ORIGINAL RESEARCH PAPER

Zoology

BIOCHEMICAL EXAMINATION OF CESTODE PARASITE IN FRESH WATER FISH MASTACEMBELUS ARMATUS FORM JAYAKWADI DAM, PAITHAN (M.S.), INDIA

KEY WORDS:
Circumoncobothrium sp., Mastacembelus armatus, cestode parasite, biochemical composition, Jayakwadi Dam.

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ABSTRACT

The present study was undertaken to investigate the biochemical composition of the cestode parasite Circumoncobothrium sp. infecting the freshwater fish Mastacembelus armatus from Jayakwadi Dam, Paithan, Maharashtra, India. Parasites are known to induce significant physiological and metabolic alterations in their hosts by utilizing host nutrients for their growth, development, and reproduction. Therefore, the present investigation aimed to evaluate the levels of major biochemical constituents, namely proteins, glycogen, and lipids, in the parasite and in the intestinal tissues of infected and non-infected hosts. The results revealed marked variations in the biochemical composition of the parasite and host tissues. Protein and glycogen contents were comparatively lower in the parasite than in the host intestine, whereas lipid content was found to be higher in the parasite. Furthermore, the intestinal tissues of non-infected fishes exhibited higher levels of biochemical constituents than those of infected fishes, indicating depletion of nutrients due to parasitic infection. The observed biochemical changes suggest a strong metabolic dependence of Circumoncobothrium sp. on its host and demonstrate the adverse effects of parasitism on the nutritional and physiological status of Mastacembelus armatus. The study contributes to a better understanding of host–parasite interactions and the biochemical adaptations of cestode parasites in freshwater ecosystems.

INTRODUCTION

Freshwater fishes constitute an important component of aquatic ecosystems and serve as a valuable source of protein, nutrition, and livelihood for millions of people worldwide. India possesses a rich diversity of freshwater fish fauna inhabiting rivers, reservoirs, lakes, ponds, and dams, which contribute significantly to inland fisheries and the national economy. Among the freshwater fishes, *Mastacembelus armatus* (Lacepède, 1800), commonly known as the zig-zag eel or spiny eel, is widely distributed in rivers and reservoirs throughout the Indian subcontinent and is valued for its commercial as well as nutritional importance.

Fish health is greatly influenced by various biotic and abiotic factors, among which parasitic infections play a major role. Parasites are integral components of aquatic ecosystems and are known to affect the physiology, growth, reproduction, and survival of their hosts. Among the diverse groups of fish parasites, cestodes (tapeworms) are commonly encountered endoparasites inhabiting the alimentary canal of freshwater fishes. These parasites absorb nutrients directly from the host through their tegument and may cause considerable physiological stress, tissue damage, nutritional deficiencies, and metabolic disturbances in infected fishes.

The genus *Circumoncobothrium* belongs to the order Caryophyllidea and comprises intestinal cestodes commonly reported from freshwater fishes. These parasites exhibit a close host-parasite relationship and derive essential nutrients from host tissues for their growth, development, and reproduction. As a consequence, infection by cestodes often leads to alterations in the biochemical composition of the host. Biochemical studies provide valuable information regarding the nutritional status of both the parasite and the host and help in understanding the metabolic adaptations associated with parasitism.

Biochemical constituents such as proteins, glycogen, and lipids are fundamental components of living organisms and play vital roles in cellular structure, energy metabolism, growth, and reproduction. Proteins serve as structural and functional molecules, glycogen acts as a primary carbohydrate reserve, and lipids function as major sources of stored energy and membrane components. Variations in the levels of these biochemical constituents may reflect the physiological condition of the host and the metabolic requirements of the parasite. Therefore, comparative biochemical analyses of parasites and host tissues are useful in elucidating nutrient utilization patterns and the impact of parasitic infections on fish health. Although several studies have been conducted on the taxonomy, morphology, and pathology of fish cestodes, information regarding the biochemical characteristics of *Circumoncobothrium* species infecting freshwater fishes remains limited. Jayakwadi Dam, one of the largest reservoirs in Maharashtra, supports a rich diversity of freshwater fishes and provides favourable conditions for the transmission and establishment of parasitic infections. However, detailed biochemical investigations of cestode parasites and their host fishes from this region are scarce.

In view of the ecological and economic importance of *Mastacembelus armatus* and the need to understand the biochemical consequences of parasitic infections, the present study was undertaken to examine the biochemical composition of *Circumoncobothrium* sp. and to compare the levels of proteins, glycogen, and lipids in the parasite and in the intestinal tissues of infected and non-infected hosts. The findings of this study are expected to contribute to a better understanding of host-parasite interactions, nutrient dynamics, and the physiological effects of cestode infections in freshwater fishes.

MATERIAL AND METHODS

Sample collection- The cestode parasites were isolated from the intestines of the freshwater fish *Mastacembelus armatus* and thoroughly rinsed with distilled water to remove any adhering debris. Following the wash, the specimens were gently blotted on filter paper to eliminate excess moisture. The cleaned worms were then placed in a watch glass and weighed using an analytical balance for accurate measurement. Subsequently, the samples were dried in a hot air oven at a temperature range of 50-60°C for 24 hours, and their dry weight was recorded for further biochemical analysis.

Biochemical estimation- The estimation of biochemical components in the cestode parasites was carried out using standard protocols. The total protein concentration was determined following the method of Lowry et al. (1951). Glycogen estimation was performed according to the procedure described by Kemp et al. (1954), while the lipid content was analysed using the method proposed by Folch et al. (1957).

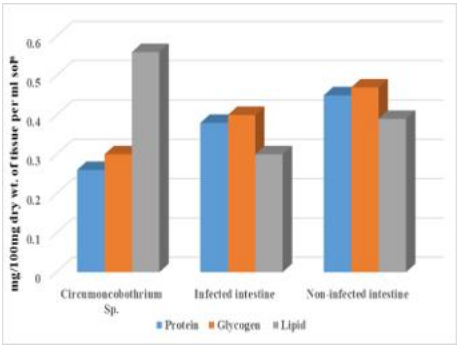
RESULT AND DISCUSSION

Table No. 1:- Biochemical estimation of *Circumoncobothrium,*

Sp. species from Fresh water fish *Mastacembalus armatus* from the Jayakwadi dam, Paithan (M.S.) India.

Name of Parameter	Circumoncobothrium Sp.	Host intestine	
		Infected	Non-infected
Protein (mg/100mg dry wt. of tissue per ml soln)	0.26 ± 0.01	0.38 ± 0.026	0.45 ± 0.017
Glycogen (mg/100mg dry wt. of tissue per ml soln)	0.30 ± 0.03	0.40 ± 0.017	0.47 ± 0.02
Lipid (mg/100mg dry wt. of tissue per ml soln)	0.56 ± 0.026	0.30 ± 0.024	0.39 ± 0.01

Graph No. 1:- Biochemical estimation of *Circumoncobothrium,* Sp. species from Fresh water fish *Mastacembalus armatus* from the Jayakwadi dam, Paithan (M.S.) India.



The biochemical composition of the cestode parasite *Circumoncobothrium* sp. and the intestinal tissues of infected and non-infected *Mastacembelus armatus* was analysed with respect to protein, glycogen, and lipid contents. The results are presented in Table and Grpah No. 1.

The protein content in *Circumoncobothrium* sp. was recorded as 0.26 ± 0.01 mg/100 mg dry weight of tissue per ml solution, which was lower than that observed in the intestinal tissues of infected (0.38 ± 0.026 mg/100 mg dry weight of tissue per ml solution) and non-infected hosts (0.45 ± 0.017 mg/100 mg dry weight of tissue per ml solution). The comparatively higher protein content in the host tissues indicates their active metabolic status, whereas the reduced protein level in the parasite may be attributed to the continuous utilization of host-derived nutrients for maintenance and reproductive activities. The decrease in protein content in infected host tissues compared with non-infected tissues suggests that parasitic infection adversely affects protein metabolism, leading to depletion of protein reserves in the host.

Glycogen content was found to be 0.30 ± 0.03 mg/100 mg dry weight of tissue per ml solution in *Circumoncobothrium* sp., while infected and non-infected host intestines exhibited values of 0.40 ± 0.017 and 0.47 ± 0.02 mg/100 mg dry weight of tissue per ml solution, respectively. The lower glycogen content in the parasite compared with host tissues may indicate rapid utilization of carbohydrate reserves to meet metabolic demands. The reduction of glycogen in infected host tissues relative to non-infected tissues suggests enhanced energy expenditure and metabolic stress caused by parasitic infestation. Glycogen serves as an important energy reserve, and its depletion reflects increased utilization of carbohydrates by both the host and parasite during infection.

In contrast, lipid content was highest in *Circumoncobothrium* sp. (0.56 ± 0.026 mg/100 mg dry weight of tissue per ml solution), followed by non-infected host intestine (0.39 ± 0.01 mg/100 mg dry weight of tissue per ml solution) and infected host intestine (0.30 ± 0.024 mg/100 mg dry weight of tissue per ml solution). The elevated lipid content in the parasite indicates its capacity for lipid accumulation and storage. Since cestodes lack a complete digestive system and absorb nutrients through their tegument, they may selectively accumulate lipids from the host tissues for energy storage and reproductive processes. The reduced lipid level in infected host tissues further supports the hypothesis that the parasite utilizes host lipid reserves, thereby affecting the nutritional condition of the fish.

The present findings demonstrate significant biochemical differences between the parasite and host tissues and reveal the influence of cestode infection on the metabolic status of *Mastacembelus armatus*. The lower concentrations of proteins and glycogen in the parasite, coupled with its higher lipid content, suggest specific metabolic adaptations that facilitate survival within the host environment. Furthermore, the consistently lower levels of all biochemical constituents in infected host tissues compared to non-infected tissues indicate nutrient depletion and physiological stress associated with parasitism. These observations support the concept that cestode parasites derive essential nutrients from their hosts, resulting in alterations in host metabolism and energy balance. Therefore, biochemical analysis serves as an important tool for understanding host–parasite interactions and assessing the impact of parasitic infections on the health and nutritional status of freshwater fishes.

CONCLUSION

The present study on the biochemical examination of the cestode parasite *Circumoncobothrium* sp. infecting the freshwater fish *Mastacembelus armatus* from Jayakwadi Dam, Paithan, Maharashtra, revealed significant variations in the levels of proteins, glycogen, and lipids between the parasite and the host tissues. The results demonstrated that the protein and glycogen contents were comparatively lower in the parasite than in the intestinal tissues of both infected and non-infected hosts, whereas lipid content was considerably higher in the parasite. Furthermore, the intestinal tissues of infected fishes showed lower concentrations of biochemical constituents than those of non-infected fishes, indicating depletion of nutrient reserves due to parasitic infection.

These findings suggest that *Circumoncobothrium* sp. depends on host-derived nutrients for its survival, growth, and metabolic activities, thereby causing alterations in the biochemical profile of the host. The reduction in protein, glycogen, and lipid contents in infected tissues reflects the physiological stress and nutritional imbalance imposed by the parasite. The higher lipid concentration observed in the parasite may represent an adaptive mechanism for energy storage and reproductive requirements. Overall, the study highlights the close metabolic relationship between the parasite and its host and emphasizes the impact of cestode infection on the nutritional status and health of *Mastacembelus armatus*. The findings contribute to a better understanding of host–parasite interactions and provide a foundation for future investigations on fish parasitology, fish health management, and the ecological significance of parasitic infections in freshwater ecosystems.

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