



Effect of Fish Meal and Poultry Waste Meal on Vitamin Composition of Three Indian Major Carps

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Abstract

Indian major carps such as Catla, Rohu and Mrigal are cultured in fresh water ponds of India to bridge the gap between demand and supply. The aim of this research study was to analyse the vitamin content of three major Indian carps reared by application of two different types of artificial diets such as fish meal and poultry waste meal in two fresh water perennial ponds of Gaya town (Bihar). Three Indian major carps such as Catla catla, Labeo rohita and Cirrhinus mrigala were reared by application of Fish meal during 2022-23 and by application of Poultry waste meal during 2023-24 in direction of evaluation of the impact of fish feed on vitamin content in muscles of these fish species. The amount of vitamin A, D, E and K (IU/100gm muscle) were observed by using standard equipment's and protocol mentioned in literature. The amount of vitamin D remained highest as 72.13, 31.20, 203.14 IU and 97.80, 25.14, 177.18 IU in muscles of Catla catla, Labeo rohita and Cirrhinus mrigala reared in Ram Sagar Pond and Dighi Pond respectively after feeding fish meal. As well as the amount of vitamin D remained high after feeding with Poultry waste meal as compared to poultry waste meal in muscles of all three fish species under present study. Thus, it became evident that muscle of Cirrhinus mrigala bears highest amount of vitamin D. Lowest amount of vitamin A was observed (3.91-4.68 IU) in muscle of Labeo rohita as compared to other two fish species. The vitamin E and K content varied in all three species reared in both ponds but not in significant amount. The overall result of this research work indicates that Poultry waste meal remain more suitable than fish meal for rearing of Indian Major Carps in Pond aquaculture. The results obtained during present research work will help the scientists, dieticians and policy makers in direction of value addition of produced fishes.

Key words: *Fish meal, Poultry waste meal, Vitamin composition, Indian major carps.*



INTRODCUTION

Infants require 300-400 mg vitamin A, 10µg vitamin D, 1 mg each of vitamin E and K on daily basis for proper growth. Vitamin D interacts with the cytosolic receptors and the complex moves into the nucleus and binds chromatin. The binding influences gene transcription. Vitamin D also acts like a hormone and increases intestinal absorption from gut. Adult human requires 750 microgram vitamin A on daily basis for proper health (Tacon and Melian, 2013). Roos *et al.* (2007) examined the role of fish in food-based strategies to combat vitamin A deficiency in developing countries.

Indian major carps are an important part of a healthy diet. Fish meat contains vitamins along with proteins, minerals etc. Fish meat contains vitamin A, D, E, K and B2 (riboflavin).

Rearing Indian major carps is crucial for improving human nutrition and food security of poor households of a developing country like India. Feedstuff used for rearing fresh water fishes in ponds influences the nutritional contents such as vitamins in cultured fishes. Fish consumption in diet reduces the risk of malnutrition. The vitamin concentration in different fish species varies, however they constitute a medium-to-good source of these vitamins. Balanced nutrition plays significant role in the expression of physical and mental health in human beings. Fishes remain as the nutritionally adequate food of a poor person in India (Ahmed, 2011). Indian major carps such as Catla, Rohu and Mrigala serve this purpose adequately.

Thus, the vitamin content in muscle of their fish species were observed after rearing on fish meal and poultry waste meal in two ponds of Gaya town.

MATERIALS AND METHOD

Fingerlings of *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* were obtained from hatchery and transferred in respective Ram Sagar Pond and Dighi Pond of Gaya town in the month of July. Poultry waste meal and fish meal were obtained from local poultry farm and fish feed seller respectively. Fish meal and poultry waste meal were applied during 2022-23 and 2023-24 respectively. The experimental diet was provided two times per day during 9.00 AM in morning and 4 PM in afternoon.

High performance Liquid chromatography (HPLC) was used for determination of vitamin content in fish muscle. Standard protocol and precautions were adopted during experimentation. The muscle of all three fish species were obtained after dissection. One year old fishes were used for this purpose.

RESULT AND DISCUSSION

Mishra (2023) stated that inland fish production in India has been carried out through ponds. A pond must be manageable for controlled fish farming. The fish can convert food in the body tissues more efficiently. The Catla, Rohu and Mrigal are fast growing fish species and highly esteemed food fish of India. The knowledge about the vitamin composition of these fish species is extremely important because these fish species are mostly consumed by people of Bihar as food. The micronutrients such as vitamins are crucial component in fishes (Tidame *et al.*, 2024).

Vitamin A remain fat soluble and heat stable. This vitamin is destroyed by oxidation. Bile acts as an agent for absorption of this vitamin. Vitamin E also remain fat soluble and remain stable to heat. Bile salts acts as agent for intestinal absorption of this vitamin. Fishes remain as important source of vitamin A and Vitamin D.



For safe and effective fish farming, information’s on the nutritional composition of fish muscle is essential. Fishes remain as most reliable food due to its nutritional qualities. The biochemical composition of different fish species reared with different types of artificial diet varies significantly. The nutritional quality such as protein, fat, carbohydrate and vitamins of fish muscle of same species also varies during different physicochemical factors and dietary materials. The suitable artificial diet must contain all the essential amino-acids, fatty acids, minerals and vitamins required by respective fish species for nutrient rich fish flesh and economic profitability (Falaye *et al.*, 2011).

Kaur *et al.*, (2018) observed during their research study that fish flesh contains vitamin A and D in desirable concentrations. Thus, it became evident that fish meat has several vitamins which plays a central and effective role in the nutritional security of Indian low-income group people. The results obtained during present research work is presented in table 1 and 2.

Table-1

Vitamin Composition of Fish Muscle fed with Fish Meal (June, 2023)

Sl.No.	Vitamin Composition (IU/100 gm muscle)	Fish Species		
		Catla catla	Labeo rohita	Cirrhinus mrigala
1.	Ram Sagar Pond			
	(a) Vitamin A	28.15+0.32	3.91+0.63	27.14+1.41
	(b) Vitamin D	72.13+3.12	31.20+1.61	203.14+2.02
	(c) Vitamin E	0.48+0.03	0.44+0.04	0.77+0.03
2.	Dighi Pond			
	(a) Vitamin A	43.12+1.12	4.62+0.15	31.18+2.12
	(b) Vitamin D	97.80+5.41	25.14+1.63	177.18+3.24
	(c) Vitamin E	0.53+0.09	0.61+0.08	0.39+0.03
	(d) Vitamin K	1.08+0.09	1.17+0.04	0.43+0.06
	+ SD, n=3			

High amount of Vitamin A, D and E was observed in muscle of fishes reared after application of fish meal in Dighi Pond as compared to Ram Sagar Pond. The Vitamin K content was observed in muscle of all three major carps reared in Ram Sagar Pond as compared to Dighi Pond. Highest amount of Vitamin D as 203.14 IU and 177.18 IU were observed in muscle of *Cirrhinus mrigala* reared in both ponds as compared to *Catla catla* and *Labeo rohita*. Highest amount of Vitamin A as 28.15 IU and 43.12 IU were observed in muscle of *Catla catla* reared in both ponds as compared to other species of Indian major carps. There is no significant difference in Vitamin E content in muscles of all three fish species reared in both ponds. Vitamin K content was observed maximum in muscle of *Catla catla* reared in Ram Sagar Pond and in muscle of *Labeo rohita* reared in Dighi Pond (Table-1).

Table-2

Vitamin Composition of Fish Muscle fed with Poultry Waste Meal (June, 2024)

Sl.No.	Vitamin Composition (IU/100 gm muscle)	Fish Species		
		Catla catla	Labeo rohita	Cirrhinus mrigala
1.	Ram Sagar Pond			
	(a) Vitamin A	30.50 \pm 0.99	4.20 \pm 0.36	25.79 \pm 2.41
	(b) Vitamin D	99.89 \pm 6.92	35.29 \pm 1.98	240.17 \pm 2.86
	(c) Vitamin E	0.45 \pm 0.06	0.49 \pm 0.03	0.88 \pm 0.02
	(d) Vitamin K	1.22 \pm 0.07	0.44 \pm 0.02	0.34 \pm 0.07
2.	Dighi Pond			
	(a) Vitamin A	37.28 \pm 0.32	4.68 \pm 0.27	28.83 \pm 3.12
	(b) Vitamin D	108.14 \pm 9.69	29.72 \pm 1.36	212.23 \pm 3.13
	(c) Vitamin E	0.51 \pm 0.02	0.56 \pm 0.05	0.78 \pm 0.05
	(d) Vitamin K	1.43 \pm 0.04	1.22 \pm 0.02	0.40 \pm 0.07
	+ SD, n=3			

Highest amount of Vitamin D was observed in muscle of *Cirrhinus mrigala* reared in both ponds as 240.17 IU and 212.83 IU fed with poultry waste meal. The Vitamin D content in muscle of all three fish species under study was observed high after feeding with poultry waste meal as compared to fish meal. Vitamin A content was observed high in muscle of *Catla catla* and *Labeo rohita* as well as low in muscle of *Cirrhinus mrigala* reared after feeding poultry waste meal as compared to fish meal (Table-2). However, Vitamin A, and D was observed higher in muscle of all three fish species reared in Dighi pond as compared to Ram Sagar Pond. Thus, it became clear that poultry waste meal remains more suitable than fish meal for all three fish species with regard to Vitamin content.

Paul *et al.*, (2016) observed higher Vitamin A and D content in muscle of *Cirrhinus mrigala* as compared to *Catla catla* and *Labeo rohita*. They do not observe any significant difference in Vitamin E content of all three Indian major carps. They observed higher Vitamin K content in *Catla catla* among all Indian major carps examined by them. They concluded their study as fish acts as a good source of fat-soluble vitamins such as Vitamin A, D, E and K. They also pointed out that Vitamin E is also required to maintain flesh quality. Ozyurt *et al.* (2009) and Ross *et al.* (2003) also examined the vitamin contents in flesh of different fish species and observed that fishes contain significant amount of Vitamin A and D.

The data presented in Table-1 and 2 indicates that Vitamin A and D content in muscle of *Cirrhinus mrigala* remained higher as compared to *Catla catla* and *Labeo rohita* during present research work. Thus, results of present research work correspond with results obtained by Paul *et al.* (2016). It also became evident that all three fish species reared in both ponds contains significant amount of Vitamin A and D. Thus, results of present study show similarity with results obtained by Ozyurt *et al.* (2009).



Three Indian major carps such as *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* are most important commercial fish species and contributes 70-75 percent of the total fresh water fish production in India. Supplementary feeding with fish meal or poultry waste meal remains as an effective strategy for enhancing the nutritional value of pond-raised fishes (Singh *et al.*, 2018). Emre *et al.* (2003) observed during their research study that poultry by product remain suitable for cultured fish species in place of fish meal. Large quantities of poultry waste remain easily available in the area of present study also. Thus, results of present study show similarity with results obtained by Emre *et al.* (2018).

The poultry waste meal also remains cheaper than fish meal. Poultry waste meal is generally acknowledged by fishermen to be the most cost effective. Daniel (2018) stated that the sustainability of aquaculture depends on many factors including cost effective feed. About 60% of the total cost of aquaculture is spent on feed. The use of poultry waste in aquaculture also contributes to recycling of waste material. Thus, integrated poultry with fish farming can be said as comprehensive model in direction of eco-sustainability. Poultry waste have inherent qualities that make waste have inherent qualities that make them suitable for fish production. The rapid expansion of aquaculture production lead also to a rapid development in the field of selection of suitable fish feed which remain more suitable and less expensive without harming the nutritional quality of fish flesh. The consumption rate of culture fishes in India have been increasing for the last several decades. To fulfill this demand, it is essential to select highly productive fish feed.

CONCLUSION

Mass scale production of Indian major carps heavily depends on the amplification of proper feed material to satisfy nutritional requirements of these cultured fish species; because natural feed is not able to meet the requirements of these fish species when raised in fishery ponds. The buy-product from poultry tends to have high amount of desired nutrients and also remain cheap and easily available as compared to fish meal. Thus, if became evident that good Number of vitamins having fishes would be realized by using poultry waste meal in place of fish meal for rearing Catla, Rohu and Mrigala in ponds of Gaya town.

The information's obtained during present research work facilitates the selection of most appropriate fish species having vitamin content in significant amount and also selection of best fish feed for this purpose. The vitamin composition can be used as an indicator to assess the nutritional status of respective fish species. Based on the results of this study, it was found that Mrigal reared on poultry waste meal showed best result as compared to other fish species under study.



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