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SEASONAL BIOCHEMICAL CHANGES IN THE MUSCLES OF FRESH WATER FISH *LABEO CALBASU (HAM)*

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ABSTRACT
The freshwater fish *Labeo calbasu* (Ham) were collected monthly from Krishna River during January 2013to Dec 2014 and were obtained from fisherman. There is no any drastic change was observed in the Protein content in the muscles, but shows its lowest value in the month of October (12.92486 ± 0.0516) and highest value is observed in the month of June (19.5555 ± 0.0437).Glycogen level steadily decreases from the month of January to December. Its highest value is recorded in the month of February (0.68175 ± 2.5666^{-3}) and lowest value was observed in the month of December (0.24058 ± 6.42132^{-3}). Ascorbic acid level shows two peak values in the months of March to June(0.3525 ± 6.4549^{-3} to 0.4316 ± 0.01123) and October to December(0.3133 ± 8.2881^{-3}). Lipid in the muscles are found at higher level in the months of August (0.55995 ± 3.5603^{-3}), December (0.6069 ± 2.4842^{-3}) and January (0.6097 ± 2.8588^{-3}). All these results show that the biochemical constituents were greatly influenced by the breeding activity.

Key words: *Mystus cavasius*, Protein, Glycogen, Lipid and Ascorbic Acid.

Introduction

Fish and shellfish are the primary sources of animal protein and valuable in the diet because they provide a good quantity (usually 70% or more) or protein of high biological value, particularly sulphur containing amino acids (Latham, 1997). Next to meat, fish is the only protein source that contains all the essential amino acids in right proportion and called complete protein. Consumption of fish provides important nutrients to a large number of people in the world and makes a very significant contribution to nutrition. Glycogen is a vital source of muscle energy of live animal and it is utilized during muscular action and stored up during rest. Glycogen in different tissues shows remarkable difference Nutritive value of fish is recognized all over the world.

Fish are not only beneficial protein and Glycogen source but also contain considerable amount of unsaturated fatty acids, and thus the studies on lipid biochemistry have been considered so important recently (Farkas and Csengeri, 1976; Farkas *et. al.*, 1978; Dave *et. al.*, 1976; Akpınar, 1986). Ascorbic acid acts as an essential factor for normal growth in rainbow trout *Salmo gairdneri* (Tucker and Halver, 1986).The accumulation of ascorbic acid at the site of wound healing was found by Gould (1963).

Therefore the fish is an important source of food for mankind all over the world from the times immemorial. So they are beneficial nutrition sources (Weatherley and Gill, 1998). In general, the biochemical composition of the whole body indicates the fish quality. Therefore, proximate biochemical composition of a species helps to assess its nutritional and edible value in terms of energy units compared to other species. Variation of biochemical composition of fish flesh may also occur within same species depending upon the fishing ground, fishing season, age and sex of the individual and reproductive status. The variation in the chemical composition of fish is closely related to feed intake, migratory swimming and sexual changes in connection with spawning. Salam et. al., (1995) studied Biochemical composition of body muscles and its caloric contents of tawes (*Puntius gonionotius*, Bleeder) and stated that variation in proximate composition of fish flesh may vary with species variation, season, age and feeding habit of the fish.

Biochemical composition, nutritive values and seasonal variation in the chemical composition of fish tissues associated with reproductive cycle were reported by (Al-Dubaikel, 1996 and Al-Mhanawi, 2001). Similarly, the present work has been undertaken to study the seasonal biochemical changes in the muscles of *Labeo calbasu* (Ham) and to report their nutrient composition from the public health point of view.

Material and Methods

The freshwater fish *Labeo calbasu* (Ham) were collected monthly from Krishna River during January 2013to Dec 2014 and were obtained from fisherman. They were brought in to the laboratory and then scarified for furthers studies. The muscle was removed

from the dorsal of the body without scales, skin and pieces of bones. The tissue was processed for Protein, Glycogen, Ascorbic Acid and Lipid estimations. The protein was estimated as method described by Lowry *et al.*, 1951. Glycogen was estimated by Anthrone Reagent Method (De Zawaan and Zandee, 1972), the total Lipids was estimated by Vanillin Reagent Method (Barnes and Black stock, 1973) and Ascorbic Acid by Roe J. H. ((1958).

Results

The seasonal variations in the biochemical contents of muscles of *Labeo calbasu* (Ham) are given in the table no.1 and graph numbers 1-4 shows variations in Protein, Glycogen, Ascorbic Acid and Lipid respectively.

There is no any drastic change was observed in the Protein content in the muscles, but shows its lowest value in the month of October (12.92486 ± 0.0516) and highest value is observed in the month of June (19.5555 ± 0.0437).

Glycogen level steadily decreases from the month of January to December. Its highest value is recorded in the month of February (0.68175 ± 2.5666^{-3}) and lowest value was observed in the month of December (0.24058 ± 6.42132^{-3}). Glycogen content is continuously decreases during pre-spawning and post-spawning period. It is due to utilization or transfer of reserve food material towards to meet energy demand and it transfer towards gonads for maturation.

Ascorbic acid level in the muscles shows two peak values in the months of March to June(0.3525 ± 6.4549^{-3} to 0.4316 ± 0.01123) and October to December(0.3133 ± 8.2881^{-3}). Lowest content of ascorbic acid is noted in the month of January (0.08479 ± 7.3521^{-3}) and highest value was recorded in the month of June (0.4316 ±0.01123). During breeding season ascorbic acid level is increased and decreased in the post-spawning period.

Lipid in the muscles are found at higher level in the months of August (0.55995 ± 3.5603^{-3}), December (0.6069 ± 2.4842^{-3}) and January (0.6097 ± 2.8588^{-3}). But Decreased values are found in the pre-spawning period, it indicates that lipid content is utilized during maturation. Due to this its level is very low in the months of April, May, June, September and October.

Discussion

In *Labeo calbasu* also protein level is more during pre-spawning period and its level decreases during spawning period. Similar result was observed by Bruce (1924) in the muscles of herrings. Jafri (1969) observed high value of muscle protein in *Ophiocephalus punctatus* with ripe gonads. Similarly the same pattern of variation was observed in the muscles of the *Puntius kolus* (Ganeshwade, 2015). During spawning, muscle protein started declining gradually due to its transfer in to gonads to meet energy requirement of fish. Similar observations made by Hickling and Rutenberg (1936), Love and Robertson (1967) and Iles (1974). They reported that protein synthesized and accumulated in the somatic tissues during pre-maturation period would be utilized for gamete formation in addition to the growth of fish.

Glycogen content in the muscles of *Labeo calbasu shows* steady decrease from the month Jan to October. Highest level was observed in the month of Jan and Feb and lowest level was observed in the month of November and December. Glycogen is a vital source of muscle energy of live animal and it is utilized during muscular action and stored up during rest (Pawar and Sonawane, 2014).Glycogen level drastically decreased from the month of Jan to October. During post-spawning its level decreases due to its utilization for to meet energy demand. During the present work it is observed that in the summer its level is more and it goes on decreasing in advancement of maturity. In post-spawning season its level is very low because it is utilized as a source of energy.

Langer et. al., (2013) studied on seasonal fluctuations in the proximate body composition of *Paratelphusa masoniana*. They observed two peaks in the muscle lipid content in the months of March (5.49 ± 0.381) and September (5.85 ± 0.46) and stated high lipid content was observed in spring and post-monsoon and this could be due to active feeding and optimum availability of food as a algal blooms and planktons. During present work highest values are observed in the months of of August (0.55995 ± 3.5603^{-3}), December (0.6069 ± 2.4842^{-3}) and January (0.6097 ± 2.8588^{-3}). But Decreased values are found in the pre-spawning period, it indicates that lipid content is utilized during maturation. Due to this its level is very low in the months of April, May, June, September and October.

There was also decline in the lipid content during spawning period and this is possibly due to mobilization of lipid as an energy source to meet the high energy demands during the act of ovulation and spawning on one hand

and due to low feeding intensity and low availability of food items on the other. Reduction in the amount of lipid content in the muscles for the development and maturation of gonads has been well discussed by Idler and Bitner (1959), Raina (1999) and Samyal et. al.,(2011).

Ascorbic acid level in the muscles shows two peak values in the months of March to June and October to December. Lowest content of ascorbic acid is noted in the month of January (0.08479 ± 7.3521^{-3}) and highest value was recorded in the month of June (0.4316 ±0.01123). The ascorbic acid plays an important role in detoxification of the foreign bodies or toxicants in metabolic process. The main site to synthesize the ascorbic acid is the liver. Ascorbic acid content in the muscles is less as compared to other tissues (Giroud et. al., 1938). It plays a role directly related to homeostatic mechanism and is essential for wound healing and regeneration (Gould, 1963). Ascorbic acid acts as an essential factor for normal growth in rainbow trout *Salmo gairdneri* (Tucker and Halver, 1986). In terrestrial animals the dietary ascorbic acid has role in the host defense system. Though the complete prevention of viral infection is not possible, high doses of ascorbic acid reduces potency of the viral diseases (Murata, 1975). During breeding season ascorbic acid content is reduces due to its utilization for the process of maturation of gonads. Some authors have observed that AA concentrated in female gonads is transferred to the oocyte during maturation and then quickly consumed during the first days of embryonic growth (Blom and Dabrowski 1995). Ascorbic acid is a key antioxidant molecule having low molecular weight and an essential fish and crustacean micronutrients (Brown and Lavens, 2001). This antioxidant is highly consumed from the tissues during oocyte maturation (Blom and Dabrowski, 1995). The overall high levels and seasonal variations of AA in ovaries have been suggested to reflect a requirement for AA in hydroxylation reactions in steroidogenesis in the ovarian follicle cells (Hilton et. al., 1979). Due to this during preparatory and post-spawning season its level is more in muscles while during breeding season they are transferred for maturation of gonads.

Table No.1 Seasonal variation in the biochemical components of the Muscles of *Labeo calbasu* (Ham) [Common Name – Kanas]

Biochemical Compo / Months	Protein	Glycogen	Ascorbic Acid	Lipid
January 2013	17.22456232 ±0.029769019	0.668064917 ±5.988800047^{-3}	0.084794474 ±7.352121999^{-3}	0.172785742 ±1.528069523^{-3}
February 2013	15.4608251 ±0.021844481	0.681753603 ±2.56662882^{-3}	0.108688871 ±5.514091501^{-3}	0.061965188 ±3.189686446^{-3}
March 2013	18.66415323 ±0.021844427	0.609032458 ±7.841179758^{-3}	0.352534254 ±6.454950736^{-3}	0.15392266 ±2.273860924^{-3}
April 2013	18.8691281 ±0.029768985	0.57709219 ±7.949339303^{-3}	0.370301882 ±7.428311888^{-3}	0.02353168 ±2.550441333^{-3}
May 2013	19.0026001 ±0.028601127	0.498453541 ±5.33715259^{-3}	0.396646986 ±0.011079121	0.021173797 ±1.780163342^{-3}
June 2013	19.55555556 ±0.043688963	0.459597635 ±0.010765345	0.431569566 ±0.011230552	0.011742261 ±1.080517886^{-3}
July 2013	18.81192581 ±0.059538046	0.448475577 ±4.711962898^{-3}	0.121555085 ±0.011028183	0.065030437 ±4.263794751^{-3}
August 2013	14.68382735 ±0.057202284	0.450757025 ±3.422171533^{-3}	0.122780438 ±9.251217311^{-3}	0.559950269 ±3.56032672^{-3}
September 2013	16.2473566 ±0.043688968	0.450471844 ±1.780954379^{-3}	0.158315695 ±7.352121998^{-3}	0.012213838 ±7.07365^{-4}
October 2013	12.924857 ±0.051561445	0.447049673 ±6.645389454^{-3}	0.313322936 ±8.288138847^{-3}	0.018815913 ±2.334185849^{-3}
November 2013	16.09958394 ±0.05156139	0.357788032 ±5.15696783^{-3}	0.354372284 ±5.615275982^{-3}	0.215699219 ±2.484184776^{-3}
December 2013	18.94539782 ±0.071502853	0.240578658 ±6.421322753^{-3}	0.40216077 ±0.011230551	0.606872159 ±2.484184876^{-3}
Jan 2014	10.87034148 ±0.05022196	0.329555117 ±4.711962877^{-3}	0.106238163 ±6.454951264^{-3}	0.609701626 ±2.858792665^{-3}

The values are expressed in mg/100mg dry weight (Mean± S.D.)

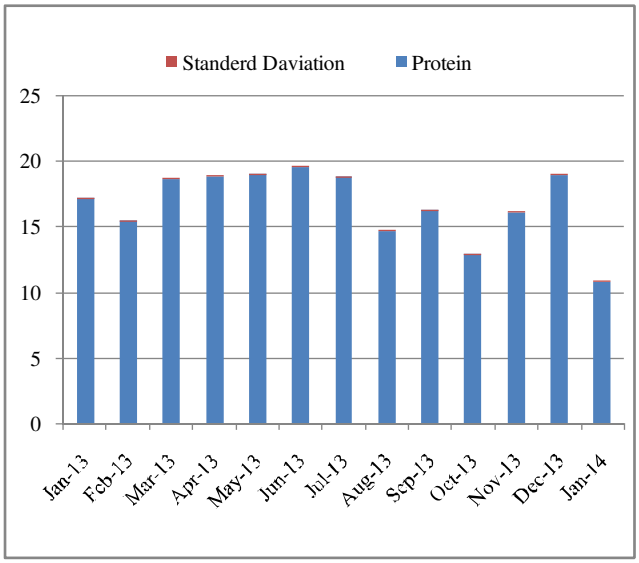

Figure 1

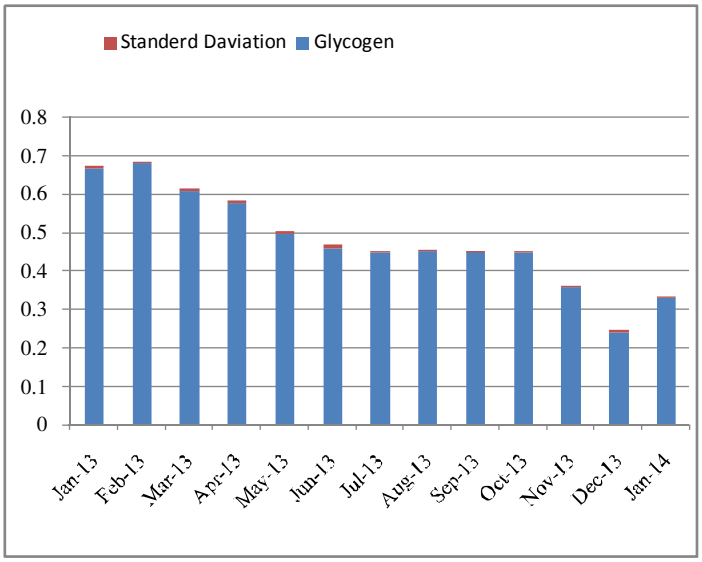

Figure 2

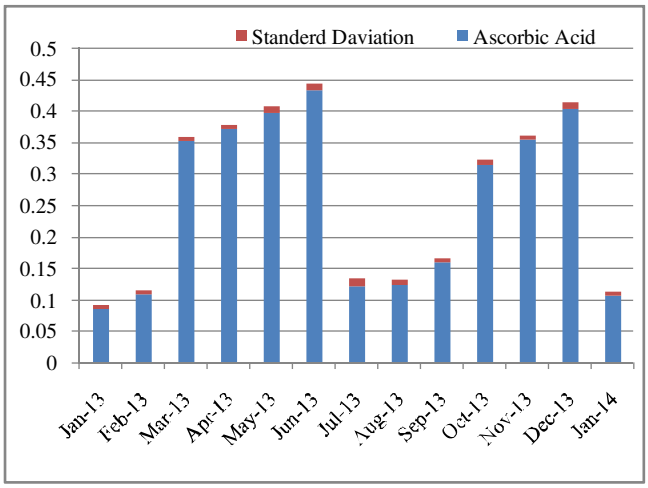

Figure 3

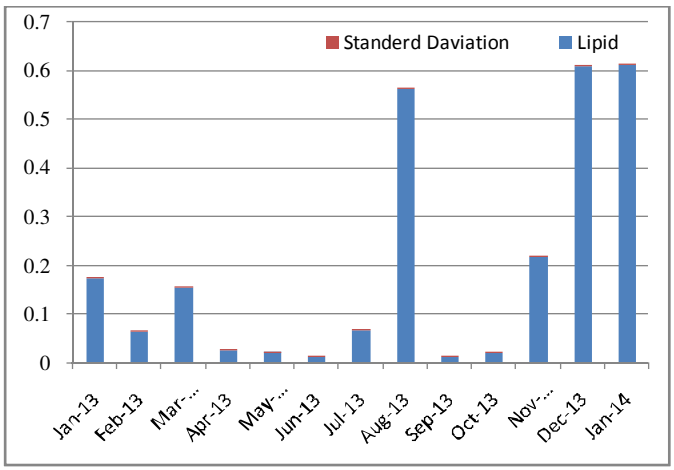

Figure 4

Figure 1-Seasonal variation of Protein in the Muscles of *Labeo calbasu* (Ham)
Figure 2- Seasonal variation of Glycogen in the Muscles *of Labeo calbasu* (Ham)
Figure 3- Seasonal variation of Ascorbic Acid in the Muscles of *Labeo calbasu* (Ham)
Figure 4- Seasonal variation of Lipid in the Muscles of *Labeo calbasu* (Ham)

Conclusion

According to present investigation and others study it is to be concluded that the variation of biochemical composition in fish flesh may also occur within the same species. It depends upon the fishing ground, fishing season, age and sex of the individual and reproductive status. The variation in the chemical composition of fish is closely related to feed intake, migratory swimming and sexual changes in connection with spawning. Some other factors like temperature , salinity and toxic stress also causes changes in the biochemical contents of the fish

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