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Zooplankton (*Cyprinotus nudus*) Biochemical Composition: Insights into Aquatic Ecosystem Functioning

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Abstract: ***Zooplanktons are important components of aquatic ecosystems, providing a vital link between primary producers and higher trophic levels. Their biochemical composition plays a crucial role in regulating nutrient cycling, energy transfer, and carbon flux in aquatic food webs. The biochemical composition of zooplankton varies widely depending on species, life stage, and environmental conditions. In present study total lipid was found maximum (44.62 %), the average protein value was found 20.60 % and total glycogen was found 4.2 % in*** **Cyprinotus nudus.** ***The lipid content of zooplankton is highly variable, ranging from less than 5% to more than 60% of dry weight. This variability is due to differences in feeding habits, metabolic rates, and environmental conditions. In general, carnivorous zooplanktons have higher lipid content than herbivorous species. The protein content of zooplankton is also variable, ranging from 10% to over 50% of dry weight. The protein content is influenced by a variety of factors, including the age and size of the zooplankton, as well as the availability and quality of their food. Glycogen content is generally lower than protein and lipid content, ranging from less than 5% to around 20% of dry weight. In summary, the biochemical composition of zooplankton is highly variable and plays a crucial role in aquatic ecosystem functioning. Understanding the factors that influence zooplankton biochemical composition is essential for predicting and managing the effects of environmental change on aquatic ecosystems. It is concluded that the experimental species of zooplankton are boon for fishery.***

Keywords: Freshwater, zooplankton, carbohydrates, protein and lipids

1. Introduction

Zooplanktons are a diverse group of small aquatic animals that play a vital role in the functioning of aquatic ecosystems. They are important intermediaries in the transfer of energy and nutrients between primary producers and higher trophic levels, and their abundance and composition can have a significant impact on ecosystem dynamics (Nicoletta and Monica, 1999). The biochemical composition of zooplankton is a critical factor in understanding their role in aquatic ecosystems. It can influence their growth, reproduction, and survival, as well as their interactions with other organisms. The major biochemical components of zooplankton, including proteins, lipids, and carbohydrates, have different functions and can vary widely depending on species, life stage, and environmental conditions (Nimbalkar *et al.*, 2013).

In recent years, there has been growing interest in the biochemical composition of zooplankton due to the potential impacts of environmental change on aquatic ecosystems. Changes in water temperature, nutrient availability, and other environmental factors can alter the composition of zooplankton communities and affect their role in ecosystem functioning. Understanding the factors that influence zooplankton biochemical composition is essential for predicting and managing the effects of environmental change on aquatic ecosystems. (Lubzens, 1987; Dhert, 1996).

Therefore, this topic is of great importance to ecologists, environmental managers, and policy - makers alike. In this paper, we will review the current knowledge of the biochemical composition of zooplankton, including the major biochemical components and the factors that influence their variation. We will also discuss the implications of this knowledge for understanding and managing aquatic ecosystems in the face of environmental change.

2. Material and Methods

Biochemical analysis:
The samples of *Cyprinotus nudus were* collected from laboratory monoculture circular glass tank with the help of plankton net (60 µm mesh size) as well as dropper in 25 ml beaker. The collected samples were washed with distilled water. The partially wet sample was kept on filter paper for surface drying. After the weight of sample is measured it was transferred into glass petridish and kept into oven at 70^{0c} for drying. The dried sample was used for estimation of protein, lipid and carbohydrate. Water content was determined by determining difference between initial wet weight and final dry weight.

Estimation of lipid (Lehtonen 1996):
The analysis was performed following the method described by Lehtonen (1996). Approximately 15 mg of dried material was weighed and homogenized in 0.5 ml of chloroform: methanol (2: 1) solution, and then centrifuged for 30 minutes. The precipitate was washed with 0.5 ml chloroform: methanol (2: 1) and centrifuged again for 30 seconds. Twenty per cent volumes (0.02 ml) of 0.9 % NaCl solution were added to the chloroform: methanol (2: 1) solution for both washes, and centrifuged. The chloroform phase containing the dissolved lipids was placed into tarred cups, and the solvent evaporated. The cups were then

weighed, and the weight of the lipids calculated from triplicate sub samples.

Estimation of total proteins (Lowry *et al.*1951):
Oven dried material was homogenized in the proportion of 0.5 mg to 3 ml of pure water (Micropur) into 10 ml test tubes. The water - soluble protein content was analysed (n = 5 - 6 sub samples) using the method described by Lowry *et al*. (1951), as modified by Fernandes *et al*. (1994).0.1ml of the aliquot was transferred into a test tube and 4 ml of alkaline copper sulphate reagent was added, followed by 0.4 ml of diluted commercial Folins reagent. The optical density of the blue colour developed was read at 540 µm after 30 minutes of addition of the Folins reagent using UV - VIS spectrophotometer (Model Digispec 200 GL). Bovine serum albumin was used as a standard. The protein content was expressed as mg/100 mg wet weight of the tissue. Live feed Culture, nutritional potential and biochemical composition.

Estimation of glycogen (DeZwaan and Zandee 1972):
Samples were separated for analysis, following essentially the same procedure as for proteins. The homogenates were analyzed (n = 4 - 5 sub samples) with the method of DeZwaan and Zandee (1972). The homogenate mixture was kept in boiling water bath for 3 to 5 minute to dissolve the tissue and then cooled. Before centrifugation 2 ml of 96% ethyl alcohol was added and the mixture was kept overnight in refrigerator. Next day this mixture was centrifuged at 3000 rpm for 15 minutes. The glycogen cake settled down on the bottom was collected and 2 ml of distilled water was added to the cake and mixed well. This mixture was kept at 700C for 5 minutes in a hot water bath.0.1 ml of the aliquot was mixed with 0.9 ml of distilled water and 5 ml of anthrone reagent was added. This mixture was kept in hot water bath for 10 minutes. The optical density was read at 610 µm against blank using UV - VIS spectrophotometer. Glycogen content is expressed in terms of mg glucose / 100 mg wet weight of tissue (Glycogen conversion is factor 0.927).

Statistical analysis:
The results of biochemical analysis were expressed as mean of three replicates and data were analyzed statistically by using student 't' test (Mungikar, 2003).

3. Results

In present study total lipid was found maximum (44.62 %), the average protein value was found 20.60 % and total glycogen was found 4.2 % in *Cyprinotus nudus.*

Table: Biochemical composition of zooplankton (*Cyprinotus nudus*)

Zooplankton	Protein	Lipid	Glycogen
Daphnia galeata	20.60	44.62	4.2

4. Discussion

Research on the biochemical composition of zooplankton has revealed important insights into the functioning of aquatic ecosystems. One of the key findings is the variability of zooplankton biochemical composition across species and environmental conditions. This variability is due to differences in feeding habits, metabolic rates, and nutrient availability.

Proteins are a major component of zooplankton biomass and are essential for growth, development, and reproduction. The protein content of zooplankton can vary widely, from less than 10% to over 50% of dry weight, depending on the species and life stage. Studies have shown that the quality and quantity of food available to zooplankton can have a significant impact on their protein content. For example, zooplankton that feed on high - quality algae tends to have higher protein content than those that feed on lower - quality algae.

Lipids are another important component of zooplankton biomass, providing a critical source of energy and essential fatty acids. The lipid content of zooplankton can also vary widely, ranging from less than 5% to more than 60% of dry weight. This variability is influenced by factors such as feeding habits, metabolic rates, and temperature. For example, warm - water zooplankton tends to have higher lipid content than cold - water species, likely due to the higher metabolic demands of warm - water environments.

Carbohydrates are the least abundant of the major biochemical components in zooplankton, but they still play an important role in energy metabolism and structural support. The carbohydrate content of zooplankton can vary from less than 5% to around 20% of dry weight, with herbivorous species generally having higher carbohydrate content than carnivorous ones. Earlier Watanabe *et al. (*1983) reported 23.1 % lipid in *Branchionus plicatilis. Moina macracopa* contained 8.94 % total lipid. Earlier Krishnakumari *et al. (*1993) recorded 45.65 % lipid in another ostracod *Xestoleberis nitida*. Higher values of lipid in different zooplankton species have been reported earlier by many workers (Maruthanayagam and Subramanian, 1999; Goswami *et al.*, 2000; Prabhu *et. al.,* 2005; Rajkumar *et al.,* 2008). Higher protein contents in copepods *Acartia spinicuda* and *Acartia similis* from costal water of Parangipettai have been reported by Rajkumar *et al., (*2008) and Rajkumar and Santhanad (2009). The protein may function as metabolic reserve in zooplankton. Guisande *et al., (*2000) made Comparison between the amino acid composition of females, eggs and food to determine the relative importance of food quantity and food quality on copepod reproduction.

Recent research has also investigated the impact of environmental change on the biochemical composition of zooplankton. For example, studies have shown that increases in water temperature can lead to changes in zooplankton lipid content, with warm - water species having higher lipid content than cold - water species. Changes in nutrient availability can also impact zooplankton biochemical composition, with some studies suggesting that nutrient enrichment can lead to higher protein content in zooplankton.

In conclusion, the biochemical composition of zooplankton is a critical factor in understanding the functioning of aquatic ecosystems. The major biochemical components of zooplankton, including proteins, lipids, and carbohydrates,

have different functions and can vary widely depending on species, life stage, and environmental conditions.

Research on zooplankton biochemical composition has revealed important insights into the factors that influence their growth, reproduction, and survival, as well as their interactions with other organisms. Variability in zooplankton biochemical composition is due to differences in feeding habits, metabolic rates, and nutrient availability. Environmental factors such as changes in water temperature and nutrient availability can also have significant impacts on zooplankton biochemical composition.

The implications of this research are important for predicting and managing the impacts of environmental change on aquatic ecosystems. Understanding the factors that influence zooplankton biochemical composition is essential for predicting and managing the effects of environmental change on aquatic ecosystems. This knowledge can inform the development of effective management strategies for maintaining the health and resilience of aquatic ecosystems.

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