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RESEARCH ARTICLE

EFFECT OF WATER QUALITY AND DIFFERENT MEALS ON GROWTH OF CATLA CATLA AND LABEO ROHITA

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ABSTRACT

The human body cannot make significant required quantities of vital nutrients but fish is minimum-fat, big-protein nutrition that delivers a variety of health advantages. Several external factors including temperature, oxygen level, alkalinity and photoperiod have impact on growth rate while water is also an important parameter in fish rising. Therefore, there is need to work and evaluate impact of fish food and water quality to improve the fish growth. For this purpose, twelve glass aquaria (six with ground water and six with surface water) were considered to assess growth and food conversion ratio (FCR) of Catla Catla and Labeo Rohita and two feeds (i.e. sunflower and bone meal) were provided. The feed has been given twice a day and changed 4% on the rate of body weight of fingerlings in the ground water pond and surface water pond as well. The fingerlings get the most elevated body weight in ground water and on sunflower meal (1.43 ± 0.01 g) as compared to surface water and bone meal (1.39 ± 0.03 g). The general lengths obtained using the fish feed have gotten to be (5.78 ± 0.03cm) on sunflower meal and (5.47±0.03 cm) on the bone meal. The values of FCR had been lower (better) on sunflower meal (2.13±0.01) as compared to bone feast (2.32±0.03). In conclusion, it was observed from the results that fishes fed on sunflower meals had shown better growth with improved morphometric parameters and lower FCR values.

KEYWORDS

Growth Performance, FCR, Feed Ingredients, Hybrid Fingerlings, Water Quality, Surface Water, Ground Water.

1. INTRODUCTION

Mostly ground and surface water are the two major water sources used in fish farming. In several ways groundwater (also termed as well-water or spring water) frequently varies in quality parameters from surface water. Groundwater is generally regarded as one of the most valuable water source for fish farming because it generally consistent in quantity and quality at some particular site. It is also seems to be free of toxicity, harmful pollutants and predator or infectious aquatic organisms. The success in variety of aquaculture operations depends upon the areas of science, engineering and financial or economic matters. One key natural component is the supply of appropriate diets that are efficaciously processed and offer the favored supplements for ideal growth (De Schryver et al., 2008). Semi-intensive and intensive cultivating practices are greatly concerned in Pakistan because of which utilization of supplementary feed has risen and become favorable for the fulfillment of fish culture. To get most extreme fish production from confined water, it's vital to apply supplementary feed at the side fertilizer in feeding the fishes. Supplementary nourishing is thought to extend the carrying capacity of ways of life frameworks and can enhance the fish growth by the utilization of numerous folds (Davendra et al., 2002). It too gives the primary rate strategy of nutrients need inside the most limited conceivable time inside the lakes. Attempts have already been taken to secure the net level of supplement need like proteins, lipids, carbohydrates, vitamins and minerals for the proper growth of fishes, which are reasonable as well (Srivastava et al., 2013).

Supplemental feed is one of the most important methods to improve the production of fish. The value of artificial feeding fluctuates depending on the strength of the crops needed. Artificial feed plays a key role in semi-intensive fishing in which a higher number of fish is needed whose natural fertility of the water can sustain (Assessement, 2005). The function of additional feed in intensive fish farming could not be neglected since the entire nutritional needs of fish rely on the food. The intensive cultivation is based purely upon feed and has been supposed to be crucial to growing fish production in the coming years (Lazard et al., 2009).

Feed Conversion Ratio (FCR) is a noteworthy method for calculating artificial feed acceptance in fish culture (Abid et al., 2009). FCR's correct information on available of locally materials will provide foundation for the production of appropriate feed, although its feed preference complicates the task of preparing appropriate artificial feed for major carps (Jabeen et al., 2004). Recently, several scientists have calculated the FCR values of different fish feeding ingredients for carps under controlled circumstances. Nevertheless, there were no data on the FCR of hybrid fingerlings. Hybrids are thought to still have a faster growth rate as well as

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higher resistivity to adverse environmental conditions (Noreen et al., 2007). Catla catla or Lobeo rohita are main carps and could be raised effectively in small and large hatcheries yet are suitable for growing but is not economically adequate (Rahman et al., 2013; Summerfelt, 2000). The current research work were carried out at Fish Nutritional Laboratory, Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad-Pakistan to assess the feed conversion ratio, growth and different water source impact on Catla catla and Labeo rohita. For this purpose, two types of feeds were used and fishes were raised in different sources of water (i.e. ground and surface water).

2. Materials and Methods

2.1 Fish hatchery collection

Catla catla and Labeo rohita samples were collected from Fish Hatchery Complex Faisalabad, Government of the Punjab-Pakisatn (Figure 1). Thereafter, these fingerlings were kept in glass aquaria for two weeks for acclimatization and during this period were fed on rice powder.

Figure 1: Collection of fingerlings from Fish Hatchery Complex Faisalabad

2.2 Experimental site

Twelve glass aquaria each of 60×40×44 cm^3 in dimensions were used for experiment at Fish Nutritional Laboratory, Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad-Pakistan. Half of the experimental aquariums (i.e. six) were filled with ground water up to 25 cm while half were filled with surface water.

2.3 Water Sources and Feeding

Two types of feeds were chosen for nourish the fishes i.e. sunflower meal and bone meal. Both the feeds were dried and pounded to powder frame for the analysis of chemical properties (Table 1).

Table 1: Chemical composition of different feeds used throughout the experiment.

Feeds	Dry Matter (%)	Crude Protein (%)	Crude Fat (%)	Gross Energy (Kcal/Kg)
Sunflower meal	95.09	38.50	3.40	2032
Bone meal	91.52	30.0	4.49	1355

After acclimatization, 10 fingerlings were shifted to each aquarium and served with feeds at the rate of 4% of body weight of the fingerlings at all the point of the exploratory period of six weeks. The normal introductory outline weight of the fingerlings was 1.21 ± 0.01g.

The nourishment arranges was feed two times every day (7 am and 7 pm) in two same parcels and temperature was maintained between 22 ºC to 26ºC by utilizing air pump throughout experiment period. Dissolved Oxygen (DO), salinity, turbidity, dissolved gases, temperature, dissolved solids and pH of water in each aquarium were tested for the different sources of water. The feeding process was ended a day before, fourth week.

2.4 Feed Conversion Ratio

Two hours after each feeding, water from aquaria was evacuated to gather the unconsumed feed and dried. The weights of the unconsumed feed were recorded ended up utilized to calculate the genuine sum of feed expended by the fish culture. The fingerlings were taken from each replicate on week after week premise after dispensing with water from the aquarium. The morphometric characteristics (i.e. outline weight and common lengths etc.) of samples were recorded to assess their growth.

The mean weight of fingerlings in each aquarium was calculated to preparing session for the feeding rate for following week. The FCR for each treatment was calculated by using following equation.

$$FCR = \frac{F}{W_f - W_o}$$

Where, F is the weight of food provided to fish culture within the course of the watch period, W_o is the remain weight of fish culture at the start and W_f is the live weight of fish at the end of the study period.

2.5 Statistical Analysis

The information on outline weight, common length and feed transformation proportion were subjected to statistical analysis. Duncan's Numerous Run test was performed to compare the differences. A computerized program *"MSTATS"* was used for the factual assessment of information.

3. Results

3.1 Water Sources

After the experiment of six weeks, results revealed that that fish gain more body length and weight in groundwater as compared to the surface water this might be due to the fact that ground water has all the favorable qualities (Table 2) that can promote fish growth. The turbidity and pH of ground water were found to be low while in surface water these parameters were high (Table 3).

Table 2: Showing comparison of different parameters (Dissolved gases and solids) between groundwater and surface water.

Variable		Ground water	Surface water
Total gas pressure (ÆP)		High (N super saturation)	Low
Nitrogen (N)		High	Low
Dissolved oxygen (DO) mg/L		Low, usually <1	Variable, but >5
Carbon dioxide ($C0_2$) mg/L		High (0-50)	Variable, but >5
Hydrogen sulfide & methane		Uncommon	In anaerobic hypolimnion of stratified ponds
TDS (mg/L) (salinity)		Variable, but it can be briny (>1,500 mg/L NaCl).	Variable, usually < 400
Phosphorus		Typically much lower than surface sources.	Typically > groundwater, but higher in watershed ponds with row crops or livestock.
Ammonia (TAN)		Low (<1.0)	Variable, may be high (cattle and hog confinement, or manure from dairy farms).
Nitrates		Variable, but high in shallow wells in areas with abundant corn production	Variable, but high in watersheds with abundant corn production.
Alkalinity (measures ability to neutralize acids)[2]		Low in granitic or shale, medium to high in limestone aquifers	Variable, but higher in watersheds underlain with limestone.
Hardness	**$(Ca^{++})^3$**	Variable, but commonly medium to hard (50-250 mg/L)	Variable, soft to hard.
	$(Mg^{++})^3$		
Soluble	**Iron (Fe^{++})**	Common, quickly oxidized in air (O_2) to insoluble forms (Fe^{+++}, Mn^{+++})	Only in anaerobic hypolimnion of stratified ponds.
	Manganese (Mn^{++})		

Table 3: Temperature, Turbidity and pH of different water sources.		
Variable	**Ground water**	**Surface water**
Temperature	Varies latitudinal and by depth of well, but constant at same site.	Varies seasonally.
Turbidity (NTU)	Low (clear water)	Variable, usually medium to high from inorganic solids (clay or silt) and/or algae
pH	Low, typically < 7.0, because of high CO_2, small diurnal *variation*.	Variable (6.5-8.5) large diurnal variation, low before sunrise, highest in mid-day, increased by algae.

3.2 Morphometric Characteristics

3.2.1 Fish Weight

The body weights of fishes nourished with two different feeds (i.e. sunflower and bone) were not vary during the first week. While, after second and third week of experiment the weight of fishes that were fed on sunflower meal were found to be higher than the bone meal but statistically non-significant (Figure 2).

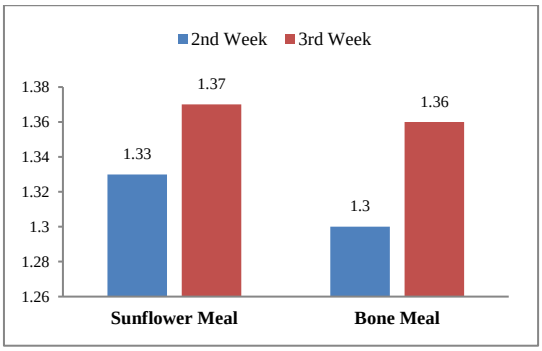

Figure 2: Variations in fish weights fed on different feeds after second and third week

All of the two check diet appeared to have distinction in term of body weight. The most elevated exceptionally final body weight of hybrids (Table 4) gotten to be on sunflower meal (1.62 ± 0.01g) as compared to bone meal (1.52 ± 0.05 g). The factual assessment uncovered that these feed components impact on body weight of fish culture, their length of six weeks changed into noteworthy (P≤0.05). At the end of 4th, 5th and 6th week sunflower meal showed the similar results by revealing higher values than bone meal (Figure 3).

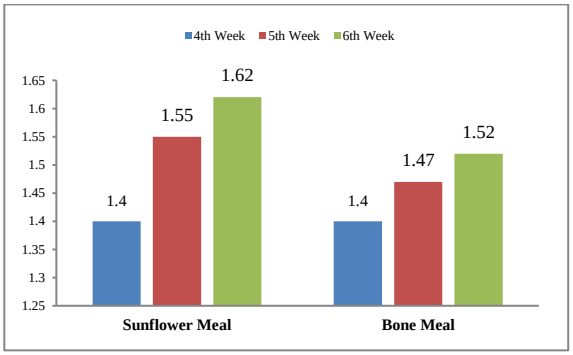

Figure 3: Changes in fish weights after fourth, fifth and sixth weeks of experiment.

Table 4: Weekly variation of mean body weight (g) of Catla catla and Labeo rohita fish fed on two different feeds.								
Weeks	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Sunflower meal	1.21±0.00^{a}	1.28±0.00^{a}	1.33±0.03^{ab}	1.37±0.00^{ab}	1.43±0.01^{b}	1.55±0.00^{a}	1.62±0.10^{a}	1.43±0.01^{a}
Bone Meal	1.21±0.00^{a}	1.26±0.00^{a}	1.30±0.00^{b}	1.36±0.15^{b}	1.40±0.00^{c}	1.47±0.00^{b}	1.52±0.05^{b}	1.39±0.03^{b}
Note: Mean values with uncommon superscripts are different significantly at P≤0.05.								

Table 5: Weekly variation of mean total length (cm) of Catla catla and Labeo rohita feed on two feeds.								
Weeks	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Sun flower meal	5.35±0.01a	5.41±0.01^{a}	5.50±0.05^{a}	5.71±0.00^{a}	5.90±0.05^{a}	6.01±0.05^{a}	6.35±0.05^{a}	5.78±0.03^{a}
Bone Meal	5.09±0.05^{a}	5.25±0.05^{a}	5.38±0.05^{b}	5.50±0.05^{b}	5.62±0.05^{b}	5.74±0.05^{a}	5.85±0.05^{b}	5.47±0.03^{b}
Note: Mean values with uncommon superscripts are different significantly at P≤0.05.								

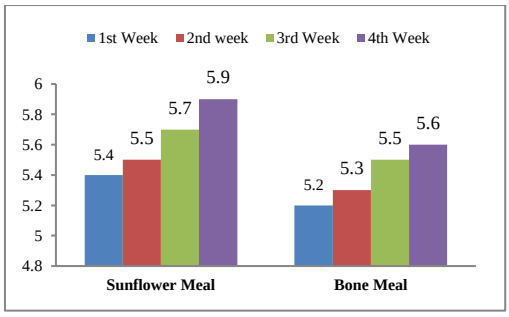

Figure 4: Body length after 1st to 4th week of experiment.

It can be seen from Table 4 that overall weight change for the two feeds was observed to be higher in sunflower feed.

3.2.2 Body length

During experiment of six weeks it was observed that within the first week body length of fish culture encouraged by sunflower meal as compared to bone meal one but statistically non-significant at p≤0.05 (Figure 4).

Amid moment, third and fourth week, the cruel common term on sunflower feast got to be broadly way better than bone meal. Within the 5th week, the way of common period on three components were none obviously particular from each other. At the end of 6th week it was observed that cruel add up to length for sunflower meal got to be broadly

exceptional from bone meal. Further results revealed that the mean length of fishes fed on sunflower meal was statistically significant and superior to bone meal (Table 5).

3.3 Feed Conversion Ratio (FCR)

Results revealed that an overall mean feed conversion ratio value was lower in sunflower meal but statistically non-significant at p≤0.05 as shown in Table 6

Table 6: Weekly variation of mean FCR values of hybrid Catla catla and Labeo rohita fed on two different feeds.

Weeks	0	1	2	3	4	5	6	Mean
Sun flower meal	2.13±0.01[a]	2.13±0.01[a]	2.13±0.01[a]	2.13±0.01[a]	2.13±0.01[a]	2.13±0.01[a]	2.13±0.01[a]	2.13±0.01[a]
Bone Meal	2.32±0.03[a]	2.32±0.03[a]	2.32±0.03[a]	2.32±0.03[a]	2.32±0.03[a]	2.32±0.03[a]	2.32±0.03[a]	2.32±0.03[a]

Note: Mean values with uncommon superscripts are different significantly at P≤0.05.

4. Discussion

Natural springs arise in which groundwater rises from an aquifer comprising a mountain layer. Since spring water has predictable but suitable temperature properties, to not include the important reality that pumping water to the raceways might not be required, springs are by far the most popular water supply for race tracks. Because of geographical features of the water table (the surface or layer of soil, gravel, or porous stone that contains water), the temperature or consistency of groundwater varies latitudinally and from location to site — old reservoirs sometimes have high levels of radioactivity, a factor rarely considered as a factor in aquacultures. In fish farming, groundwater termed to be of deficient consistency for human use (i.e., water with high levels of magnesium sulfate which has respiratory depressant for humans) might be beneficial (Summerfelt, 2000).

Low quality of the water decreases production and impacts fisheries' health. Amid pressure from poor quality of water, aquatic infections occur. Water quality control is quite critical when water is scarce, and also the key source of water for aquaculture is rainfall or any other aquifers (Boyd, 1982).

High body mass as well as maximum length on sunflower meal and bone meal were obtained by the hybrid fingerlings (Catla catla and Labeo rohita). Even for sunflower meal, the overall growth rate of fingerlings stayed maximum. On sunflower meal, the documented growth of Cirrhinus mrigala accompanied by maize gluten as well as wheat bran (Shabbir et al., 2003). It was observed that Labeo rohita acquired 2.63 ± 0.45 g weights on sunflower meal, which is greater than that of the caloric expenditure by hybrids (1.62 ±0.05). The weight gain discrepancy might be attributable to laboratory fish or feed combinations used. The handle or experimental fish has low food conversion ratio rather than other fishes (Kanwal et al., 2017). The implementation level of feed often plays a key role in the fish's development. The correct and suggested feeding distribution rate is 4% of net body weight. These 4% feeding rate is defended in many researches. It was registered that Labeo rohita has substantial growth at 4% feed (Ghosh et al., 1984; Salim et al., 1999). The development reactions of fish Labeo rohita's were researched. Catla catla and Labeo rohita's development efficiency was also examined. In a 90-day culture study, he explores the development of fishes. The relative impacts of fertilization and additional feed on the growth quality of all these species were examined with the results that the fertilization of the pond with additional food is suggested for optimum fish development (Sumaira et al., 2010).

5. Conclusions

The human body cannot make significant quantities of vital nutrients but fish is minimum-fat, big-protein nutrition that delivers a variety of health advantages. As the water is important parameter in fresh growth the water source is also considered in the experiment (ground and surface water). A range of external factors, like temperature, the concentration of oxygen, alkalinity and photoperiod, impact rate of growth throughout the water. That's why it is necessary to work on fish food and water parameter to enhance the fish growth. Based on the results of the existing ponder, it got to be concluded that ground water is more prefer in aquaculture due to high contents in it. Both the nutrients are essential and increased the body weight and length as well but, sunflower meal is more recommended meal for fingerling proper development and feeding. Food conversion ratio is also low in sunflower meal as compared to the bone meal.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Abid, M., Ahmed, M.S. 2009. Growth response of Labeo rohita fingerlings fed with different feeding regimes under intensive rearing. J. Anim. Pl. Sci, 19, 45-49.]

Ali, T., 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.

Assessment, M.E. 2005. Ecosystems and human well-being (Vol. 5). Washington, DC: Island press.

Besson, M., Aubin, J., Komen, H., Poelman, M., Quillet, E., Vandeputte, M., De Boer, I. J. M. 2016. Environmental impacts of genetic improvement of growth rate and feed conversion ratio in fish farming under rearing density and nitrogen output limitations. *Journal of cleaner production*, *116*, 100-109.

Boyd, C. E. 1982. Water quality management for pond fish culture. Elsevier Scientific Publishing Co.

Craig, S., Helfrich, L.A., Kuhn, D., Schwarz, M.H. 2017. Understanding fish nutrition, feeds, and feeding.

De Schryver, P., Crab, R., Defoirdt, T., Boon, N., Verstraete, W. 2008. The basics of bio-flocs technology: the added value for aquaculture. Aquaculture, 277(3-4), 125-137.

Devendra, C., Thomas, D. 2002. Crop–animal interactions in mixed farming systems in Asia. Agricultural Systems, 71(1-2), 27-40.

Ghosh, S. K., Mandal, B. K., Borthakur, D. N. 1984. Effect of feeding rates on the production of common carp and water quality in the paddycum fish culture. Aquaculture, 40(2): 97-101.

Gull, Y., Salim, M., Shahzad, K., Noreen, U. 2005. Study on the growth performance and feed conversion ratio of Labeo rohita fed on soybean meal, blood meal and corn gluten 60%. Indus J. Biol. Sci., 2(4): 556-562.

Jabeen, S., Salim, M., Akhtar, P. 2004. Feed conversion ratio of major carp Cirrhinus mrigala fingerlings fed on cotton seed meal, fish meal and barley. Pakistan Veterinary Journal, 24(1), 42-45.

Jabeen, S., Salim, M., Akhtar, P. 2004. Study on feed conversion ratio of major carp Cirrhinus mrigala fingerlings fed on cotton seed meal, fish meal and barley. Pakistan Vet. J., 24(1): 42-46.

Javed, M. 2006. Studies on Growth Responses of Fish During Chronic. Pakistan Journal of Biological Sciences 9, 318-322.

Jhingran, V.G., 1991. Fish and Fisheries of India. 3rd Ed., Hindustan Publishing Co., Delhi, India.

Kanwal, Q. 2017. Growth performance of Catla catla fish in earthen pond under metal stressed conditions. 2. 23-28.

Lazard, J., Dabbadie, L. 2009. Freshwater aquaculture and polyculture. Fisheries and Aquaculture-Volume IV, 55.

Nandeesha, M. C., Gangadhara, B., Manissery, J. K., Venkataraman, L. V. 2001. Growth performance of two Indian major carps, catla (Catlacatla) and rohu (Labeorohita) fed diets containing different levels of Spirulina platensis. Bioresource Technology, 80(2), 117-120.

Noreen, S., Salim, M., Zahra, M., Gul, Y. 2007. Effect of soybean meal, maize gluten 30% and feather meal on the growth performance and feed conversion ratio of hybrid (Labeo rohita x Catla catla) fingerlings. Pakistan Veterinary Journal, 27(4), 167.

Rahman, M. A., Arshad, A., Marimuthu, K., Ara, R., Amin, S. M. N. 2013. Inter-specific hybridization and its potential for aquaculture of fin fishes. Asian J. Anim. Vet. Adv, 8, 139-153.

Saeed, M., Salim, M., Noreen, U. 2005. Study of the growth performance and feed conversion ratio (FCR) of Labeo rohita fed on soybean meal, blood meal and corn gluten 60%. Pakistan Vet. J., 25(3): 121-126.

Salim, M., Sheri, A. N. 1999. Influence of protein sources, levels of protein and levels of feeding on growth of rohu (Labeo rohita) fingerlings under intensive culture system. Pakistan J. Sci. Res., 51(3-4): 85-88.

Shabbir, S., M. Salim, M. Rashid. 2003. Study on the feed conversion ratio (FCR) in major carp Cirrhinus mrigala fed on sunflower meal, wheat

bran and maize gluten 30%. Pakistan.

Srivastava, P.P., Jena, J.K., Chowdhary, S., Sharma, P., Raizada, S., Dayal, R. 2013. Performances of catla (catla catla) fingerling reared on locally available feed ingredients.

Sumaira, A., Iftikhar, A., Muhammad, S. 2010. Comparative effects of fertilization and supplementary feed on growth performance of three fish species. International Journal of Agriculture and Biology, 12(2), 276-280.

Summerfelt, R. C. 2000. Water quality considerations for aquaculture. Department of Animal Ecology, 2-7.

Tacon, A. G., Metian, M. 2008. Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: Trends and future prospects. *Aquaculture*, *285*(1-4), 146-158.