C.V.%	
D (Duration)	0.024		0.068		5.19	
T (Treatment)	0.024		0.068			
T X D	0.053		0.152			

Table 5: Total weight gain (%) of *L. rohita* fry recorded in different treatments during culture period (Mean \pm S.E.)

Duration (Days)	Treatment					Mean
	T0 (Control)	T1	T2	T3	T4	
60 th	203.67 \pm 7.35	242.49 \pm 9.71	298.43 \pm 5.15	233.02 \pm 2.83	215.62 \pm 12.54	238.64
T (Treatment)	S.Em. \pm		C.D. at 5%		C.V.%	
	8.2491		25.9918		5.987	

Total length (cm)

The average length (cm) of *L. rohita* observed at the periodic interval is shown in Table-6. The final average length recorded were 4.57 \pm 0.09cm, 5.48 \pm 0.08cm, 5.97 \pm 0.09cm, 4.98 \pm 0.26cm and 4.53 \pm 0.18cm in treatment T0, T1, T2, T3 and T4 respectively (Plate 4.1-B). The highest length gain was significantly observed in T2 (5.97 \pm 0.09cm) and lowest in

T4 (4.53 \pm 0.18cm) treatments.

Average total length gain of fishes fed with different diets is listed in Table 4.4. The highest length gain was found in treatment T2 (140.36 \pm 16.06%), whereas lowest in T4 diet (83.63 \pm 2.55%). Significant difference was found between the treatment for length gain of fish ($p < 0.05$).

Table 6: Total length (cm) of *L. rohita* fry recorded in different treatments during culture period (Mean \pm SE)

Duration (Days)	Treatment					Mean
	T0 (Control)	T1	T2	T3	T4	
0	2.26 \pm 0.11	2.35 \pm 0.04	2.51 \pm 0.18	2.46 \pm 0.10	2.46 \pm 0.07	2.41
15 th	2.93 \pm 0.12	3.25 \pm 0.07	3.41 \pm 0.18	3.14 \pm 0.09	3.04 \pm 0.09	3.16
30 th	3.69 \pm 0.13	4.04 \pm 0.07	4.25 \pm 0.17	3.80 \pm 0.14	3.61 \pm 0.09	3.88
45 th	4.22 \pm 0.11	4.59 \pm 0.07	5.01 \pm 0.04	4.18 \pm 0.19	3.99 \pm 0.16	4.4
60 th	4.57 \pm 0.09	5.48 \pm 0.08	5.97 \pm 0.09	4.98 \pm 0.26	4.53 \pm 0.18	5.11
Mean	3.53	3.94	4.23	3.71	3.53	
Treatment	S.Em. \pm		C.D. at 5%		C.V.%	
D (Duration)	0.057		0.1624		5.84	
T (Treatment)	0.057		0.1624			
T X D	0.128		0.3631			

Table 7: Total length gain (%) of *L. rohita* fry recorded in different treatments during culture period (Mean \pm S.E.)

Duration (Days)	Treatment					Mean
	T0 (Control)	T1	T2	T3	T4	
60 th	102.72 \pm 7.15	133.38 \pm 5.79	140.36 \pm 16.06	103.04 \pm 12.90	83.63 \pm 2.55	112.63
T (Treatment)	S.Em. \pm		C.D. at 5%		C.V.%	
	10.15		31.99		15.61	

Specific Growth Rate (SGR)

The specific growth rate (SGR) of *L. rohita* fry in different treatments is given in Table-8. Highest SGR was found in T2 diet treatment (1.00 \pm 0.01) followed by T1 (0.89 \pm 0.02), T3 (0.87 \pm 0.01), T4 (0.83 \pm 0.03) and T0 (control) (0.80 \pm 0.02).

Thus, the lowest SGR (0.80 \pm 0.02) was observed in T0 (control). Significant difference ($p < 0.05$) was observed among the treatment diets; T2 was found to be higher as compared to the other treatments.

Table 8: Specific growth rate (%) of *L. rohita* fry recorded in different treatments during culture period (Mean \pm S.E.)

Duration (Days)	Treatment					Mean
	T0 (Control)	T1	T2	T3	T4	
60 th	0.80 \pm 0.02	0.89 \pm 0.02	1.00 \pm 0.01	0.87 \pm 0.01	0.83 \pm 0.03	0.88
T (Treatment)	S.Em. \pm		C.D. at 5%		C.V.%	
	0.0186		0.0586		3.665	

Survival%

Mean survival rate was observed 100% among all the

treatment at 60 days of experimental period.

Effect on feed utilization and body composition**Feed conversion ratio (FCR)**

Feed conversion ratio was significantly highest ($p < 0.05$) in T0 diet (2.77 ± 0.10) followed by 2.70 ± 0.12 , 2.53 ± 0.02 , 2.48 ± 0.07

and 2.17 ± 0.03 in T4, T3, T1 and T2 treatments respectively (Table-9). There was significant difference observed in all the treatment ($p < 0.05$).

Table 9: Feed conversion ratio (FCR) of *L. rohita* fry recorded in different treatments during culture period (Mean \pm S.E.)

Duration (Days)	Treatment					Mean
	T0 (Control)	T1	T2	T3	T4	
60 th	2.77 \pm 0.10	2.48 \pm 0.07	2.17 \pm 0.03	2.53 \pm 0.02	2.70 \pm 0.12	2.53
T (Treatment)			S.Em. \pm	C.D. at 5%	C.V.%	
			0.078	0.246	5.362	

Protein efficiency ratio (PER)

The results on protein efficiency ratio (PER) of *L. rohita* under different treatments are given in Table-10. The highest PER was found in T2 (1.31 ± 0.02) followed by T1

(1.16 ± 0.03), T3 (1.13 ± 0.01), T4 (1.06 ± 0.05) and T0 (control) (1.04 ± 0.04). With respect to PER, all the treatments were significantly differing with each other ($p < 0.05$).

Table 10: Protein efficiency ratio (PER) of *L. rohita* fry recorded in different treatments during culture period (Mean \pm S.E.)

Duration (Days)	Treatment					Mean
	T0 (Control)	T1	T2	T3	T4	
60 th	1.04 \pm 0.04	1.16 \pm 0.03	1.31 \pm 0.02	1.13 \pm 0.01	1.06 \pm 0.05	1.14
T (Treatment)			S.Em. \pm	C.D. at 5%	C.V.%	
			0.0318	0.1002	4.826	

Proximate analysis of fish carcass

At the end of the feeding period, five fish from each tank were collected randomly for proximate analysis of fish carcass. The data for proximate analysis of fish whole body after the experiment (dry weight basis) are given in Table-11. The protein content was significantly highest (14.71%) in T2 compared to other treatments. The fat content was significantly highest (3.38%) as compared to control with maximum in T2 followed by T4, T1 and T3. The ash content was significantly highest (4.39) in T4 as compared to control. The moisture content was found highest (75.69%) in T1 as compared to other treatments.

Table 11: Proximate analysis of fish carcass (dry weight basis)

Experimental Fish	Protein%	Fat%	Ash%	Moisture%
T ₀	12.85	3.38	2.79	74.85
T ₁	13.95	3.41	3.61	75.69
T ₂	14.71	3.00	3.93	73.87
T ₃	13.11	3.23	4.03	73.54
T ₄	12.92	3.44	4.39	74.25

Conclusion

The five experimental diets consisted of a control diet (traditional feed) and three other dietary ingredients in which seaweed *Caulerpa* spp. added as a feed additive (3%, 6%, 9% and 12% of dietary protein) were prepared. The diets were formulated to provide 35% crude protein on a dry weight basis. The percentage of weight gain was significantly higher in treatment T2 ($298.43 \pm 5.15\%$), where as the lower in T0 diet ($203.67 \pm 7.35\%$). Similarly, the highest length gain was found in treatment T2 ($140.36 \pm 16.06\%$), whereas the lowest was found in T4 diet ($83.63 \pm 2.55\%$). Similarly, highest SGR was found in T2 diet treatment (1.00 ± 0.01) followed by T1 (0.89 ± 0.02), T3 (0.87 ± 0.01), T4 (0.83 ± 0.03) and T0 (control) (0.80 ± 0.02). The highest PER was found in T2 (1.31 ± 0.02) followed by T1 (1.16 ± 0.03), T3 (1.13 ± 0.01), T4 (1.06 ± 0.05) and T0 (control) (1.04 ± 0.04); with reference to PER, all the treatments were found to be significant ($p < 0.05$). Based on the results obtained from the experiment conducted, it was found that higher growth, SGR, PER and lowest FCR were obtained

by feeding the fish with the diet containing 6% *Caulerpa* spp. (T2). The proximate analysis of fish whole body was done after the end of experiment. The protein content was significantly highest in T2 compared to other treatments.

Reference

- Anonymous. The State of World Fisheries and Aquaculture. Food and Agriculture Organization United Nations Rome. 2018, 227.
- Khan HA, Jhingran VG. Synopsis of biological data on rohu *Labeo rohita* (Hamilton, 1822) 1975.
- Mukherjee S, Parial D, Khatoon N, Chaudhuri A, Senroy S, Home Chaudhuri S *et al.* Effect of Formulated Algal Diet on growth performance of *Labeo rohita* Hamilton. J. Algal. Biomass Utiln 2011;2(4):1-9.