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Karni Bishnoi
M.F.Sc. Scholar Department of Aquaculture, College of Fisheries, MPUAT, Udaipur, Rajasthan, India

ML Ojha
Assistant Professor, Department of Basic Science, College of Fisheries, MPUAT Udaipur, Rajasthan, India -313001

VP Saini
Professor, Aquaculture Research and Seed Unit, MPUAT, Udaipur, Rajasthan, India

SK Sharma
Professor and Head, Department of Aquatic Environment, College of Fisheries, MPUAT Udaipur, Rajasthan, India

Correspondence
Karni Bishnoi
M.F.Sc. Scholar Department of Aquaculture, College of Fisheries, MPUAT, Udaipur, Rajasthan, India

Evaluation of growth and metabolism of *Labeo rohita* (Hamilton, 1822) fingerlings with *Aloe vera* supplementation diet

Karni Bishnoi, ML Ojha, VP Saini and SK Sharma

Abstract
The role of *Aloe vera* as fish diet supplement on growth and metabolism of *Labeo rohita* was evaluated. For this purpose six graded levels {0(D1), 100(D2), 200(D3), 400(D4), 600(D5) and 800(D6) g/kg)} of *Aloe vera* pulp were mixed in basal diet and fed (@ 4% of body weight per day) to experimental fish for a total period of 60 days. The supplementation of *Aloe vera* had significant impact on fish growth. The highest weight gain (60.410±0.996g), percent weight gain (275.700±14.683%), SGR (2.203±0.066%) and GCE (0.579±0.011) were recorded in D_4. The fishes fed with D_4 have also indicated better food utilization with lesser food conservation ratio (FCR) i.e. 1.726±0.032 as compared to other treatments. Similarly, the higher value of Amylase activity (27.480±0.068), Protease (28.456±0.255) and Lipase (0.6333±0.015) were also recorded in D_4. Therefore, it can be concluded that *Aloe vera* @400g/kg diet had significant role in improving rohu growth and metabolism.

Keywords: *Aloe vera*, Growth, Herbs, Metabolism, *Labeo rohita*

Introduction
Aquaculture, the fastest growing food producing sector is perceived as having the greatest potential to meet the growing demand for aquatic food [1]. World aquaculture production is likely to grow continuously but at slow rate than the present growth rate [1]. World production attained another all-time high of 158.0 million tons out of which aquaculture contributes about 66.6 million tons [1]. Global trend of aquaculture development is gaining importance in total fish supply which has remained uninterrupted. Farmed food fishes contributed a record 42.2% of the total 158.0 million tons produced (both capture and culture) which is much higher than 13.4% in 1990 and 25.7% in 2000[1]. Asia as a whole has been producing more farmed fish than wild catch since 2008. Asia's share in global aquaculture production has reached 89% [1]. To achieve the higher growth of culture fish especially carps. Supplementary feed have been suggested as critical input. However, the cost of production is significantly higher with supplementary feeding as the cost of input is more than 65-70% as feed [2]. Considering, this aspect several feed additives have been tested to enhance fish growth and reduce the cost of feed from this point of view herbs are of paramount importance as fish feed additives [3]. The herbs are not only safe for consumers but also widely available throughout Asia and they also have a significant role in aquaculture. The inclusion of herbal feed supplements often provides cooperative action to various physiological functions [4].

Aloe vera, plant of the lily family in warm and frost-free climates, has been known for centuries as a potent medicinal plant according the "folk medicines" of cultures around the world [5]. Any *Aloe vera* liquid product, whether called gel, juice or whole leaf extract, comprises the fluid obtained by breaking up the structure of the Aloe leaf and separating off the solid residues to leave a more or less clear solution [5]. Beneficial effects of *Aloe vera* in human and laboratory animals are contributed to the promotion of immune system; anti-inflammatory, pro-healing, gastrointestinal, antidiabetic and anti-arthritic effects [6]. However, there is limited information available on the immunostimulatory, anti-toxicity and growth effects of Aloe in fish [8]. Considering the medicinal importance of *Aloe* vera the present study was designed to investigate the effect of *Aloe vera* on growth and metabolism of *Labeo rohita* (Hamilton, 1822) fingerlings.

Materials and Methods

Experimental fish: The Indian Major Carp, *L. rohita* was selected for the present study. The healthy fingerling (24.0±1.5g) of this fish were procured from Aquaculture Research and Seed Unit DOR, MPUAT, Udaipur.

Experimental diet supplement: For the present study *Aloe vera* was chosen as feed supplement to evaluate its effect on rohu growth and metabolism.

Experiment setup: The experiment was conducted during March-April, 2017 at Aquaculture Research and Seed Unit Directorate of Research, MPUAT, Udaipur (Rajasthan). A total 180 numbers of *L. rohita* (24.0±1.5g) fingerlings were obtained from university fish seed production unit and acclimatized for 3 days under laboratory conditions. Following complete randomized designee (CRD), the fingerlings were stocked in 18 FRP tanks of $2m^3$ size. These fingerlings were fed @ 4% of their body weight per day for a total period of 60 days. The fish growth parameters were observed on initial day and subsequently at an interval of 15 days.

Preparation of Diet

The basal diet was prepared by using groundnut oil cake, rice bran and wheat flour @ 40, 40, and 20% respectively [7]. Six graded levels of *Aloe vera* pulp 0(D_1, control), 100(D_2), 200(D_3), 400(D_4), 600(D_5) and 800(D_6) g/Kg of basal diet were added to prepare experimental diet. The dry ingredients of the basal diets were thoroughly mixed and dough was formed and placed in autoclave at 15lbs pressure for 30 minutes. After cooling graded levels of *Aloe vera* pulp were added to the basal diet. The paste was then extruded through a commercial pelletizing machine. The resulting spaghetti like diet (2.0 mm diameter) was air dried and stored in air tight containers for further use (Table.1).

Table 1: Proximate composition of experimental diets (g/kg).

S. No.	Treatment Proximate	Treatments					
		D_1 (Control)	D_2	D_3	D_4	D_5	D_6
1	Moisture	8.47^{a}±0.26	8.60^{a}±0.15	9.27^{b}±0.08	9.33^{bc}±0.08	9.77^{cd}±0.14	9.87^{d}±0.06
2	Protein	23.93^{c}±0.06	22.47^{b}±0.31	20.47^{a}±0.31	20.33^{a}±0.33	20.37^{a}±0.41	19.93^{a}±0.06
3	Fat	9.83^{d}±0.03	9.80^{d}±0.05	9.50^{cd}±0.05	9.33^{c}±0.08	8.33^{b}±0.24	7.43^{a}±0.06
4	Carbohydrate	45^{a}±0.25	49^{ab}.90±3.9	49.30^{ab}±1.1	49.17^{ab}±0.32	50.13^{ab}±0.29	51.43^{b}±0.96
5	Ash	12.77^{a}±0.14	9.23^{a}±3.7	11.47^{a}±0.73	11.83^{a}±0.03	11.40^{a}±0.55	11.33^{a}±0.83
Data expressed as Mean ± SE (n=3) *Mean values in the same row sharing different superscripts are significantly different ($p<0.05$)*							

Water Quality Analysis

Water quality parameters such as temperature, pH, dissolved oxygen and total hardness were analyzed on initial day and subsequently at fortnightly intervals following standard methods [9, 10].

Growth Parameters

The growth performance of experimental fish weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR) and gross conversion efficiency were estimated as follows.

1. Weight Gain: The body weight of *L. rohita* (Ham.) fingerling was obtained initially and thereafter at fifteen days interval upto completion of the experiment i.e. 60^{th} days.
The weight gain (g) was calculated as given below:
Weight gain (g) = Final weight (g) - Initial weight (g)

$$\text{Weight gain in per cent} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}} \times 100$$

2. Specific Growth Rate (SGR)

$$\text{SGR } (\%) = \frac{(\ln \text{Wt} - \ln \text{Wo})}{\text{D}} \times 100$$

3. Feed Conversion Ratio (FCR)

$$\text{FCR} = \frac{\text{Weight of food given (g)}}{\text{Weight gain of fish (g)}}$$

4. Gross Conversion Efficiency (GCE)

$$\text{GCE} = \frac{\text{Weight gained (g)}}{\text{Food given (g)}}$$

Proximate composition of experimental feed and fish carcass

The proximate analysis of experimental feed and fish were done following the method of AOAC [11]. Feed composition was estimated before the initiation of experiments, while that of the experimental fish, the proximate composition was performed initially and at the termination of experiments.

Metabolism Study

Three important digestive enzymes like intestinal amylase, protease and lipase were assayed following standard protocols. Protease activity was determined by the casein digestion method of Drapean [12]. Amylase activity was estimated using dinitrosalicylic- acid (DNS) method of Rick and Stegbauer [13]. While, the lipase activity was assayed by the method of Cherry and Crandell [14].

Statistical analysis

Statistical analysis of the recorded data was carried out using standard statistical methods to draw meaningful conclusion. The analysis of variance (ANOVA) and standard error were performed using SPSS 16.0.

Results and Discussion

In the present study, the weight gain, percentage weight gain, specific growth rate, food conversion ratio and gross conversion efficiency were significantly different ($p<0.05$) in *Aloe vera* supplemented diet feed fish. Still, the better growth performance was observed in treatment D_4 (400g/kg feed *Aloe vera*. In this treatment weight gain was 60.410±0.996g. (275.700±14.683%) and specific growth rate (SGR) was also highest (2.203±0.066). The lowest FCR (1.726±0.032) was recorded in D_4 as compared to all other treatments and control. The gross conversion efficiency (GCE) for this diet was (0.579±0.011). In control diet the overall growth of fish was the lowest. The statistical analysis of data has revealed significant variations in the result of weight gain, SGR, FCR and GCE.

Influence of dietary *Aloe vera* and other herbs supplementation on growth (weight gain) have been evaluated with another species. Mahdavi *et al.* [15] have found better growth performance of common carp (*Cyprinus carpio*) with herb supplemented diet. They reported that the *Aloe vera* extract as a growth promoter, appetite stimulator, tonic and immunostimulant in the diet can reduce stress, reduce food losses and protect fish in order to better growth. Gabrial *et al*. [16] studied dietary *Aloe vera* supplementation on growth haemato-biochemical parameters and disease resistance against *Streptococcus iniae* in tilapia (GIFT). Fish fed with 0.5, 1, and 2% *A. vera* supplemented diet had significantly higher (p<0.05) weight gain. Ojha *et al*. [17] evaluated the dietary effect of ethanolic extract of *Mucuna pruriens* on growth, metabolism and haematoimmunological parameters of an Indian Major Carp, *L. rohita* fingerlings. They reported highest weight gain in 0.06 g/100 gm *Mucuna pruriens* supplemented diet.

Lee *et al*. [18] investigated the supplemental effects of dietary garlic extract (GE) on growth performance of juvenile starlet sturgeon (*Acipenser ruthenus*). Significantly higher protein (PRE 20.4%) and lipid retention efficiencies (LRE, 74.5%) were found in 0.5% GE group (p<0.05). They suggested that the dietary GE could improve growth and feed utilization of juvenile starlet sturgeons. Kumar [19] reported the use of herb Ashawangandha as growth promoter in the supplementary feed on Indian major carp *Cirrhinus mrigala* (Ham.). He reported that the, ashawagandha @ 0.08 g/kg had higher weight gain (45.14%) as compared to the control (19.86%). Thus the results of present study are comparable to the above referred studies on different herbs supplementation as the growth performance of experimental fish was significantly higher in treatments than control.

The effects of dietary *Aloe vera* on growth performance, some histological alterations in rainbow trout skin and gastrointestinal tract and disease resistance against *Streptococcus agalactiae* were studied by Heidarieh *et al*. [20] they found that *Aloe vera* supplementation @ 0.1 and 1% had improved specific growth rate (SGR) in fish. Gabrial *et al*. [16] have also reported the similar observation in tilapia fed with *Aloe vera* supplemented diet. The significantly higher SGR values reported for *Aloe vera* supplemented diet to fish in present study further justified support from the fingerling of [16] as they have also noticed similar result.

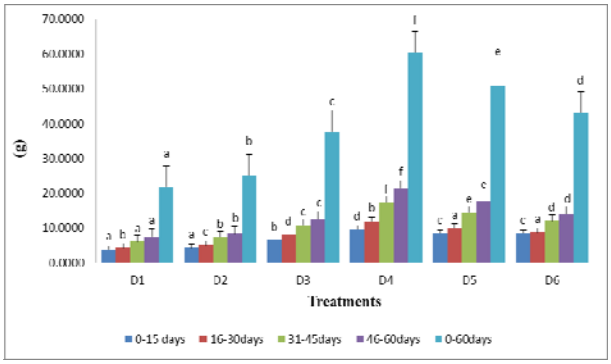

Fig 1: Weight gain of *L. rohita* fed with *Aloe vera* supplementation diet

In the present study, the proximate composition of fish carcass has been assessed after the completion of experimental period. The moisture and protein contents increased significantly with increased level of *Aloe vera* as compared to control. The highest protein contents were recorded in D_5 (21.90±0.45) compared to control (19.85±0.20) respectively. However, fat content of D_3 was higher (6.957±0.152%) and lowest in initial fish sample (6.283±0.088%) respectively. The highest Ash contents recorded in treatment D_2 (4.017±0.044%) and lowest in treatment D_3 (3.180±0.291%) respectively. The carbohydrate contents of whole fish were higher in initial fish sample (2.110±0.064%) and lowest in D_4 (0.330±0.017%).

Table 2: Summary data on growth performance of *L. rohita* fed with *Aloe vera* supplementation diet

S. No.	Treatment	Parameter				
		Net weight gain (g)	Weight gain (%)	SGR (%)	FCR	GCE
1.	D_1(Control)	21.86^{a}±0.166	88.300^{a}±1.249	1.054^{a}±0.011	3.443^{d}±0.037	0.290^{a}±0.003
2.	D_2	25.133^{b}±0.405	97.133^{a}±6.383	1.129^{a}±0.054	3.221^{d}±0.169	0.312^{a}±0.016
3.	D_3	37.776^{c}±1.244	154.230^{b}±5.725	1.554^{b}±0.038	2.295^{c}±0.054	0.436^{b}±0.010
4.	D_4	60.410^{f}±0.996	275.700^{d}±14.683	2.203^{d}±0.066	1.726^{a}±0.032	0.579^{d}±0.011
5.	D_5	50.700^{e}±0.642	195.370^{c}±10.798	1.802^{c}±0.061	1.946^{ab}±0.074	0.515^{c}±0.019
6.	D_6	43.233^{d}±0.845	180.130^{c}±3.637	1.716^{c}±0.021	2.097^{bc}±0.028	0.477^{c}±0.006
Data expressed as Mean ± SE (n=3) Mean values in the same column sharing different superscripts are significantly different (p<0.05)						

A significant effect *Aloe vera* on amylase activity was clearly seen from the recorded data (Tab.3). The highest amylase activity was observed in treatment group D_4 (27.480±0.068) and lowest in D_1 (control) (19.598±0.171). Similarly, the protease activity was highest in treatment group D_4 (28.456±0.255) and lowest in D_1 (control) (17.698±0.083). The lipase activity was highest in treatment group D_4 (0.633±0.015) and lowest in treatment group D_6 (0.536±0.002). The level of digestive enzymes in fish may be influenced by type of feeding [21, 22, 23], biochemical composition of food and onset of sexual maturity [19]. It is also known that age and stage of development significantly influence the digestive enzyme activities in different fish species [24, 25, 26, 27]. Amylase is one of the major carbohydrases which hydrolysis glycosidic bonds between sugar residues in large carbohydrate molecules. Amylase specifically breakdowns starch into glucose molecules. Low amylase activity in the carnivorous and high activity in omnivorous fishes is the general assumption [28, 29]. Ojha *et al*. [30] have also reported significantly higher levels of amylase in herbs supplement diet feed in rohu. Proteases are digestive enzymes which hydrolyzes the peptide bonds between the adjacent amino acids in the proteins. Protease activities in intestine were higher than the hapatic the hepatic protease activity, which was supported by the result of [29]. Kumar *et al*., [31] reported functional efficacy of digestive proteases of catla (*Catla catla)*, rohu (*Labeo rohita)*, and silver carp (*Hypophthalmichthys molitrix)* total protease activity was higher in rohu followed by silver carp, and catla. Lipases hydrolyze the ester bonds among the fatty acids and glycerol in lipids.

Table 3: Evaluation of dietary supplementation of *Aloe vera* on Amylase, Protease and Lipase in intestine of *L. rohita*

S.NO	Treatment	Amylase	Protease	Lipase
1.	D1(Control)	$19.598^{a} \pm 0.171$	$17.698^{a} \pm 0.083$	$0.5480^{a} \pm 0.010$
2.	D2	$21.514^{b} \pm 0.064$	$20.532^{b} \pm 0.058$	$0.5820^{bc} \pm 0.005$
3.	D3	$23.819^{d} \pm 0.067$	$24.625^{d} \pm 0.021$	$0.595^{c} \pm 0.002$
4.	D4	$27.480^{f} \pm 0.068$	$28.456^{f} \pm 0.255$	$0.6333^{d} \pm 0.015$
5.	D5	$25.738^{e} \pm 0.045$	$26.690^{e} \pm 0.175$	$0.5640^{ab} \pm 0.011$
6.	D6	$22.884^{c} \pm 0.038$	$23.554^{c} \pm 0.235$	$0.536^{a} \pm 0.002$
Data expressed as Mean ± SE (n=3) *Mean values in the same column sharing different superscripts are significantly different ($p<0.05$)*				

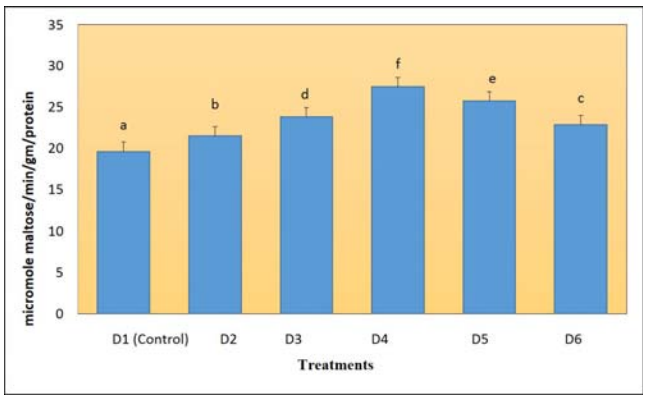

Fig 2: Evaluation of dietary supplementation of *Aloe vera* on Amylase activity in *L. rohita***.**

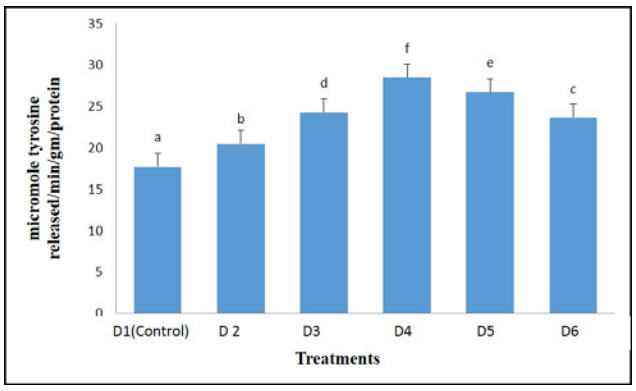

Fig 3: Evaluation of dietary supplementation of *Aloe vera* on Protease activity in *L. rohita*.

Conclusion

The result of present study prove significant role of *Aloe vera* as an herbal growth promoter when mixed in the basal diet of groundnut oil cake, rice bran and wheat flour for *L. rohita* fingerling. The incorporation of *Aloe vera* in fish diet does not show adverse impact on health of *L. rohita* and it is environment friendly. On the basis of the results obtained in the present experiment, it can be concluded that *Aloe vera* supplementation @ 400g/kg diet has paramount importance in enhancing the growth performance and metabolism.

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References

1. FAO. Food and Agriculture Organization of the United Nations; Eurospan Distributor, Rome, Landon. 2014, 243.
2. Michal BN, Imre C. Aquafeeds in Asia-A regional overview. In: Farm-made aquafeeds. FAO Fisheries Technical Paper. 1997; 343:1-23.
3. Nahak G, Mishra RC, Sahu RK. Phytochemical investigation and *in vitro* antioxidant evaluation of some *Ocimum* species. Journal of Pharmacy Research. 2014; 4(7):2340-2343.
4. Shalaby AM, Khattab YA, Rahman AAM. Effect of garlic (*Allium saivum*) and hloramphenicol on growth performance, physiological parameters and survival of Nile tilapia (*Oreochromis niloticus*). Journal of Vernomous Animals and Toxins Including Tropical Diseases. 2005; 12(2):172-201.
5. Plaskett LG. The Health and Medical Use of Aloe vera. Life Sciences Press ISBN: 0-943685-21-4 (Hardback).1998, 129.
6. Ahilan B, Nithiyapriyatharshini A, Ravaneshwaran K. Influence of certain herbal additives on the growth, survival and disease resistance of gold fish *Carassius auratus* (L.). Tamilnadu Journal of Veterinary and Animal Science. 2010; 6(1):5-11.
7. Nandeesh MC. Aquafeed and feeding strategies in India. In: Farm-made aquafeeds. FAO Fisheries Technical Paper. 1997; 343:213-243.
8. Wang L, Liu J, Li X, Shi J, Hu J, Cui R et al. Growth propagation of yeast in linear arrays of microfluidic chambers over many generations. Bio microfluidics. 2011; 5(4):44118-441189.
9. Ellis MM, Westfall BA, Ellis MD. Determination of water quality. Fish and Wild Life Services, United State Department of the Interior. 1949, 122.
10. APHA. Standard methods for examination of water and waste water. American Public Health Association, Washington, D.C. 1989; 1452.
11. AOAC. Methods of analysis of the Association of Official Analytical Chemists 12th Ed, 1970.
12. Drapean G. Protease from *Staphylococcus aureus*. In: Methods in Enzymology (ed. Lorand B.L.)Academic Press, New York, USA. 1974, 469.
13. Rick W, Stegbauer HP. Alpha-amylase by measurement of reducing groups. Ibid. 1974; 90:210-213.
14. Cherry IS, Crandell LAJr. The specificity of pancreatic lipase: its appearance in blood after pancreatic injury. American Journal of Physiology. 1932; 100:266-273.
15. Mahdavi M, Hajimoradloo A, Ghorbani R. Effect of *A. vera* extract on growth parameters of common carp (*Cyprinus carpio*). World Journal of Medical Sciences. 2013; 9(1):55-60.
16. Gabriel NN, Qiang J, He J, Ma XY, Kpundeh MD, Xu P. Dietary Aloe vera supplementation on growth performance, some haemato-biochemical parameters and disease resistance against *Streptococcus iniae* in tilapia (GIFT). Fish and Shellfish Immunology. 2015; 44(2):504-14.
17. Ojha ML, Chadha NK, Saini VP, Damroy S, Chandraprakash, Sawant PB. Effect of ethanolic extract of *Mucuna pruriens* on growth, metabolism and

immunity of *Labeo rohita* (Hamilton, 1822) fingerlings. International Journal of Fauna and Biological Studies. 2014; 1(5):01-09.
18. Lee DH, Ra CH, Song YH, Sung KI, Kim JM. Effects of dietary garlic extract on growth, feed utilization and whole body composition of juvenile starlet sturgeon (*Acipenser ruthenus*). Asian-Australian Journal of Animal Science. 2012; 25(4):577-583.
19. Kumar A. Use of Ashwagandha (*Withania somnifera)* (L.) Dunal as growth promoter in the supplementary feed of an Indian major carp (*Cirrhinus mrigala*) (Ham.). M.Sc. Thesis, MPUAT, Udaipur, 2000.
20. Heidarieh M, Mirvaghefi AR, Sepahi A, Sheikhzadeh N, Shahbazfar AA, Akbari M. Effects of dietary *Aloe Vera* on growth performance, skin and gastrointestine morphology in rainbow trout (*Oncorhynchus mykiss*). Turkish Journal of Fisheries and Aquatic Sciences. 2013; (13):367-373.
21. Hofer R, Schiemer F. Proteolytic activity in the digestive tract of several species of fish with different feeding habits. Oecologia. 1981; 48:342-345.
22. Hofer R. Protein digestion and proteolytic activity in the digestive tract of an omnivorous cyprinid. Biochemical Physiology. 1982; 72A:55-63.
23. Janas E, Ragyanszki M, Olah J, Boross L. Proteolytic digestive enzymes of carnivorous (*Silurus glanis* L.), herbivorous (*Hypophthalmicthys molitrix* Val.) and omnivorous (*Cyprinus carpio* L.) fishes. Aquaculture. 1983; 30:145-154.
24. Kuzmina VV. Influence of age on digestive enzyme activity in some freshwater teleosts. Aquaculture. 1996; 148:25-37.
25. Kuzmina VV. Season and age change of o-amylase activity in bream. Voprosy Icthyologii. 1980; 20:128-133.
26. Cousin JCB, Baudin-Laurencin F, Gabaudan J. Ontogeny of enzymatic activities in fed and fasting turbot, *Scophthalmus maximus* L. Journal of Fish Biology. 1987; 30:15-33.
27. Stroganov NS, Buzinova NS. Seasonal and age changes of digestive enzymes maintenance in grass carp and silver carp. Vesmik MGU Ser Biology. 1970; N5:11-15.
28. Sabapathy U, Teo LHA. Quantitative study of some digestive enzymes in rabbitfish, *Siganus canaliculatus* and sea bass, *Lates calcarifer*. Journal of Fish Biology. 1993; 42:595-602.
29. Hidalgo MC, Urea E, Sanz A. Comparative study of digestive enzyme in fish with different nutritional habits. Proteolytic and amylase activities. Aquaculture. 1999; 170:267-283.
30. Ojha ML, Chadha NK, Saini VP, Damroy S, Chandraprakash, Sawant PB. Effect of ethanolic extract of *Mucuna pruriens* on growth, metabolism and immunity of *Labeo rohita* (Hamilton, 1822) fingerlings. International Journal of Fauna and Biological Studies. 2014; 1(5):01-09.
31. Kumar S, Sahu NP, Pal AK, Choudhary D, Mukherjee SC. Study on digestibility and digestive enzyme activities in *Labeo rohita* (Hamilton) juveniles: effect of microbial a-amylase supplementation in non-gelatinized or gelatinized corn-based diet at two protein levels. Fish Physiology and Biochemistry. 2006; 32:209-220.