ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 06 | June - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARISON OF PROTEIN, LIPID AND CARBOHYDRATE CONTENT BETWEEN THE MARINE AND FRESH WATER FISHES AVAILABLE IN THE LOCAL MARKET OF BALASORE, ODISHA, INDIA

Zoology

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ABSTRACT

The fishes were collected prior to the experiment and study was aimed to analyze the nutritional profiles (protein, lipid and carbohydrate content) of eight commercially available freshwater fish species and the marine water fish species. Among the fresh water fish species: *Cirrhinus mrigala* (mrigal carp), *Channa striata* (striped snakehead), *Labeo bata* (bata labeo) and *Mystus gulio* (Indian mystus) and four fresh marine fish species: *Pennahia argentata*, *Escualosa thoracata*, *Coilia dussumieri*, and *Tenualosa toil* were collected from the local fish market of Remuna, Balasore. Additionally, to compare the effects on cold shock on the nutritional content of these selected fish species at specific interval of time for 7, 14, and 21 days respectively at a temperature of -23 °C and estimated the biochemical composition especially protein, lipid and carbohydrate. The entire process was repeated several times. The entire storage time showed a considerable drop in the amounts of protein, lipid and carbohydrate. The protein, lipid and carbohydrate contents of the eight fresh water and marine fish species dropped as the freezing time increased. The protein and lipid content were dropped to 1-2 percent in the third weeks as the freezing time increased. Additionally, the carbohydrate contents after three weeks of freezing condition, also decreased to 0.5- 1 percent. The study of these fishes revealed that the fresh water fishes are better than the marine, nutritionally. But marine fishes are preferable rather than the fresh water fishes when they are preserved in cold.

KEYWORDS

Protein, lipid, carbohydrate, marine and fresh water fishes

INTRODUCTION

Fish is an important nutrient for maintaining a healthy body and one of the most important animal protein sources which contain 16% of entire animal protein consumed by the people of the world (Ondo-Azi etal., 2013). Fish proteins contain enough amounts of necessary amino acids which have a great biological significance (Moujahed, 2015). After a numerous studies it is obtained that the EPA/DHA obtained from natural marine and freshwater fishs act as a major source of diet in the human (Panchal and Brown, 2021).

Fish is rich in essential nutrients that can be utilized to enhance meals for both babies and children's. Fish, on the other hand, is mostly made up of protein, fat, ash, and water, with minor quantities of polysaccharides and non-protein substances. The protein composition of most fish is between 15 and 30% of weight, the fat level is between 0 and 25%, and the moisture content is around 50–80% of body weight (Menon etal., 2010; Hasan etal., 2015; Hossain etal., 2015; Chakma etal., 2020). As opposed to this, minerals can play a pivotal role in maintaining acid-base and water balance, formation teeth structure and bones, and accelerating metabolic reactions in the human body (Zhang etal., 2020). In addition to their nutritional and physiological impacts, minerals are important as food additives because they enhance food flavor, promote or inhibit enzyme-catalyzed and other biochemical activities, and alter food texture (Ersoy and Celik, 2010).

MATERIALS AND METHODS

Collection and preparation of the sample

Marine (4 species) as well as fresh water fishes (4 species) were collected from Remuna fish market, Balasore. Among the marine species the *Pennahia argentata*, *Escualosa thoracata*, *Coilia dussumieri*, *Tenualosa toli* and among the fresh water species the *Cirrhinus mrigala*, *Channa striata*, *Mystus gulio* and *Labeo bata* were chosen and processed for different biochemical assay in the laboratory.

METHODS

Estimation of Protein by Lowry *et al.,* (1961) lipids by Folch *et al.,* (1957) and Carbohydrate by anthrone method.

RESULTS

Protein Content:

The inferences drawn from this study demonstrate that *L. bata* showed the highest protein content with 37.14% and *Tenualosa toli* with lowest protein level that is 3.09% per 1gm of tissue weight at control (0 day). *L. bata* showed the highest protein content with 23.35% and *Tenualosa toli* with lowest protein level that is 2.56% per 1gm of tissue weight after 7 days. *L. bata* showed the highest protein content with 15.67% and *Tenualosa toli* with lowest protein level that is 1.94% per 1gm of tissue weight after 14 days. *Pennahia argentata* showed the highest protein content with 14.87% and *Tenualosa toli* with lowest protein level that is 1.47% per 1gm of tissue weight after 21 days.With that, there is gradual decrease in protein content on freezing in all these species with specific interval of day.

Lipid Content:

The inferences drawn from this study demonstrate that *Coilia dussumieri* showed the highest lipid content with 37.14% and *Channa striata* with lowest lipid level that is 0.98% per 1gm of tissue weight at control (0 day). *Coilia dussumieri* showed the highest lipid content with 3.02% and *Channa striata* with lowest lipid level that is 0.86% per 1gm of tissue weight after 7 days. *Coilia dussumieri* showed the highest lipid content with 2.47% and *Channa striata* with lowest lipid level that is 0.39% per 1gm of tissue weight after 14 days. *Coilia dussumieri* showed the highest lipid content with 2.01% and *Channa striata* with lowest lipid level that is 0.37% per 1gm of tissue weight after 21 days. With that, there is gradual decrease in lipid content on freezing in all these species with specific interval of day. Effect of freezing was non-uniform and showed deterioration among all the eight species.

Carbohydrate Content:

The inferences drawn from this study demonstrate that *Labeo bata* showed the highest carbohydrate content with 1.96% and *Pennahia argentata* with lowest carbohydrate level that is 0.89% per 1gm of tissue weight at control (0 day). *Labeo bata* showed the highest carbohydrate content with 1.68% and *Pennahia argentata* with lowest carbohydrate level that is 0.56% per 1gm of tissue weight after 7 days. *Labeo bata* showed the highest carbohydrate content with 1.22% and *Pennahia argentata* with lowest carbohydrate level that is 0.39% per 1gm of tissue weight after 14 days. *Labeo bata* showed the highest carbohydrate content with 1% and *Pennahia argentata* with lowest carbohydrate level that is 0.09% per 1gm of tissue weight after 21 days. With that, there is gradual decrease in lipid content on freezing in all these species with specific interval of day. Effect of freezing was non-uniform and showed deterioration among all the eight species. Low carbohydrate content suggesting that these species could be good for consumption as a low-carbohydrates containing diet. Also, it showed significant decreases in carbohydrates content on freezing with specific interval of days.

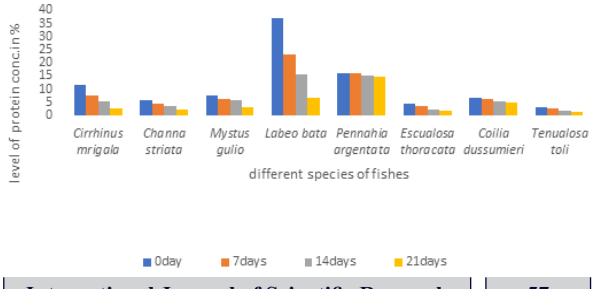

Fig 1: comparative value of protein (in mg % per 1gm of muscles tissue) of fish sample at specific day interval

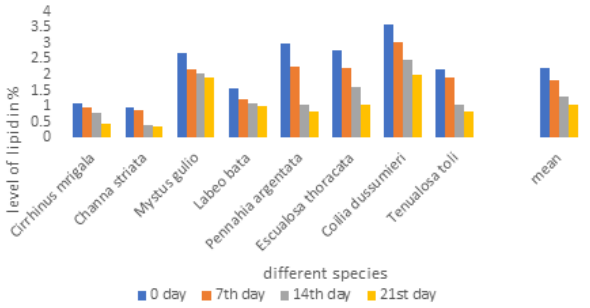

Fig 2: comparative value of lipids (in mg % per 1gm of muscles tissue) of fish sample at specific day interval

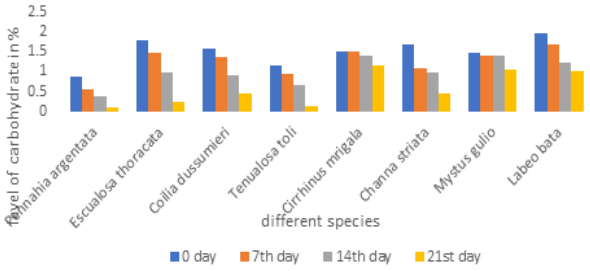

Fig 3: Comparative value of carbohydrates (in mg % per 1gm of muscles tissue) of fish sample at specific day interval

DISCUSSION

The % of proteins, carbohydrates, lipids, vitamins and minerals, present within the fish make it a nutritious food. The protein content was significantly higher in freshwater fishes than in marine (frozen) fishes which could be due to denaturation of protein in some marine (frozen) fishes as a result of freezing and variability in temperature (Careche *et al.,* 2001)

Understanding the potential benefits of fresh water and marine water fishes as food sources requires analyzing their nutritional composition. Every one of these experimental species have an own unique nutritional profile and a number of variables, including freezing, can alter their nutritional compositions. Similarly, for lipid content, some freshwater fishes often have lower lipid content, when compared to oily fish species found in marine habitats. Comparative study shown that there is noticeable differences in lipid content ranges from species to species respectively. On the other hand, the lipid content of fish can be somewhat impacted by freezing. The effect of freezing on lipid content can be reduced, however, provided the product is packaged appropriately and kept at a low temperature. Fish mostly have their energy protein and lipids, and they typically have very few carbohydrates. But there might be small quantities of carbohydrates, mostly in the form of glycogen in the muscle tissue of the fish. From the table-3, it was shown that carbohydrate content is highest in *L. bata* and lowest in *M. gulio* i.e. 1.96% and 1.46% respectively. Also, comparatively all species have quite little variations in carbohydrates content, as freshwater fish has very few carbohydrates, and freezing usually doesn't make a big difference in the quantity of carbohydrates they contain.

CONCLUSION

The results of this study showed that the nutritional value in different species of fresh water fish and marine fish that are *Pennahia argentata*, *Escualosa thoracata*, *Coilia dussumieri*, *Tenualosa toli, Labeo bata, Channa striata, Mystus gulio, and Cirrhinus mrigala* changes after freezing for specific interval (0, 7, 14, 21 days). In comparison to fresh muscle fish, the percentages of protein, fat and carbohydrates drop when fresh fish is frozen. The decline in biochemical contents of fish after freezing underscores the importance of balancing convenience with nutritional integrity although freezing extends shelf life. And this is due to ice crystal formation and enzymatic reactions. As the storage duration lengthens, there is a rise in bacterial growth, protein denaturation, lipid hydrolysis, and oxidation. Also due to denaturation, gelatin loss from extended freezing storage, and proteolysis caused by the enzymatic activities of psychotropic microbiological development, the protein concentration decreased.

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