International Journal of Research Studies on Environment, Earth, and Allied Sciences (IJRSEAS)
| *Volume-3 Issue-2* | *April-2026* | *ISSN: 3066-0637* | *Website:* https://eesrd.us

Manuscript ID:
IJRSEAS-2026-030232

Quick Response Code:

Website: https://eesrd.us

DOI: 10.5281/zenodo.21292730

DOI Link:
https://doi.org/10.5281/zenodo.21292730

Volume: 3

Issue: 2

Pp. 178-181

Month: April

Year: 2026

E-ISSN: 3066-0637

Submitted: 14 Mar. 2026

Revised: 25 Mar. 2026

Accepted: 15 Apr. 2026

Published: 30 Apr. 2026

Address for correspondence:
Dr. Sayara B. Nadaf
Assistant Professor, Department of Zoology, Devchand College, Arjunnagar
Email: drsayaranadaf@gmail.com

How to cite this article:
Nadaf, S. B. (2026). Nutritional Impact of Formulated Feed on Growth of Freshwater Fishes. International Journal of Research Studies on Environment, Earth, and Allied Sciences, 3(2), 178–181. https://doi.org/10.5281/zenodo.21292730

Nutritional Impact of Formulated Feed on Growth of Freshwater Fishes

Dr. Sayara B. Nadaf
Assistant Professor, Department of Zoology, Devchand College, Arjunnagar

Abstract

Aquaculture is a dynamic industry that continues to provide consumers with a reasonably priced high-quality protein. The impact that any aquaculture system has on the environment, is today, and will continue to be in the forefront, when environmental issues are discussed in context of fish feed. A better understanding of the dietary nutrient requirements of cultured fish species and a continual search for accessible and digestible proteins to replace expensive fishmeal is need of time. This approach coupled with applying the ideal protein concept in the formulation of fish feeds can greatly ameliorate pollution arising from fish production systems and increase profitability in terms of fish protein. Fishes do not require feed ingredients or formulas, but rather the nutrients, which are part of the chemical composition of these ingredients and feed formulas. Therefore, a feed formula is meaningless if we don't understand the nutritional principles involved in formulating the feed. It is characterized by high levels of production and a diversification of species, requiring increased industrial capacity and improvements in feed. So taking into account above considerations the present work was undertaken to evaluate proximate analysis, enzymatic studies, and morphometric measurements of freshwater fish by applying standard methods.

Keywords: *Aquaculture, Freshwater fishes, Formulated feed, Ingredients*

Introduction

Aquaculture, beyond doubt, is the fast-growing food producing sector in the world. The important role of aquaculture is providing aquatic animal protein to make up for the shortfall in capture fisheries, and its socio-economic role in providing livelihood opportunities and economic security, particularly for the less developed regions of the world, is now being strongly recognized globally. The intensification of fish production made it essential to develop complete and supplemental favorable essential amino acid profile diets for use in aquaculture.

Traditionally, fishmeal is preferred as dietary protein source for many farmed fish. They are considered most viable alternatives to replace fish feed for economic fish production. However, the threat of disease has now become a primary, constrain and risk to the growth of the aquaculture sector, significantly impeding both economy and socio-economic development in regions dependent on aquaculture and fisheries.

Water is an essential requirement for fish farming, so any proper-prepared plan for aquaculture must describe the quality and quantity of water available for this purpose (Summerfelt, 2000). Water quality determines to a great extend the success or failure of a fish culture operation (Piper *et al.*, 1982). Moreover it has lately been accepted that the welfare of farmed fish merits consideration, where welfare can be considered to represent the physical and mental state of animal is relative to its environment. Fish growth depends on water quality in order to boost its production as physicochemical parameters are known to affect the biotic components of an aquatic environment in various ways (Ugwumba and Ugwumba, 1993).

Morphometriccan be used to quantify a trait of evolutionary significance, and by detecting changes in the shape, deduce something of their ontogeny function or evolutionary relationships.A major objective of morphometrics is to statistically test hypotheses about the factors that affect shape."Morphometrics", in the broader sense of the term, is also used to precisely locate certain areas of featureless organs such as the brain and is used in describing the shapes of other things. Morphometric study is a powerful tool for characterizing strains of same species which involves detection of suitable variation of shape independent of size similarly it is important for fish culturists to proper management and extension of fish production and also the assessments of probability of the fish in fresh water bodies.

Expansion of fish farming is strictly related to improvement in nutrition, fish welfare, and husbandry practices. Each of these topics represents a challenge for future development in aquaculture. Mass production of new species depends strongly on the elaboration of proper feeding protocols able to satisfy their nutritional requirements. Studies aimed at investigating the functioning of the digestive tract in different species can provide relevant tools for the optimization of the relative percentage of their dietary macronutrients; therefore, knowledge of digestive enzymes of fish has important practical implications for their nutrition.

The ability of fish to metabolize a diet depends on the availability of appropriate digestive enzymes, which mediate specific degradation pathways, as well as on both physical and chemical nature of food (Phillips,1969) The measurement of specific activities (proteases, amylase and lipases) may provide information about the whole digestive capacity and the efficiency of species reared to use feeding components (Buddington,1979).

As knowledge of the hematological indices is an important tool that can be used as an effective and sensitive index to monitor physiological and pathological changes in fishes, the goal of the present study is to determine the basic hematological profile. The determination of hematological values of fishes are carried out for variety of purposes: to establish a 'normal range' of blood parameters (Etim, *et al.*, 1999), to investigate conditions that might lead to alterations of values such as sampling methods, temperature, sex, maturity, disease condition or nutrition of the fish (Clarks *et al.*, 1979; Barham*et al.*, 1980) and to ascertain the effects of certain chemical pollutants (e.g. insecticide) and sub lethal strength of some toxicants (such as heavy metals e.g. lead) on blood values (Mathiessen, 1981; Etim*et al.*, 1999).

Materials And Methods

Experimental protocol:

The fingerlings of freshwater fish *Labeorohita* (measuring about 4 to 5 cm in length and 2 to 4 gm in weight) were obtained from the Fish Seed Rearing Centre, Rankala, Dist. Kolhapur, unit of Department of Fisheries, Government of Maharashtra, during the experimental period. They were brought to the laboratory and acclimatized in rectangular glass aquaria of 36x12"with 60 liters capacity containing aerated water for seven days.

During acclimatization adequate aeration was maintained and temperature was maintained from 28 ^{0}C to 30 ^{0}C. The fishes which survived during acclimatization were distributed randomly into five aquaria (15 in each) and labeled as per the feed combination. They were fed at the rate of 2% of total body weight. The feeding was done once in a day. The body weights and lengths were recorded at each time interval i.e.30, 45, 60, 75 and 90 days throughout the experimental period respectively.

Proximate analysis of feed: Total Moisture by oven drying (Shaw, T.M. and R.H.Eisken 1956) Crude Protein by Kjeldhal method (APHA 1980), Total ash by drying in muffle furnaceCrude fiber is determined as that fraction remaining after acid digestionCrude fat after acid extraction, Gross energy values were calculated assuming the energy value of protein, lipid and Carbohydrates respectively, (NRC, 1993).

Morphometric study:

In the laboratory twelve morphometrics characters as, Total body weight, Total length, Standard length, Forked length, Head length, Eye diameter, Length of Snout, Pelvic fin, Pectoral fin, Dorsal fin, Anal fin and Caudal fin were recorded.

Length of fishes were from each group were measured by using measuring scale in cm while weight of the fishes were taken on electronic weight balance and recorded in gm.

Results & Discussion

Table No.19: Physico-Chemical parameters of water holding experimental fishes:

Sr.No.	Physicochemical parameter	Experimental Range
1.	Temperature (^{0}C)	27 ^{0}C -28 ^{0}C
2.	pH	8.1 - 8.5
3.	Dissolved Oxygen (DO) (mg/l)	2.02 - 6.60
4.	free Carbon dioxide (mg/l)	0.04 – 0.08
5.	Hardness ($CaCO_3$/mg/l)	60-80
6.	Phosphates (mg/l)	0.024 – 0.048
7.	Nitrate (mg/l)	0.0048 – 0.0076

Physico-chemical parameters of water holding experimental fishes:

Table No. 19, represents the experimental range of Physico-chemical parameters of water holding experimental fishes, *Labeo rohita*. From the table the physical parameters of water like temperature and pH varies between 27 ^{0}C -28 ^{0}C and 8.1 - 8.5 respectively. The chemical parameters of water like dissolved oxygen in water ranges between 2.02 - 6.60 mg/l, free carbon dioxide range was in between (0.04 – 0.08mg/l) and hardness ranges from 60- 80($CaCO_3$/mg/l. Phosphate ranges in between 0.024 – 0.048 mg/l while nitrate ranges from 0.0048 – 0.0076 mg/l respectively.

Tabal No.1. Analytical results of formulated feeds:

Sr. No.	parameters	Unit	100% Conventional fish feed	100% Formulated fish feed	75% Formulated fish feed	50% Formulated Fish feed	25% Formulated fish feed
1.	Moisture	%	5.461	4.792	6.077	4.705	6.010
2.	Total ash	%	4.712	4.787	5.021	4.767	1.634
3.	Protein	%	24.495	28.718	26.960	31.64	30.653
4.	Fat	%	7.716	8.065	7.184	8.512	7.84
5.	Fiber	%	0.148	0.182	0.162	0.158	0.144
6.	Carbohydrates	%	57.464	54.465	54.596	50.218	53.719
7.	Energy	kcal/ 100g	397.28	405.317	390.88	404.04	408.048

Table No.2.: Estimated parameters of the length-weight relationships:

Sr.no.	Type of formulated feed	A	b	SD value of b	R^2
1	100% conventional feed	-1.541	2.411 NA	±0.1128	0.211
2	100% formulated feed	-2.205	3.231 PA	±0.1104	0.312
3	75% formulated feed	-1.659	2.573 NA	±0.5763	0.364
4	50% formulated feed	-4.617	3.858 PA	±0.1280	0.094
5	25% formulated feed	-1.622	2.523 NA	±0.2060	0.299

n= number of samples =5, a= intercept of regression line, b= slope of regression line, S.D = Standard Deviation, R = regression coefficient, PA= positive allometric, IS= isometric, NA= negative allometric

Table No.3: PROTEASE activity in intestine of *Labeo rohita* fed on conventional and combinations of formulated feed:
(Specific activity in mg tyrosine /gm protein /hr.)

Number of days	100% Conventional fish feed	100% Formulated Fish feed	75% Formulated fish feed	50% Formulated fish feed	25% Formulated fish feed
30	0.133±0.012	0.205±0.074*	0.177±0.036***	0.221±0.085***	0.142±0.045***
45	0. 275±0.044	0.335±0.083**	0.327±0.087***	0.392±0.127***	0.305±0.086**
60	0.409±0.140	0.486±0.137***	0.456±0.121 NS	0.522±0.141***	0.425±0.145*
75	0.437±0.131	0.553±0.181***	0.513±0.145***	0.693±0.226***	0.476±0.145***
90	0.586±0.180	0.656±0.199***	0.696±0.126*	0.723±0.146*	0.615±0.117*

(Value expressed is mean of n (n=5); ±: SD)
*P<0.05, **P< 0.01, ***P< 0.001, NS – Non Significant

Table No.4: AMYLASE activity in intestine of *Labeo rohita* fed on conventional and combinations of formulated feed:
(Specific activity in mg maltose /gm protein /hr.)

Number of days	100% Conventional fish feed	100% Formulated Fish feed	75% Formulated fish feed	50% Formulated fish feed	25% Formulated fish feed
30	0.273±0.086	0.284±0.099***	0.166±0.076***	0.135±0.075*	0.283±0.069**
45	0.505±0.041	0.444±0.064**	0.437±0.071*	0.395±0.057**	0.487±0.083*
60	0.685±0.091	0.568±0.056***	0.507±0.062*	0.486±0.059***	0.625±0.084***
75	0.884±0.048	0.824±0.055***	0.766±2.041**	0.747±0.056**	0.875±0.094***
90	1.346±0.129	0.953±0.041**	0.924±0.056***	0.905±0.056***	1.115±0.163***

(Value expressed is mean of n (n=5); ±: SD)
*P<0.05, **P< 0.01, ***P< 0.001, NS – Non Significant

Acknowledgment
The author expresses sincere gratitude to the Principal and Management of Devchand College, Arjunnagar, for providing the necessary facilities and institutional support to carry out this research work successfully.
The author is also deeply thankful to the Department of Zoology for their continuous encouragement, guidance, and valuable suggestions throughout the study.

Financial support and sponsorship
Nil.

Conflicts of interest
The authors declare that there are no conflicts of interest regarding the publication of this paper.

Bibliography

1. Abdoli A., Rasooli P., Mostafavi H. (2008): Length-weight relationships of Capoeta capoeta capoeta (Guldenstaedt, 1772) in the Gorganrud River, south Caspian Basin – J.Appl. Ichthyol. 24: 96-98.
2. Adeyeye E.I. (2000): Bio-concentration of macro and trace minerals in prawns living inLagos lagoon. Pak. J. Sci. Ind. Res. 43:367-373.
3. AOE, H. - I. MASUDA – I. ABE – T. SAITO-Y. TAJIMA (1971): Water soluble vitamin requirement of carp. VII.Some examinations of utility of the reported minimum requirements. Bull.Jap.Soc.Sci.Fish 37:124 -129.
4. Alam, A.K., E. Maugham and W.J. Matter, (1996). Growth response of indigenous and exotic carp species to different protein sources in pelleted feeds.Aqua.Res.,27(9):673- 679.
5. Alga Swami (1991): Brackish water aquaculture in India-An appraisal of present status and future prospects. Aquaculture productivity by V.R.P.Shinha and H.C. Shrivastava.
6. Ali, T. and M. Salim, (2004): Studies on the growth response and feed conversion ratio (FCR) of *Labeo rohita* fingerlings fed on rice polish, fish meal and sunflower meal. Int. J. Agri. Biol., 6(5): 914-917.
7. BARKER, S. B. AND SUMMERSON, W. H. (1941): The colorimetric determination of lactic acid in biological material. J. Biol. Chem., 138, 535-554.
8. Barlas, A., (1986): Post–harvest technology for fish. *Progressive Farm.*, 6:59–65.
9. Bassompierre, M., Kjaer, A., McLean, E. (1997): Simulating proteindigestion on trout: a rapid and inexpensive method for documentingfish meal quality and screening alternative protein sources foruse in aquafeeds. Ribarstvo 55, 137–145.
10. Boyd, C. E. and LichtlrOppler F. R. (1985): Water Quality Management in POOC1 FiSI7 Culture. Res. Dev. Ser.: 22 Auburn University Auburn Alabama.
11. Brett, J. R. (1979). Environmental factors and growth. In *Fish Physiology*, Vol. VIII (Hoar, W. S., Randall, D. J. & Brett, J. R., eds), pp. 599–675. London: Academic Press.
12. Brown, M.E. (1957): Experimental studies on growth In: M.E. Brown (Editor) The Physiology of fishes, Vol. I. Academic Press, New York, pp,361-400.fish diet –in nutrition and feeding in fish, C. B. Cowry, A.M.Mackie, and J.G. Bell, London: Academic Press, - Pp 95 – 117.
13. Cho, C.Y., Bureau, D.P., (2000): Nutrition, energetics and growth of fish: Current challenges and approches. Proceeding of the NATO Symposium on Mariculture, 12-17 September 1998, Porto, Portugal (in press).
14. Chou R-L, Su M-S, Chen H-Y. (2001): Optimal dietary protein and lipid levels for juvenile cobia (*Rachycentron canadum*). Aquaculture; 193: 81-89.
15. Clarks S, Whitemore DH Jr. and McMahon RF. (1979): Consideration of blood parameters of largemouth bass, Micropterus salmoides. Journal of Fish Biology, 14: 147 – 154.
16. Clucas, I.J. and Sutcliffe, P.J. (1981): An introduction to fish Handling and Processing. pp.86-91. Tropical Products Institute. London,
17. Ugolev AM, Kuz'mina V.V. (1994): Fish enterocyte hydrolases. Nutrition adaptations. Comp Biochem Physiol; 107A: 187-93.
18. Ugwurnba, A. O. and Ugwurnba, A. A (1993): A 'study of the ohysico-cl*micalhlff2rology and Plankton of Awba Lee in lbadan, Nigeria Fish Acodbia t orntn.1(1-4):20-428.
19. United States Agency of International Development (USAID): Jan.2006.
20. Van der Meer, M.B., J.E. Zamora and M.C. Verdegem. (1997): Effect of dietary lipid level on protein utilization and the size and proximate composition of body compartments of Colossoma macropomum (Cuvier). Aquaculture Research 28:405-417.
21. Velasquez (1991): The nutritive value of various feeds of carp.Bamidgen 9 (1):13-2
22. Vera Reader (1930): "The assay of vitamin B4" Biochem J, 24(6):1827-31.