INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 8, No. 4, p. 11-17, 2016

RESEARCH PAPER OPEN ACCESS

Effect of *Moringa oleifera* meal on the growth, body composition and nutrient digestibility of *Labeo rohita*

Hussain Mehdi[1], Noor Khan[1], Khalid Javed Iqbal[2*], Fayyaz Rasool[1], Muhammad Shafiq Chaudhry[2], Karim Johar Khan[3]

[1]*Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore, Pakistan*

[2]*Department of Life Sciences, The Islamia University of Bahawalpur, Pakistan*

[3]*Fisheries and Aquaculture Lab, Department of Animal Sciences, Quaid-i-Azam University Islamabad, Pakistan*

Key words: *Moringa oleifera*, *Labeo rohita*, Growth, Body composition, Apparent digestibility.

http://dx.doi.org/10.12692/ijb/8.4.11-17 Article published on April 23, 2016

Abstract

In the present study, various concentration of *Moringa oleifera* meal was explored as protein source on the growth, body composition and apparent digestibility on *Labeo rohita* fingerlings. The experimental fish (*Labeo rohita*) fingerlings with an average body weight of 5.7g were stocked in eight glass aquaria. Twenty two fingerlings were stocked in each aquarium. Four diets designated as treatments; T_1, T_2, T_3, and T_4 were prepared on the basis of *Moringa oleifera* inclusion level as 0%, 10%, 20% and 30% by replacing fish meal and fed to fish at 4% body weight for eight weeks. Highest weight gain (13.01±2.26g) and length increase (3.26±1.43cm) was observed in T_1. Significant difference ($P \leq 0.05$) was observed in FCR and SGR among the treatments. Better FCR (1.805±0.005) was observed in T_1 while poor (3.10±0.0) was observed in T_4. Highest SGR (2.14±0.01) was observed in T_1 while lowest (1.425±0.025) was observed in T_4. Significant ($P \leq 0.05$) difference was observed in digestibility of crude protein (CP), fat and fiber among the treatments indicated the ability of *Labeo rohita* to digest the moringa leaf meal. These results indicated that increase of *Moringa oilefera* in feed decrease the growth of fish which may be due to the negative effect of some anti-nutrients.

* **Corresponding Author:** Khalid Javed Iqbal ✉ khalidjavediqbal@gmail.com

Introduction

Fish culture is anticipated to be a fastest evolving field to fulfill nutritional especially protein requirement of humans body in some parts of the world especially Pakistan. Fishmeal being excellent nutrient profile, is a major source of animal protein generally used for all types of fishes (El-Saidy and Gaber, 2003; Siddhuraju and Becker, 2003; Wu *et al*., 2004). However, increasing fishmeal cost and competition with other livestock feed industries are the main factors that hinder the development of fish industry (Xie *et al*., 2001; FAO, 2002). The issue has been addressed and successful substitutes of fishmeal has been explored (partially if not completely) with more success rate in herbivorous fishes (Shiau *et al*., 1987; El-Saidy and Gaber, 1997; Wilson *et al*., 2004). Moreover, the aquaculture nutritionists are in a continuous search to reduce the use of fishmeal and look for more cost effective substitutes (Craig, 2004).

Nowadays, plant sources have been used to replace the protein in fishmeal, soybean meal and many other plants either partially or totally. *Moringa olifera* is commonly known as "The Miracle Tree," "Horseradish-tree," or "Ben oil tree"). It is the well-known widely distributed species of Moringaceae family and having an impressive range of medicinal uses with high nutritional value all over the world (Luqman *et al*, 2012). Moringa leaf has been widely studied as an alternative protein source in fish diet and seems to be a promising protein source. Moringa leaf can partially replace conventional diets without any depression in growth performance of Nile tilapia (*Oreochromis niloticus* L.) (Richter *et al*., 2003, Afuang *et al*., 2003). Several previous studies demonstrate that plant protein (*Moringa oleifera* leaf meal and Sesbania aculeate seed meal) could partially replace fishmeal in the diet of tilapia, *Oreochromis niloticus* and common carp, *Cyprinus carpio* (Hossain *et al*., 2001, Richter *et al*., 2003, Dongmeza *et al*., 2006).

The purpose of this study is to observed effect of different inclusion level of *Moringa oleifera* meal on the growth, body composition and apparent digestibility on *Labeo rohita* fingerlings.

Materials and methods

Site and Experimental Animals

Fish *Labeo rohita* fingerlings with average body weight (ABW) of 5.72 g were used as experimental animal. Fish was collected from the nursery ponds of the University of Veterinary and Animal Science, Ravi Campus, Pattoki, Punjab, Pakistan and trial was conducted in glass aquarium inside fish hatchery building.

Aquaria and fingerling stocking

A total number of eight fiber glass aquaria were used and each treatment replicated twice. Twenty two (22) fishes were stocked in each aquarium.Water in the aquaria was exchanged after every three days throughout the experiment.

Processing of Moringa oleifera meal and diet preparation

Moringa oliefera leave, stem and flowers were taken from a small town named Choti Zareen, District Dera Ghazi Khan, Punjab province and were dried under sun directly. They were dried separately and grinded to make paste (powder).

Four types of diets were prepared; control (0%), *Moringa oliefera* 10%, *Moringa oliefera* 20% and *Moringa oliefera* 30%. In control *Moringa oliefera* meal was not mixed and remaining three diets were prepared by the mixing of *Moringa oliefera* 10%, 20% and 30%, respectively. In all four diets different types of ingredients were mixed to prepared perfect diet. Their inclusion level (IL) is given in table 1.

To determine the digestibility 1% chromic oxide was added in feed and ingredients were mixed properly to make pellets with the addition of water then put into the pellet machine. These pellets were dried under sunlight, sacked and stored properly until used.

Feeding rate

Fish were fed at 4% of their body weight. The total diet of 4% was divided into 3 parts and offered three

time of a day; 9:00 a.m., 12:00 noon and 3:00 p.m., respectively.

Measurements of fish growth

The fish in each aquarium were weighed after every week in order to check their growth (weight and length) performance. An electronic digital balance was used to measure weights of fish every week. The fish were weighed one by one and then returned into their respective aquarium. No feed was offered during weighing days. At the end specific growth rate (SGR), feed conversion ratio (FCR) values were calculated.

Proximate analysis

The diets used for fish feed were analyzed for dry matter (DM), crude protein (CP), crude fiber (CF), Ash, fat and P according to AOAC (2006).

Digestibility

Fecal matter was collected on daily basis in the entire aquarium by siphoning methods early in the morning at 8:30 a.m. before feed was applied. Fecal matter was put in Petri dishes and then stored in refrigerator at 4℃. After the termination of research trial fecal matter were finely grounded and weighed to check the digestibility of *Moringa oleifera* meal following the Furukawa and Tsukahara (1966).

Statistical analysis

The obtained data was analyzed through statistical software SAS (version 9.1) and Analysis of Variance (ANOVA) was applied to compare the effects of feeds on fish growth and digestibility.

Results and discussion

During present study maximum weight gain (13.01±2.26g) and length increase (3.26±1.43cm) was observed in T_1. Significant ($P \leq 0.05$) difference was observed in FCR and SGR among the treatments. Better FCR (1.805±0.005) was observed in T_1 while poor (3.10±0.0) in T_4. Highest SGR value (2.14±0.01) was observed in treatment T_1 while lowest (1.425±0.025) in T_4 (Table 2). These results indicated that increase of *Moringa oilefera* in feed decrease the growth of fish which may be due to the negative effect of some anti-nutrients. Our study supported by Samkelisiwe and Ngonidzashe (2014).

Table 1. Inclusion level of different feed ingredients.

Ingredients	Control	*M. oleifera* 10%	*M. Oleifera* 20%	*M. Oleifera* 30%
Rice polish	50	43	36	29
M. oleifera meal	0	10	20	30
Fish meal	30	28	26	24
Sunflower meal	14	13	12	11
Sunflower oil	3	3	3	3
Mineral mix	1	1	1	1
Vitamin mix	1	1	1	1
Chromic oxide	1	1	1	1
Total	100	100	100	100

They found that growth of *Clarias gariepinus* dcrease when fishmeal was replaced with *Moringa oilefera*. Similarly, the findings of Richter *et al.* (2003) also revealed that persistent increase in the substitution levels of fish meal with *M. oleifera* meal in the diets could retard fish growth. According to Eusebio *et al.* (2004) the presence of anti-nutrients may hinder the digestibility and utilization of dietary nutrients. Further, Espe *et al.* (2006) and Olsvik *et al.* (2011) stated that plant based feed may reduce the fish growth due to reduction in feed intake.

Richter *et al.* (2003) and Ozovehe (2013) suggested that, moringa leaf meal can be used to substitute up to 10% of dietary protein in Nile tilapia and *Clarias gariepinus* without significant reduction in growth. Richter *et al.* (2003) agree the present study and recommended 30% substitution of moringa leaf for fishmeal for Nile tilapia.

Table 2. Weight gain, length increase, FCR and SGR% of *Labeo rohita* under different treatments of *Moringa oleifera* supplemented diets.

Treatment	Weight Gain (g)	Length Increase (cm)	FCR	SGR%
T_1	13.01±2.26[a]	3.26±1.43[a]	1.805±0.005[c]	2.14±0.01[a]
T_2	10.03±2.12[a]	2.53±0.42[a]	2.27±0.010[b]	2.005±0.005[b]
T_3	11.05±1.41[a]	2.77±0.16[a]	2.245±0.005[b]	1.915±0.015[c]
T_4	8.01±2.12[a]	2.02±0.08[a]	3.10±0.0[a]	1.425±0.025[d]

Mean with same letters are non -significant.

Digestibility

During present study statistical analysis showed significant ($P \leq 0.05$) difference in digestibility of crude protein (CP), fat and fiber among the treatments indicated the ability of *Labeo rohita* to digest the moringa leaf (Table 3). Samkelisiwe and Ngonidzashe (2014) stated that protein efficiency and digestibility decreased when fishmeal replaced with kikuyu meal and moringa meal base diets in O*reochromis niloticus*. Further they also compared kikuyu meal (KM) and moringa meal (MM) and reported maximum protein efficiency ratio and protein digestibility in kikuyu meal based diets which indicate that KM is digested and utilized better than Moringa meal. Yuangsoi and Masumoto (2012) tested moringa leaf to replace soybean for fancy carp and suggested that upto 20g kg-1 soybean protein can be replaced without negative effect on digestibility.

Table 3. Apparent Nutrients Digestibilityof *Labeo rohita* fingerlings using various levels of *Moringa oleifera* supplemented diets.

Treatment	CP	Fat	Fiber
T_1	38.66±0.01[b]	16.835±0.045[c]	29.21±0.01[c]
T_2	43.64±0.37[a]	13.045±0.055[d]	34.36±0.04[b]
T_3	12.36±0.02[d]	44.16±0.15[b]	48.255±0.265[a]
T_4	27.455±0.035[c]	98.78±0.24[a]	26.955±0.145[d]

Similar mean in Colum showed non-significant; Mean values ± Standard Error (SE).

Proximate analysis

During present study significant higher amount of moisture content (10.12), crude protein (63.98 %), fiber (1.17 %) and phosphorus (1.17 %) was observed in T_4 while fat (10.02%) in T_3, ash (16.89 %) in T_1. Whereas, lowest values of moisture content (10.12) in T_2, crude protein (53.93%) in T_3, fat (7.66 %) in T_4 and fiber contents (0.41 %) and phosphorus (0.41 %) in T_1, ash (15.19 %) in T_2 were observed during current study (Fig 1).

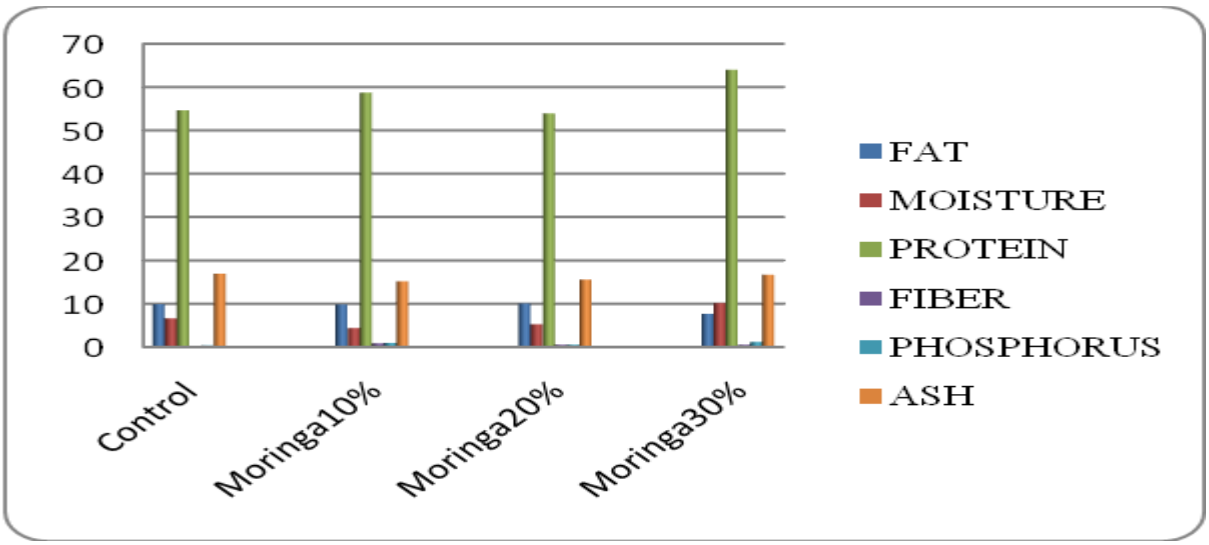

Fig. 1. Proximate analysis of fish (Post experiment).

Ganzon-Naret (2014) studied different inclusion level of moringa leaf meal as plant protein source and observed significant difference in crude protein and crude ash of sea bass among the treatment. Our study supported by Madalla *et al.* (2013) who observed higher body moisture content of fish when fed high levels of moringa leaf meal (MLM). Hossain (1988) also reported similar results for carp fed diets containing higher amounts of plant proteins. In present study it was observed that up to 20% inclusion of moringa fat increases growth and decrease with increasing concentration. According to the Madalla *et al.* (2013) lipid content probably decreased due to poor feed intake which resulted in starvation and in turn led to mobilization of body lipid reserves to meet energy requirements for vital body functions. Ganzon-Naret (2014) and Glencross (2003) observed increasing trend of crude fat or lipid after addition of moringa in fish feed to replace fish meal protein and canola meal in red sea bream diets.

Conclusion

It has been concluded that for better growth performance of *Labeo rohita* 10% inclusion of *Moringa oilefera* in artificial feed is appropriate beyond which it can decrease the growth of fish that might be due to the negative effect of anti-nutrients and needs to be explored in future studies.

References

Afuang W, Siddhuraju P, Becker K. 2003. Comparative nutritional evaluation of raw, methanol extracted residues and methanol extracts of moringa (*Moringa oleifera Lam.*) leaves on growth performance and feed utilization in Nile tilapia (*Oreochromis niloticus* L.). Aquaculture Research **34,** 1147-1159.

Craig SR. 2004. Organic agricultural feed. Aqua Feeds: Formulation and beyond **1,** 11-13.

Dongmeza E, Siddhuraju P, Francis G, Becker K. 2006. Effects of dehydrated methanol extracts of moringa (*Moringa oleifera Lam.*) leaves and three of its fractions on growth performance and feed nutrient assimilation in Nile tilapia (*Oreochromis niloticus* (L.). Aquaculture **261,** 133-148.

El-saidy DMS, Gaber MMA. 1997. Total replacement of fish meal by soybean meal, with various percentages of supplemental L-methionine, in diets for Nile tilapia, *Oreochromis niloticus* fry. Annals Of Agricultural Science, Moshtohor **35,** 1223-1238.

El-saidy DMS, Gaber MMA. 2003. Replacement of fish meal with a mixture of different plant protein sources in juvenile Nile tilapia (*Oreochromis niloticus (L.*) diets. Aquaculture Research **34,** 1119-1127.

Espe M, Lemme A, Petri A, El-Mowafi A. 2006. Can Atlantic salmon (*Salmo salar*) grow on diets devoid of fish meal? Aquaculture **255,** 255-262.

Eusebio PS, Coloso RM, Mamauag EP. 2004. Apparent digestibility of selected ingredients in diets for juvenile grouper, *Epinephelus coides* (Hamilton). Aquaculture Research **35,** 1261-1269. http://dx.doi.org/10.1111/j. 1365-2109.2004.01148.x;

FAO.
2002. The state of world fisheries and aquaculture. Food and Agriculture Organization, Fisheries Department, Rome, 159 P.

Furukawa H, Tsukahara H. 1966. On the acid digestion method for the determination of chromic oxide as an index substance in the study of digestibility of fish fed. Bulletin of the Japanese Society of Scientific Fisheries **32,** 502-508.

Ganzon-Naret ES. 2014. Utilization of *Moringa oleifera* leaf meals as plant protein sources at different inclusion levels in fish meal based diets fed to *Lates calcarifer*. ABAH Bioflux **6**, 158-166.

Glencross BD. 2003. Pilot assessment of the potential for canola meal and oil use in aquaculture feeds, final report for the grains research and

development corporation no. 5. Department of Fisheries, Western Australia.
http://dx.doi.org/10.1.1.231.3860

Hossain MA, Focken U, Becker K. 2001. Effect of soaking and soaking followed by autoclaving of Sesbania seeds on growth and feed utilisation in common carp, *Cyprinus carpio* L. Aquaculture **203**, 133–148.

Hossain MA, Focken U, Becker K. 2001. Effect of soaking and soaking followed by autoclaving of Sesbania seeds on growth and feed utilisation in common carp, *Cyprinus carpio* L. Aquaculture 203, 133–148.

Hossain MA. 1988. Nutritional evaluation of some Bangladeshi oilseed by-products as dietary protein sources for common carp (*Cyprinus carpio L*). Ph.D. Thesis. University of Stirling, United Kingdom.

Hossain MA. 1988. Nutritional evaluation of some Bangladeshi oilseed by-products as dietary protein sources for common carp (*Cyprinus carpio L*). Ph.D. Thesis. University of Stirling, United Kingdom.

Luqman S, Srivastava S, Kumar R, Maurya AK, Chanda D. 2012. Experimental of *Moringa Oleifera* Leaf And Fruit for Its Antistress, Antioxidant and Scavenging Potential Using In Vitro And In Vivo Assay. Evidence-Based Complementary and Alternative Medicine.
http://dx.doi.org/10.1155/2012/519084

Madalla N, Agbo NW, Jauncey K. 2013. Evaluation of Aqueous Extracted Moringa Leaf Meal as a Evaluation of Aqueous Extracted Moringa Leaf Meal as a Protein Source for Nile Tilapia Juveniles Protein Source for Nile Tilapia Juveniles. Tanzania Journal of Agricultural Sciences **12,** 53-64.

Olsvik PA, Torstensen BE, Hemre G-I, Sanden M, Waagbø R. 2011b. Hepatic oxidative stress in Atlantic salmon (*Salmo salar* L.) transferred from a diet based on marine feed ingredients to a diet based on vegetable plant ingredients. Aquaculture Nutrition **17,** e424–e436.

Ozovehe BN, Nzeh GC. 2013. Effects of varying levels of Moringa oleiferaleaf meal diet on growth performance, hematological indices and biochemical enzymes of African catfish Clarias gariepinus(Burchell 1822). Elixir Aquaculture 57A http://dx.doi.org/14459-14466.

Richter N, Siddhruraju A, Becker K. 2003. Evaluation of nutritional quality of moringa (Moringaoleifera Lam.) leaves as alternative protein source for Tilapia (*Oreochromis niloticus L.*). Aquaculture **217,** 599-611.

Richter N, Siddhruraju A, Becker K. 2003. Evaluation of nutritional quality of moringa (Moringaoleifera Lam.) leaves as alternative protein source for Tilapia (*Oreochromis niloticus L.*). Aquaculture **217,** 599-611.

Samkelisiwe HN, Ngonidzashe MAG. 2014. Replacing Fishmeal with Kikuyu Grass and Moringa Leaves: Effects on Growth, Protein Digestibility, Histological and Haematological Parameters in *Clarias gariepinus*. Turkish Journal of Fisheries and Aquatic Sciences **14**, 795-806.

Samkelisiwe HN, Ngonidzashe MAG. 2014. Replacing Fishmeal with Kikuyu Grass and Moringa Leaves: Effects on Growth, Protein Digestibility, Histological and Haematological Parameters in *Clarias gariepinus*. Turkish Journal of Fisheries and Aquatic Sciences **14**, 795-806.

Shiau SY, Chuang JL, Sun CL. 1987. Inclusion of soybean meal in tilapia (*Oreochromis niloticus x O. aureus*) diets at two protein levels. Aquaculture 65, 251-261.

Siddhuraju P, Becker K. 2003. Comparative nutritional evaluation of differentially processed mucuna seeds [*Mucuna pruriens* (L.) *D C. var. Utilis (Wall ex Wight) Baker ex Burck*] on growth

performance, feed utilization and body composition in Nile tilapia (*Oreochromis niloticus L*). Aquaculture Research **34,** 487-500.

Wilson MF, Luiz EP, Margarida MB, Pezzato AC, Valéria RB. 2004. Use of ideal protein concept for precision formulation of amino acid levels in fish meal free diets for juvenile Nile tilapia (*Oreochromis niloticus L*). Aquaculture Research **35,** 1110-1116.

Wu GS, Chung YM, Lin WY, Chen HH. 2004. Effect of substituting de-hulled or fermented soy bean meal for fishmeal in diets on growth of hybrid tilapia, *Oreochromis niloticus x O. aureus*. Journal of The Fisheries Society of Taiwan **30,** 291-297.

Xie S, Zhu X, Cui Y, Yang Y. 2001. Utilisation of several plant proteins by gibel carp (*Carassius auratus gibelio*). Journal of applied Ichthyology **17,** 70-76.

Yuangsoi B, Masumoto T. 2012. Replacing moringa leaf (*Moringa oleifera*) partially by protein replacement in soybean meal of fancy carp (*Cyprinus carpio*). Songklanakarin Journal of Science and Technology **34**, 479-485.