

Effect of *Zingiber officinale* and *Tinospora cordifolia* on Freshwater Fish *Ophocephalus striatus* (Bloch 1973)

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Aquaculture also known as fish farming, is an important sector in the Indian economy and plays an essential role in the country's food security. Aquaculture is the fastest food production sector in the world due to the demand and scarcity of other sources of food production and also due to the health benefits of fish consumption the demand for fishes as a source of food widely throughout the world. The additional demand for fish consumption must be achieved only through aquaculture [1]. Aquaculture farming in India has spot tremendous growth over the last few decades, with significant offering to employment, export earnings, and rural development. As the world population increases the demand of the aquaculture industry increases [2]. Aquaculture become an important resource for humans worldwide, in addition; it is one of the cheapest sources of easily digestible animal protein.

Fishes play a vital role in food security and poverty alleviation in both rural and urban areas often referred to as "rich food for people". Fish provide essential nourishment more ever quality proteins, vitamins, and minerals [3]. Due to high protein content, low fat, and abundant amount of omega-3 fatty acid present in the fish which is an important part of the human diet. Freshwater fish food is essential for the nutrition of famed fish. Fishes require a balanced diet to grow and develop properly, lack of essential nutrients can lead to stunted growth, reduced immunity, and increased mortality. Freshwater fish food typically contains a combination of plant and animal ingredients including soybean meal, corn, wheat, vitamins, and minerals. Fish meal is considered as the major source of dietary protein and lipid supplement in the diets of carnivore fishes. Herbs are more compatible with the body because of their normal nature and having medicine homologous components together and lack of unwanted side effects, therefore they are most suitable [4]. This sustainable and successful freshwater fish culture on a scientific basis principally depends upon the use of adequate, economically valuable, and environmentally artificial food as well as the use of ayurvedic plants to improve the yield of fish culture.

Zingiber officinale is a versatile root that has been used for centuries for its medicinal and culinary properties. It is highly valued for its many health benefits, which include reducing inflammation, improving digestion, boosting the immune system, and reducing nausea [5].

Tinospora cordifolia commonly known as giloy or heart-leaved moonseed is a popular medicinal plant that has been used in Ayurveda as a medicine for centuries. *Tinospora cordifolia* has a rich source of antioxidants, including alkaloids, glycosides, and steroids which have been shown to have anti-inflammatory and immune-boosting properties [6]. In the present investigation, the effect of *Zingiber officinale* and *Tinospora cordifolia* on freshwater fish *Ophocephalus striatus* was observed.

The basal experimental diet was formulated with the commonly available ingredients. The formula and analyzed proximate composition of basal the diet is shown in (Table 1).

Table 1 Analyzed proximate composition of basal the diet

Ingredients (gm/ dry weight)	Control diet (100gm)	Experimental (100gm)
Prawns	60	60
Fish meal powder	40	35
<i>Zingiber officinale</i>	00	2.5
<i>Tinospora cordifolia</i>	00	2.5

The freshwater fishes were collected from a local fish market measuring about 7.8-11.5 cm in length and weighing ranges from 4.60-14.95gm for the experimental study. The fishes were brought to the laboratory and acclimatized for seven days by feeding them with prawns.

After acclimatization, the two groups of fishes were made:

- Group I) Control
- Group II) Experimental

During Experiment, fishes were fed with a prepared formulated diet twice a day. After 7, 14, 21, and 28 days from each group, the fishes were taken out and tissue of the liver and muscle was removed for the further investigation of total protein [7] ash content [8], and moisture [9].

Total protein

The present study (Table 2, Fig 1) showed that the total protein of muscle and liver of experimental fishes were found to increase in trend 71.87±1.85, 78.83±0.69, 79.90±0.78, 81.90±1.06 and 37.98±1.01, 39.90±1.15, 43.76±1.80,

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45.78±0.93 from 7, 14, 21, 28, days as compared with control group of fishes total protein 58.50±1.8, 62.56±2.2, 68.90±1.5,

72.76±2.6 and 34.44±1.81, 36.76±2.66, 36.79±1.62, 37.90±1.11 respectively.

Table 2 Total protein (gm/100gm) of *Ophiocephalus striatus* fed with *Zingerber officinale* and *Tinospora cordifolia*

Days	Control(gm/100gm)		Experiment (gm/100gm)	
	Muscle	Liver	Muscle	Liver
7 days	58.50 ± 1.8	34.44 ± 1.81	71.87 ± 1.85	37.98 ± 1.01
14 days	62.56 ± 2.2	36.76 ± 2.66	78.83 ± 0.69	39.90 ± 1.15
21 days	68.90 ± 1.5	36.79 ± 1.62	79.90 ± 0.78	43.76 ± 1.80
28 days	72.76 ± 2.6	37.90 ± 1.11	81.90 ± 1.06	45.78 ± 0.93

*Values are mean ± SD

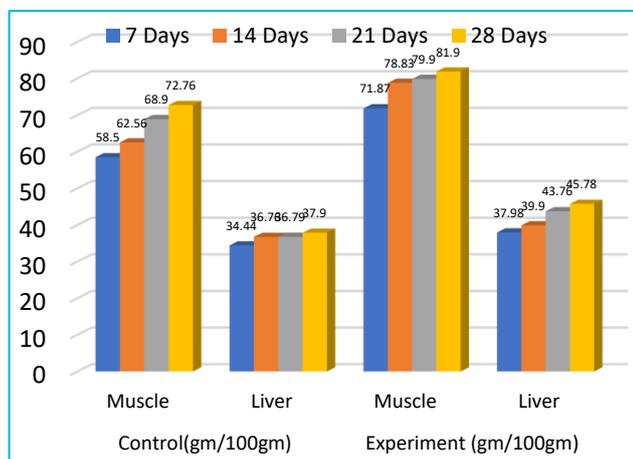


Fig 1 Total protein (gm/100gm) of *Ophiocephalus striatus* fed with *Zingerber officinale* and *Tinospora cordifolia*

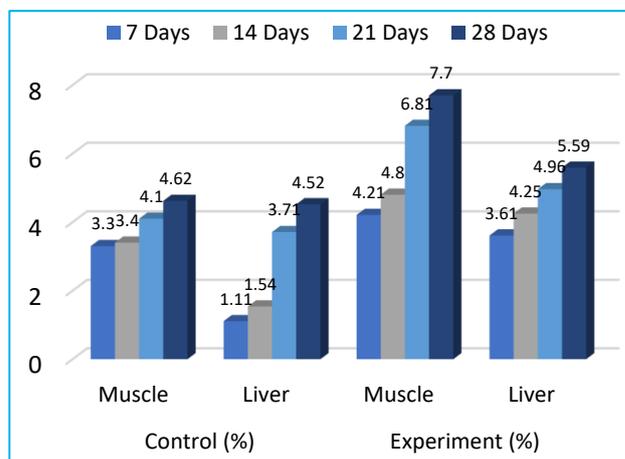


Fig 2 Ash content (%) of *Ophiocephalus striatus* fed with *Zingerber officinale* and *Tinospora cordifolia*

Ash content

The ash content (Table 3, Fig 2) showed increasing in trend in the experimental group of fishes fed with *Zingerber officinale* and *Tinospora cordifolia* in muscle tissue 4.21%, 4.80%, 6.81%, 7.70% and 3.61%, 4.25%, 4.96%, 5.59% in liver tissue as compared with control group of fishes 3.30%, 3.40%, 4.10%, 4.62% and 1.11%, 1.54%, 3.71%, 4.52% from 7, 14, 21, 28 days respectively.

Moisture content

The moisture content (Table 4, Fig 3) showed increasing in trend in the experimental group of fishes fed with *Zingerber officinale* and *Tinospora cordifolia* in muscle tissue 76.1%, 82.2%, 88.9%, 96.2% and 80.6%, 84.8%, 88.4%, 89.6% in liver tissue as compared with control group of fishes 80.6%, 84.8%, 88.4%, 89.6% and 78.1%, 79.5%, 82.41%, 88.6% from 7, 14, 21, 28 days respectively.

Table 3 Ash content (%) of *Ophiocephalus striatus* fed with *Zingerber officinale* and *Tinospora cordifolia*

Days	Control (%)		Experiment (%)	
	Muscle	Liver	Muscle	Liver
7 days	3.30	1.11	4.21	3.61
14 days	3.40	1.54	4.80	4.25
21 days	4.10	3.71	6.81	4.96
28 days	4.62	4.52	7.70	5.59

Table 4 Moisture content (%) of *Ophiocephalus striatus* fed with *Zingerber officinale* and *Tinospora cordifolia*

Days	Control (%)		Experiment (%)	
	Muscle	Liver	Muscle	Liver
7 days	76.1	88	80.6	78.1
14 days	82.2	89	84.8	79.5
21 days	88.9	92.1	88.4	82.41
28 days	96.2	94.1	89.6	88.6

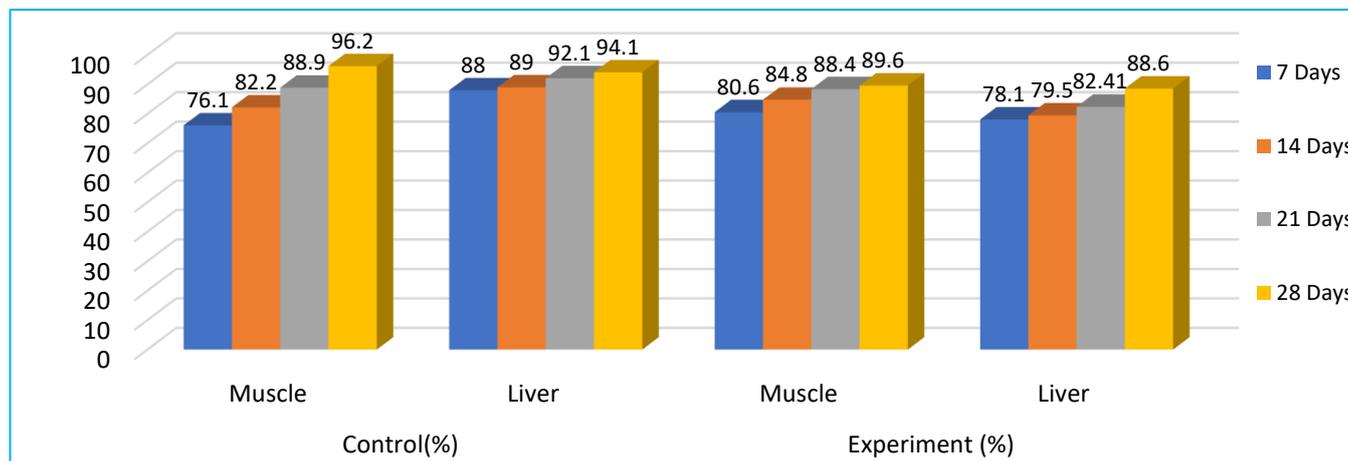


Fig 3 Moisture content (%) of *Ophiocephalus striatus* fed with *Zingerber officinale* and *Tinospora cordifolia*

The obtained results fed with *Zingiber officinale* and *Tinospora cordifolia* to freshwater fish *Ophicephalus striatus* showed major improvement in body weight as compared to control groups. Furthermore, dietary *Zingiber officinale* and *Tinospora cordifolia* enhance metabolic activities and enhance the level of protein. Moreover, the study provided a new dimension for the use of medicinal plants as supplementation to fishes. Kobeisy and Hussain [10], studied *Oreochromis niloticus* and found that dietary food was given to the fishes showed a significant increase in protein level and body weight of fish. Among three carps *Catla catla*, showed maximum average body weight (1256 g), followed by *Labeo rohita* (1215.0g) and *Cyprinus carpio* (1119.01g) in a supplemented diet. Mansour *et al.* [11] studied that ginger has been purported to have anti-inflammatory, anti-hypertensive, and glucose-sensitizing effects as well as stimulatory effects on the gastrointestinal tract by increasing gastric secretions. Also, Singh and Gaur [12], stated that weight gain is maximum when various dietary protein levels and carcass composition are given to *Labeo rohita* fingerlings. Finally, in the present investigation, it was suggested that the *Zingiber officinale* and *Tinospora*

cordifolia as feed alternative solutions in aquaculture feed as growth promoters. Distinctly it showed a significant increase in growth performance, feed utilization, and increase in metabolic activity.

SUMMARY

The study aimed to observe the effect of *Zingiber officinale* and *Tinospora cordifolia* on freshwater fish *Ophicephalus striatus*. The experimental diet was formulated to contain *Zingiber officinale* (2.5gm/100gm diet), and *Tinospora cordifolia* (2.5gm/100gm diet) prepared in the pellet form and fed to the experimental fishes to observe the total protein, ash content, and moisture of the freshwater fish *Ophicephalus striatus* for 7th, 14th, 21st, 28th days. The results showed that significant increase in total protein, ash content, and moisture of the experimental group of fishes. The results of this study show that the addition of *Zingiber officinale* and *Tinospora cordifolia* to a fish diet can promote the health benefit and growth of fish.

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