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## Variation of biochemical composition in relation to reproductive cycle of Mud Eel (*Monopterusuchia*) under the agro climatic conditions of Meghalaya, India

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### Abstract

Seasonal changes in biochemical composition of Mud Eel (*Monopterusuchia*) were analyzed. The fish species were collected from three different areas of Meghalaya (viz; Nongpoh, Shella and Baghmara) from May 2016 to August 2017. Protein content was high during pre-breeding season with a mean value of  $855.1\mu\text{g} \pm 0.04$  and low during spent season ( $454.4\mu\text{g} \pm 0.05$ ). The carbohydrate content of this species reveals that there was no significant difference from all four seasons with a mean value of  $0.003\mu\text{g} \pm 0.001$ . The lipid content was highest during breeding season with a mean value of  $154.2\mu\text{g} \pm 0.5$ , but dropped during post-breeding ( $61.4\mu\text{g} \pm 0.5$ ) and lowest during spent season ( $51.8\mu\text{g} \pm 0.5$ ).

**Keywords:** *Monopterusuchia*, protein, carbohydrates, lipids, breeding season

### 1. Introduction

The fresh water mud eel, *Monopterusuchia*, is an air breathing fish which is nutritious as food with therapeutic value. These species are swamp dwellers belonging to the family Synbranchidae of the order Synbranchiformes. It is locally known as *Khabseiñ* in Khasi language in Meghalaya. The species is commonly available in the fresh water of Bangladesh, Pakistan, Northern and North-East India and Nepal (Jhingran and Talwar, 1991) <sup>[1]</sup>. This species thrive on small fishes, prawns, molluscs, aquatic insects, small frogs, etc (Ponniah, 2000) <sup>[2]</sup>. However, in recent years it has been noticed that the population in natural water bodies has gradually declining especially in the North-East region of India. This species is very tasty, nutritionally rich with medicinal value and it is also one of the most expensive species especially in the international market.

Nutritional quality of a food is very important and consumption of fish provides an important nutrient to a large number of people worldwide and thus makes a very significant contribution to nutrition. Biochemical assessment is necessary to ensure the nutritional value as well as palatability of the fresh fish (Azam *et al.*, 2004) <sup>[3]</sup>. Knowledge of biochemical composition of fish assists in elucidating its environmental, physiological and nutritive status (Abdullah and Lohar, 2011) <sup>[4]</sup> as well as to evaluate the impact of environment. Knowledge on biochemical composition of muscles of major carps, *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*, is of great help in evaluating not only its nutritive value but also helps in quality assessment and optimum utilization of these natural resources (Gonzales *et al.*, 2006) <sup>[5]</sup>. Biochemical composition of fish is subject to variations depending on season, feed intake, breeding and migration (Sivakami *et al.*, 1986) <sup>[6]</sup>. At any given time, biochemical composition of an individual fish is the result of complex interactions between physical and biological characteristics like size, sex, temperature, food availability and reproductive stage (Basade *et al.*, 2000) <sup>[7]</sup>. Fish is generally of high value compared to other protein foods, because of its high protein quality and palatability (Lovell, 1978) <sup>[8]</sup>. Biochemical composition of fish flesh is a good indicator for the fish quality (Hernandez *et al.*, 2001) <sup>[9]</sup>, the physiological condition of fish and habitat of fish (Shamsan and Ansari, 2010) <sup>[10]</sup>. Fishes exhibit large variations in their biochemical compositions from species to species, from fish to fish and among different body parts. Hence the knowledge of the proximate compositions of fish is of paramount importance to evaluate it in regard to nutritive value and physiological condition (Love, 1970) <sup>[11]</sup>, (Gershanovich *et al.*, 1984) <sup>[12]</sup> and (Brown and Murphy, 1991) <sup>[13]</sup>.

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Thus in the present study, analysis of seasonal variation of the biochemical composition of Mud Eel (*Monopterusuchia*) has been done under the agro-climatic condition of Meghalaya, India since this species is known for its high nutritive as well as medicinal value.

**2. Materials and Methods**

Forty (40) specimens of *Monopterusuchia* collected from three different areas of Meghalaya (viz; Nongpoh, Shella and Baghmara) from May 2016 to August 2017 for the analysis of biochemical composition. After measuring the total length and weight of the fishes, the specimens were dissected and the edible portions (such as the muscle tissues of the body) were separated from the head, skin, bone and the viscera. The muscles were carefully removed from the bones and then cut into small pieces. Homogenized tissues (10%) were prepared using an electrical homogenizer. The homogenized tissues were then used for determination of proteins, carbohydrates and lipids. The Folin- Ciocalteau Phenol Method (Lowry *et al.*, 1951) [14] was adopted for the estimation of total proteins in the tissue. In addition to this, Carbohydrate content was

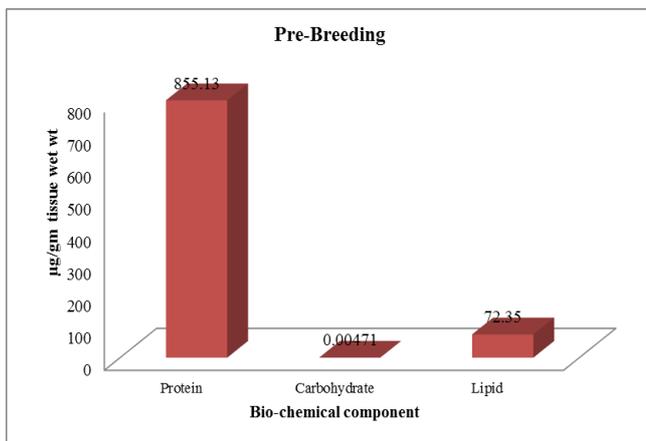
determined by Anthrone Method (Roe, 1955) [15] and Lipids estimation was done using Zlatkis Method (Zlatkis *et al.*, 1953) [16]. The data was prepared according to months and season (Pre-breeding: January- February; Breeding: March-June; Post-breeding: July-September and Spent: October-December). The data collected were calculated using statistical analysis.

**3. Results**

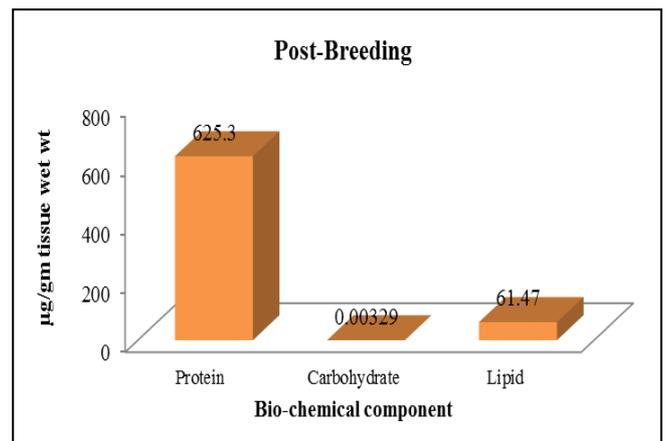
The results of the analysis of biochemical compositions of *Monopterusuchia* were calculated and presented in Table-1 and the column charts were shown in Fig-1 respectively. From the experiment conducted, it was found out that *M. cuchia* is an excellent source of protein because of its low fat content and it is one of the best nutritious foods for human body due to its abundant protein. The amount of protein was highest during pre-breeding season and lowest during spent season. The carbohydrate content of this species reveals that there was no significant difference from all four seasons. Moreover, the lipid content was highest during breeding season but lowest during post-breeding and spent season.

**Table 1:** Variation in tissue biochemical composition of Mud Eel (*Monopterusuchia*)

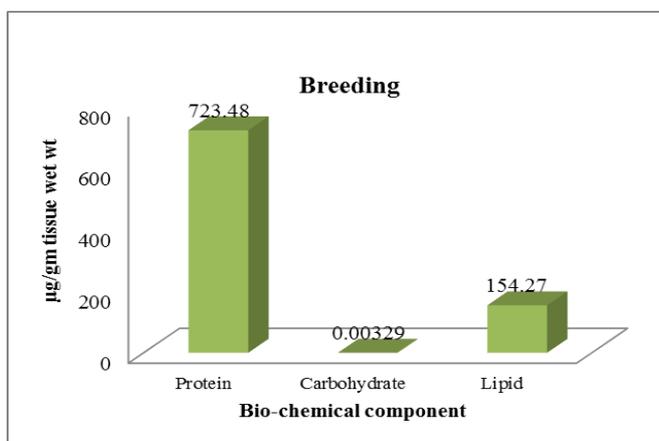
Stages	Degree of maturity	Months of availability	Protein (%) ±SD (µg)	Carbohydrate (%) ±SD (µg)	Lipid (%) ±SD (µg)
I	Immature	Spent (Oct-Dec)	454.4±0.05	0.003±0.0004	51.8±0.5
II	Maturing	Pre-Breeding (Jan-Feb)	855.1±0.04	0.004±0.001	72.3±0.5
III	Mature	Breeding (Mar-Jun)	723.4±0.04	0.003±0.002	154.2±0.5
IV	Spent	Post-Breeding (Jul-Sep)	625.3±0.04	0.003±0.001	61.4±0.5



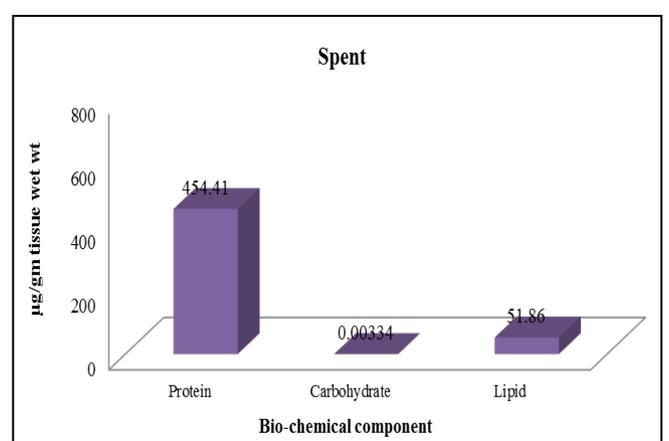
**Fig 1(a):** Biochemical composition of *M. cuchia* during Pre-Breeding season.



**Fig 1(c):** Biochemical composition of *M. cuchia* during Post-Breeding season.



**Fig 1(b):** Biochemical composition of *M. cuchia* during Breeding season.



**Fig 1(d):** Biochemical composition of *M. cuchia* during Spent season.

**Fig 1:** Column charts showing variation of biochemical composition in relation to reproductive cycle of Mud Eel (*Monopterusuchia*)

#### 4. Discussion

Biochemical analysis of fish tissue is important for evaluation their physiological needs at different periods of life. In general, changes in the biochemical composition of fish body have been known to reflect storage or depletion of energy reserves. The knowledge of chemical composition of fish species is extremely important since the nutritive value is reflected in its biochemical content. Moreover, the biochemical composition of the whole body indicates the fish quality. Biochemical composition of tissue is a good indicator for the fish quality (Hernandez *et al.*, 2001) <sup>[9]</sup>, the physiological condition of fish and habitat of fish (Aberoumad and Purshafi, 2010) <sup>[17]</sup>, (Shamsan and Ansari, 2010) <sup>[10]</sup> and (Ravichandran *et al.*, 2011) <sup>[18]</sup>. Fish of various species do not provide the same nutrient profile to their consumer (Takama *et al.*, 1999) <sup>[19]</sup> and the nutritive value of a fish varies with season (Varljen *et al.*, 2003) <sup>[20]</sup>. Protein in fish is an excellent source, because of the amino acid composition and degree of digestibility (Louka *et al.*, 2004) <sup>[21]</sup>. Body composition illustrates the nutritional quality of the food because analysis of biochemical composition including protein and fat is very important in assessing food value (Kamal *et al.*, 2007) <sup>[22]</sup>. So, biochemical evaluation is necessary to ensure the nutritional value as well as eating quality fish (Azam *et al.*, 2004) <sup>[3]</sup>. According to (Kingston and Venkataramani, 1994) <sup>[23]</sup> knowledge of biochemical composition of fish is of great help in evaluating its nutritive value. Moreover, (Waters, 1982) <sup>[24]</sup> reported that seasonal variation in chemical composition is due to an alternate accumulation and expenditure of fat and protein. The values of body composition in fishes varies considerably within and between species (Jacquot, 1961) <sup>[25]</sup>, with fish size, sexual condition, feeding, time of the year, activity (Weatherly and Gill, 1987) <sup>[26]</sup>, (Muraleedharan *et al.*, 1996) <sup>[27]</sup>, food composition, environment and genetic trait (Oni *et al.*, 1983) <sup>[28]</sup>.

Since *Monopterusuchia* is a low-fat high protein quality, therefore the present study revealed that protein was the most dominant biochemical constituent in the muscle of this species. This may be due to the availability of protein rich food in that area and shows that the protein forms the largest quantity of dry matter in fish. Similar findings were also reported by several workers (Bhuyan *et al.*, 2003) <sup>[29]</sup>, (Jyrwa and Bhuyan, 2016) <sup>[30]</sup>, (Steffens, 2006) <sup>[31]</sup> and (Devi and Sarojnalini, 2013) <sup>[32]</sup>.

The present study revealed that the carbohydrate content was less and there was no significant difference from all the four different seasons. Carbohydrate occurs in a very minute quantity in the fish tissue and it formed a minor percentage of the total composition of the fish muscle. The low values of carbohydrates recorded in the present study supports the view that carbohydrate plays an insignificant role as energy reserve in aquatic animals (Love, 1970) <sup>[11]</sup>. In addition to this, (Vijayakumaran, 1979) <sup>[33]</sup> stated that carbohydrate plays a minor part in the energy reserves of *Ambassis gymnocephalus* and the depletion due to spawning is also negligible when compared to lipid and protein. Similar findings were also reported by (Phillips, 1969) <sup>[34]</sup>, (Mathana *et al.*, 2012) <sup>[35]</sup>. Lipids are the primary energy storage material in fish (Love, 1970) <sup>[11]</sup>, (Adams, 1999) <sup>[36]</sup> and (Tocher, 2003) <sup>[37]</sup>. Fish store the lipids in various organs particularly in muscles and liver. Lipid composition and distribution between and within tissues in fish vary from species to species and are influenced by seasonal and dietary variations (Ackman, 1980) <sup>[38]</sup>,

(Henderson and Tocher, 1987) <sup>[39]</sup>. Thus, the lipid content of a fish indicates the surplus energy available for future maintenance, growth, and reproduction. Lipid content is a good index of future survival in some species (Simpkins *et al.*, 2003) <sup>[40]</sup> and a strong indicator of reproductive potential in some fish stocks (Marshall *et al.*, 1999) <sup>[41]</sup>. Lipid content is an important aspect affecting the flesh taste in many species (Robb *et al.*, 2002) <sup>[42]</sup>. The concentration of lipid varies considerably in different parts of the body of the fish (Love, 1970) <sup>[11]</sup>. The lipid content in the body of the fish changes depending on the time of the year (Dawson and Grimm, 1980) <sup>[43]</sup>, environmental conditions (Gill and Weatherly, 1984) <sup>[44]</sup>, stage of maturity of the gonads (Craig, 1977) <sup>[45]</sup>, state of nutrition (Elliot, 1976) <sup>[46]</sup> and age (Parker and Vanstone, 1966) <sup>[47]</sup>. In fact, total lipid and its composition in fish vary more than any other nutrient component (Thakur *et al.*, 2003) <sup>[48]</sup>. The increased in the lipid content during breeding season may be due to the fact that the fish is ready to spawn and there is an increase in nutrient sources with the increase in temperature. Similar results were also reported by other workers (Jyrwa and Bhuyan, 2016) <sup>[30]</sup>, (Stansby, 1985) <sup>[49]</sup> and (Hamre *et al.*, 2003) <sup>[50]</sup>. Several workers have been reported on the analysis of biochemical components of various fish species at different levels. However, a report about variation in the biochemical compositions of Mud Eel in Meghalaya is not available. Due to this reason, most people are not fully aware about the importance of *Monopterusuchia* as a natural source of food, its nutritional profile since this species could provide more protein and other essential nutrients for the betterment of human health.

Therefore, overall information about these biochemical components of fishes is essential for human health as well as nutritionists, pharmaceuticals, chemists etc.

#### 5. Conclusion

The present study revealed the seasonal changes in the biochemical composition of protein, carbohydrates and lipid of *Monopterusuchia*. Since this species has higher values of protein quantity, therefore this depicts a good nutritional quality of fish as human food and it is an important source of animal protein. Traditionally used as a diet for anemic people as well as it is equally commercial important fish in Meghalaya and has been observed that this fish can be cultured commercially to meet the increasing demand of animal protein in the state.

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