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Seasonal changes in the biochemical composition of four different tissues of red spotted emperor *Lethrinus Lentjan (Family:Lethrinidae)*

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ABSTRACT

Seasonal changes in biochemical composition of the Lethrinus lentjan were studied for a period of one year from February 2010 to January 2011 in the fishing area (Chinnamuttom harbour– Southern tip of Kanyakumari). The amounts of carbohydrate, lipid and protein were determined in muscles, liver, gills and kidney. The results were expressed as mg/gm. The concentration of carbohydrates fluctuated from 1.12 to 1.75, 2.12 to 2.73, 0.72 to 1.99 and 0.32 to 0.68, protein content varied from 18.75 to 23.84, 17.18 to 18.73, 14.35 to 15.42 and 15.32 to 16.89 and the lipid content ranged from 7.28 to 9.88, 6.18 to 9.92, 7.75 to 8.95 and 7.05 to 8.45mg/gm respectively (muscles, liver, gills and kidney). Protein content was high during spawning season and low during the post-spawning season. Lipid content estimated was also low during the spawning season and high during pre-spawning season in all the four selected tissues. This indicated that a significant inverse relationship between protein and lipid in muscles, liver, gills and kidney (r = - 0.45, -0.114, -0.099 and -0.37 respectively).

Keywords: *Lethrinus lentjan*, Red spotted emperor, Carbohydrates, Proteins and Lipids.

INTRODUCTION

Water constitutes about 71% of the earth's surface and has always been an important actual and potential source of food. There is an increasing demand for aquatic resources and fish products as dietary protein source around the World (1). Fish is a favorite foodstuff for the majority of societies. Fish meat contains most important nutritional components and serves as a source of energy for human beings (2, 3). Fish is also a vitamin and mineral rich food for young as well as old age people (4, 5).

Majority of the nutitionalists recommended that human beings should eat fish every day (6, 7). An increasing amount of evidences suggest that, fish meat and oil contains high amount of polysaturated fatty acid that are valuable in decreasing the serum cholesterol to prevent a number of coronary heart diseases (8, 9). Regular consumption of fish can promote the defense mechanism for protection against invasion of human pathogens because fish food has antimicrobial peptide (10). Ingesting fish can reduce the risk of some type of cancer, including colon, breast and prostate (11, 12, 13) and lower the risk of developing dementia, including Alzheimer's diseases (14). Breastfed babies of mothers who eat fish have better eyesight perhaps due to the omega-3-fatty acid transmitted in breast milk (15). Fish oil may be useful in treating dys-lipidemia in diabetes (16). Eating fish during pregnancy may help to reduce the risk of delivery of a premature baby (17).

Biochemical composition of flesh is a good indicator for the fish quality (18), the physiological condition of fish and habitat of fish (19, 20, and 10). Fish of various species do not provide the same nutrient profile to their consumer (21) and the nutritive value of a fish varies with season (22). Protein in fish is the excellent source, because of the amino acid composition and degree of digestibility (23). 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 (24). So, biochemical evaluation is necessary to ensure the nutritional value as well as eating quality fish (25). Although several studies deal with the biochemical composition of many commercially important fishes (26, 27, 28 and 19).

In Chinnamuttom, *Lethrinus lentjan* is a commercially and economically important species of the people. This fish is frequently caught by fishermen and the people prefer this particular fish because of its best quality, unique meat texture and their taste. It is normally utilized as fresh, preserved, dried or salted. These are marketed all over the country and transported from one landing center to another with the assistance of the cooler. The biochemical composition of *Lethrinus lentjan* is not yet determined in Chinnamuttom. Therefore, the present study was undertaken to elucidate the dynamics of the biochemical composition of different tissues of *Lethrinus lentjan* with reference to the season.

MATERIALS AND METHODS

Specimens of *Lethrinus lentjan (Family:Lethrinidae)* used for this study were bought from Chinnamuttom harbour, Kanyakumari, Tamil Nadu. For estimating carbohydrate, proteins, and total lipids, the tissues such as muscle, liver, gills and kidney of the fishes were used. The carbohydrate content of the tissue extracts was estimated by Anthrone method (29). The Folin – Ciocalteu Phenol method (30) was adopted for the estimation of protein in the tissue. The chloroform - methanol extraction procedure (31) was used for extracting and estimating lipid from the various body parts.

RESULTS

The biochemical composition and relationship of carbohydrate, protein and lipid content in four different tissues (muscles, liver, gills and kidney) of *Lethrinus lentjan* were indicated in Table 1 to 3 and graphically represented in Fig.1. Carbohydrate content was always minimum in all the four different selected tissues of *Lethrinus lentjan*. The results were expressed as mg/gm. The concentration of carbohydrates was higher in liver (2.420± 0.0268) during post-spawning and lower values were observed in kidney (0.421±0.01303 during pre-spawning season with a significant difference (P< 0.05%). Protein content ranged from 14.35 (gills) to 23.84 (muscles) in post and pre-spawning seasons respectively. A positive correlation was observed between carbohydrate and protein in the muscles (r= 0.404) and gills (r=0.2159). A significant difference in the protein of muscles and kidney (P< 0.05%) was observed during pre-spawning and post spawning season. Lipid content was low during spawning season (6.3808±0.0516) and high during pre-spawning season (9.794±0.0296) with highly significant (P <0.05%).

Table: 1 - Bio Chemical Composition of different tissues of *Lethrinus lentjan*

Months	Muscles (mg/gm)			Liver (mg/gm)			Gills (mg/gm)			Kidney (mg/gm)		
	Carbohydrates	Protein	Lipid	Carbohydrates	Protein	Lipid	Carbohydrates	Protein	Lipid	Carbohydrates	Protein	Lipid
Feb-10	1.35	18.75	8.99	2.23	17.18	7.64	0.72	14.35	7.77	0.63	16.87	7.35
Mar-10	1.12	18.84	9.15	2.34	17.35	7.78	1.99	14.62	8.43	0.68	15.53	7.42
Apr-10	1.38	22.89	9.53	2.22	17.98	9.92	1.95	15.35	7.82	0.48	16.35	8.35
May-10	1.75	22.74	9.88	2.12	17.99	8.35	1.88	14.96	8.95	0.35	16.38	8.45
Jun-10	1.48	22.84	7.58	2.25	17.88	6.32	0.83	14.98	8.32	0.38	16.42	7.12
Jul-10	1.44	23.1	7.63	2.32	17.36	6.45	0.79	14.98	8.35	0.65	16.78	7.32
Aug-10	1.35	23.25	7.75	2.39	17.52	6.44	0.78	14.99	8.82	0.58	16.79	7.35
Sep-10	1.38	23.75	7.82	2.42	17.98	6.63	0.95	15.23	8.72	0.43	16.82	7.12
Oct-10	1.68	23.84	7.28	2.55	18.73	6.18	0.98	15.42	7.75	0.38	16.89	7.05
Nov-10	1.62	19.75	8.34	2.69	17.54	9.91	0.98	14.67	8.85	0.32	16.85	7.83
Dec-10	1.37	19.35	8.88	2.69	17.55	6.97	0.97	14.52	8.88	0.44	15.32	7.89
Jan-11	1.42	19.12	8.57	2.73	17.48	6.99	0.85	14.38	8.03	0.48	15.35	7.92

Table : 2 Bio Chemical Composition of Different Tissues of *Lethrinus lentjan* at Different Seasons

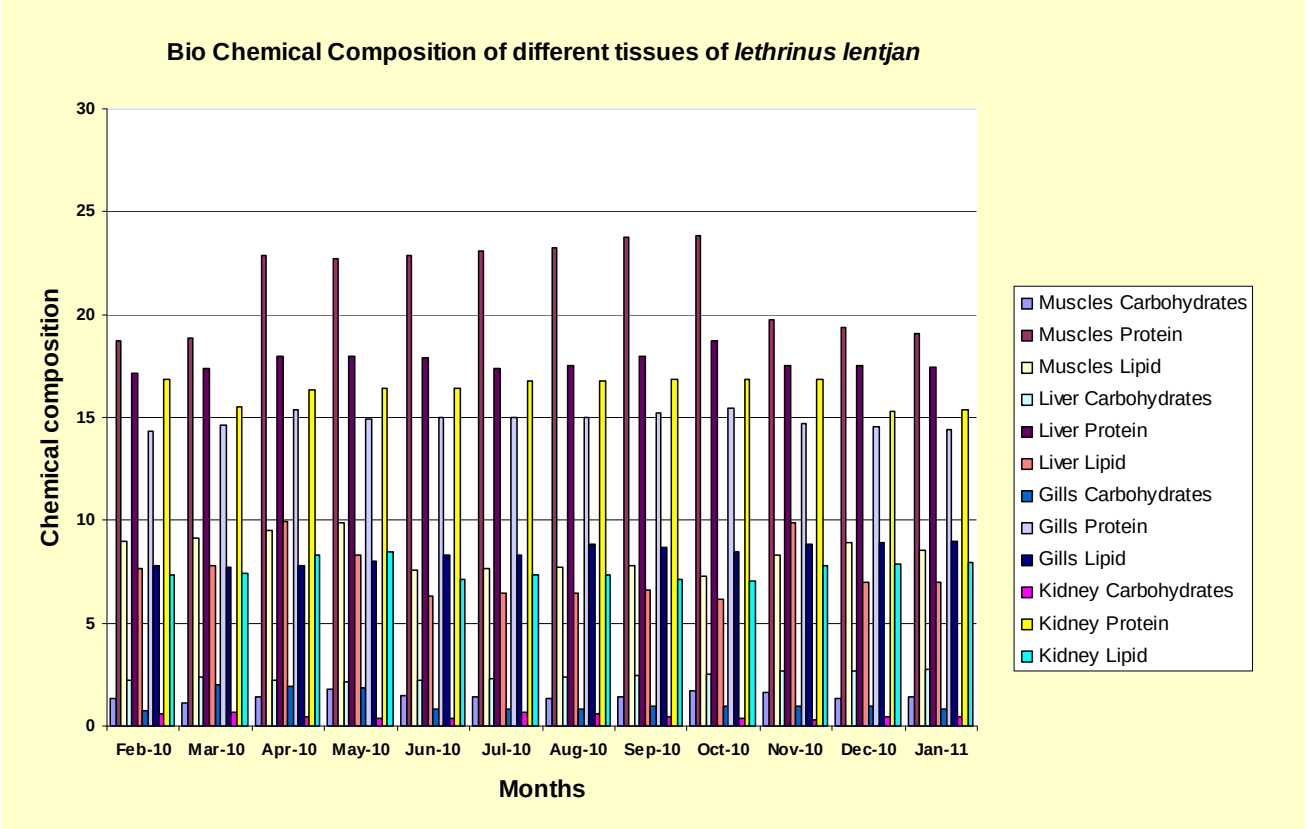
Parameters	prespawning season	spawning season	Post spawning season
	M ± S.E	M ± S.E	M ± S.E
Muscles			
Carbohydrates	1.422± 0.055*	1.489± 0.03115*	1.457± 0.0436*
Protein	19.157± 0.0174**	22.82± 0.1301**	18.1008± 0.1168
Lipid	9.794± 0.0296***	8.714± 0.0474***	7.6492± 0.0737***
Liver			
Carbohydrates	2.285± 0.0154**	2.42166± 0.0268**	2.489± 0.06498
Protein	1798± 0.0033*	17.999± 0.1519*	17.4190± 0.00362
Lipid	9.088± 0.1787***	6.3808± 0.0516***	7.9109± 0.39115
Gills			
Carbohydrates	1.914± 0.00805***	0.8583± 0.0211***	1.25± 0.0388
Protein	15.029± 0.0083*	15.009± 0.0578*	14.49± 0.03116
Lipid	8.934± 0.0214***	7.60116± 0.0053***	8.128± 0.1654
Kidney			
Carbohydrates	0.421± 0.01303**	0.51917± 0.0226**	0.5245± 0.0379
Protein	16.364± 0.0045**	16.77± 0.426**	16.142± 0.0215
Lipid	8.406± 0.01002***	7.2375± 0.03224***	7.666± 0.0603

** - In significant, ** - Significant, *** - Highly Significant*

Table No: 3 Correlation intermatrix between the Bio-Chemical composition of Different tissues of *Lethrinus lentjan*

Relations	Muscles	Liver	Gills	Kidney
Carbohydrates Vs Protein	0.4044	- 0.025	0.2159	-0.156
Carbohydrate Vs Lipid	- 0.102	- 0.91	- 0.613	- 0.273
Protein Vs Lipid	- 0.453	- 0.115	- 0.099	- 0.37

Figure 1



DISCUSSION

In the present study, a variation in the seasonal biochemical composition of various tissues of *Lethrinus lentjan* were observed. The low values of carbohydrates recorded in the present study could be due to the fact that a carbohydrate does not contribute much to the reserves in the body. Similar findings were observed by Vijayakumaran (32) who

stated that carbohydrate plays a minor part in energy reserves of *Ambassis gymnoccephalus* and depletion due to spawning is negligible when compared to lipid and protein. A fall in the carbohydrate level in this study may be due to the rapid utilization of energy during various metabolic activities. Similar results were also reported by Philips et al., (33) in trout. In the present investigation, the high value of carbohydrates in the liver may be due to the accumulation of carbohydrates and low values in kidney might probably be due to the carbohydrate metabolism that occur in it and export of hexose units for maintenance of blood glucose. Similar findings were made by Ansari *et al*., (34) who, reported that the carbohydrates of many sea animals are mainly composed of glycogen and changes in the carbohydrate level may be due to the accumulation of glycogen at different stages like gametogenesis and spawning.

Muscle, rich in proteins, forms mechanical tissue intended for mobility and do not participate in metabolism. The liver being the center for various metabolisms is also rich in proteins. High protein content during spawning season has been reported during this study may be due to the availability of protein rich food in that area. Similar findings were observed by Bhuyan *et al.,* (35) from *Cynoglossids* in Kutuboha Channel. The low level of protein during a post-spawning period in our observation may be due to the quality of food that considerably affects the concentration of various protein factors of fish tissue. The seasonal cycle of protein and nitrogen fraction also seem to be influenced by maturation cycle and depletion of gonad (25). It is an accepted fact that there exists a strong link between the main energy yielding reserves like fat and protein to the water, the ' milieu ' of all biological functions. Inverse relationships were observed between lipid and protein. A similar observation was observed and reported by Boran *et al.,* (27) from some fish species in black sea.

The lipid content of the *Lethrinus lentjan* during pre-spawning season was slightly higher and the reason for this situation may be due to the fish is ready to spawn, increase in nutrient sources with the increase in temperature of the seawater and also prolific feeding of plankton rich food. Similar results were also reported that for Norwegian herring (*Clupea harengus* L.) by Hamre *et al.,* (36), Stansby (37) and (38). Low content of lipids was observed during the spawning period might be due to mobilization of the constituent to gonad development, physiologically inability to store an appreciable quantity of fat in the body and also low and carnivorous feeding. Similar findings were observed by Parulekar and Bal (39) from Bregmaceros mclwllandi. But high fat and protein content during spawning season has been reported for other fishes (19, 34). It is also believed that in winter months *Lethrinus lentjan* are tastier. This condition may be due to the seasonal differences in the availability of food and changes in the reproduction cycle have considerable effect on the tissue biochemistry of the fish, particularly fat. The diet of this species is mainly composed of molluscs, crustaceans, polychaete worms, and echinoderms. Similar findings were observed by Vijayakumaran (32) who stated that intensive feeding in *Ambassis commersoni* coincides with the occurrence of high fat content in the muscle of fish.

CONCLUSION

The present study revealed the seasonal changes in the biochemical composition of different tissues. They are associated with feeding, reproductive cycle, storage and utilization of reserves. From the present study it can be concluded that the carbohydrates were utilized for energy and various metabolic activities. Similarly, lipid has been used for energy; however, protein was used for body building during different phases of maturation. The selected fish *Lethrinus lentjan* is the high fat fish. This fish is the most preferable food for human consumption because of its relatively high value of lipid and protein content in the flesh. This is an ideal dietetic food for human beings.

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