ISSN 2250-3153

Changes in the Muscle Biochemical Composition of *Lagocephalus Spadiceus* (Richardson, 1845) and *Lagocephalus Lunaris* (Bloch and Schneider, 1801) off Visakhapatnam, East Coast of India

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Abstract- Seasonal changes in the biochemical parameters such as protein, carbohydrate, lipid and ash besides moisture content in the muscle of Lagocephalus spadiceus (Richardson, 1845) and Lagocephalus lunaris (Bloch and Schneider, 1801) has been carried out during January to December 2009. The percentage composition of moisture, protein, carbohydrate, lipid and ash contents showed variations in their abundance in different seasons in both the species. The highest content of protein (18.11%) in the muscle was recorded in L. spadiceus in summer, while it was high (14.20%) in L. lunaris in monoon season.

Index Terms- *Lagocephalus spadiceus*, *Lagocephalus lunaris*, muscle, biochemical aspects, Visakhapatnam coast.

I. INTRODUCTION

Ever increasing population and day – by - day depletion of natural resources, it is high time to efficiently use all aquatic forms like pufferfishes along with other table fish and shrimp as this forms one of the alternative to meet the food demand. Studies on biochemical composition are very essential to assess the nutritional value of the pufferfishes because Visakhapatnam, on the east coast of India supports a wide variety of pufferfishes, which can be exploited rationally for economic purpose. Pufferfishes belonging to the order Tetraodontiformes are so called because of the presence of four teeth; two on the upper jaw and two on the lower jaw. Puffers are circum-globular tetraodontids and bentho - pelagic species found in tropical and temperate waters. These are the diverse group of aquatic organisms and are non-target species incidentally or accidentally caught by trawling. These fishes are known to contain a toxin called Tetrodotoxin in the skin, liver, gonads and intestines. Hence, these are treated as trash fish, which are dumped with other uneconomical fish at Visakhapatnam fishing harbour. Instead of wasting them, these fishes can also be used as food fish to meet the nutritional requirements of increasing population by removing the skin and visceral organs which are suspected to contain the toxin. Approximately 189 species of pufferfishes and 28 genera in the family Tetraodontidae are known all over the world (Oliveira *et.al.* 2006). Over 50 species have been reported as poisonous to man under certain conditions (Russel, 1965). No toxicity was found in *L. spadiceus* (Chunfai Yu and Peter Hoifu Yu, 1997; Brilliantes *et. al*., 2003; Ngy *et. al*., 2008) whereas *L. lunaris* was toxic in most organs (Brilliantes *et. al*., 2003; Somiranjan Ghosh *et. al*., 2004; Ngy *et. al*., 2008). Even though these fishes are toxic, they are eaten in countries like Japan after some special preparations (Chunfai Yu and Peter Hoifu Yu, 1997) as they contain rich sources of nutrients in their muscle. This paper deals with the seasonal changes of moisture, protein, carbohydrate, lipid and ash in the muscle of *L. spadiceus* and *L. lunaris*.

II. MATERIALS AND METHODS

The fish were collected at monthly intervals throughout the year (January 2009 to December 2009) from fishing harbour, Visakhapatnam (Latitude 17° 41'N, Longitude 83° 17'E). Fishes were brought to the laboratory in fresh condition. After recording the body weight and length of the two species, the muscle samples of each species were taken out, weighed and kept in a hot air oven at 60-70ºC for about 2 to 3 days till the moisture was completely evaporated. The dried tissue was then ground in a mortar and all the samples were placed in desiccator for further analysis in order to avoid moisture from atmosphere. The finely powdered samples were used for the determination of protein, carbohydrate, lipid and ash by standard methods, Lowry *et. al.*(1951), Carroll *et.al.*(1956), Bligh and Dyer (1959) and Hort and Fisher (1971) respectively.

The results were expressed in percentage of wet weight of the tissue and the data was reported month wise and season wise (Monsoon: June to September; Post-monsoon: October to January; Summer: February to May).

III. RESULTS

Biochemical composition of *L. spadiceus*:

Monthly variations of water, protein, carbohydrate, lipid and ash were reported in Table. 1. The water, protein, carbohydrate, lipid and ash showed wide variations and showed high percentages of water (85.17%) in January, protein (22.74%) in September, carbohydrate (2.57%) in November, lipid (4.62%) in June and ash (3.13%) in June. The mean value of water (78.43% ± 1.4101), protein (15.65% ± 1.2495), carbohydrate (1.49% ± 0.1681), lipid (2.93% ± 0.2564) and ash (1.49% ± 0.2156) were reported in *L. spadiceus* during January – December 2009 in Fig. 3.

Seasonally highest percentage of water (81.18%) was noticed in post-monsoon season, protein (18.11%) in summer season, carbohydrate (1.75%) in post-monsoon season, lipid (3.31%) in monsoon season and ash (1.80%) in summer season in Fig. 1.

Biochemical composition of *L. lunaris*:

Monthly variations of water, protein, carbohydrate, lipid and ash were reported in Table. 2. The water, protein, carbohydrate, lipid and ash showed minor variations and showed high percentages of water (80.54%) in August, protein (15.31%) in April, carbohydrate (3.56%) in April, lipid (15.62%) in July and ash (5.66%) in November. The mean value of water (72.58% ± 1.7310), protein (12.96 % ± 0.6629), carbohydrate (2.32 % ± 0.2824), lipid (9.34 % ± 1.0731) and ash (2.79 % ± 0.4811) were reported in *L. lunaris* during Jan – Dec 2009 in Fig. 3.

Seasonally highest percentage of water (74.63%) was noticed in summer season, protein (14.20%) in monsoon season, carbohydrate (2.69%) in summer season, lipid (11.02%) in monsoon season and ash (4.87%) in post-monsoon season in Fig. 2.

IV. DISCUSSION

The water in the flesh of fishes varies widely between 65 and 90 percent (Viswanathan Nair and Suseela Mathew 2000). The water content of *L. spadiceus* in the present study was higher than *L. lunaris* and reports of earlier workers on other teleostean fishes. There exists an inverse relationship between water and fat content. Low water content was observed during monsoon season in both the species indicating that the water content decreases as fishes advance towards maturity. Low water content is usually associated with relatively high fat content and vice-versa (Das, 1978; Viswanathan Nair and Suseela Mathew, 2000; Anthony *et.al*. 2000; Zaboukas 2006; Shamsan, 2008 and Manal, 2009). Similar results were also observed in the two fishes analyzed in the present study.

According to Viswanathan Nair & Suseela Mathew (2000) protein is the major biochemical constituent of fish meat and is generally present in the range of 16-18%, though values ranging from as low as 8% to as high as 22% have been reported in some common fishes in India. The protein is dominant constituent among biochemical components except water in *L. spadiceus* and *L. lunaris* in the present study. It is also observed that protein content is inversely related to water content in the present study. Seasonal variations showed highest protein content of *L. spadiceus* during summer season while it was during monsoon season in *L. lunaris* in the present study. Anthony *et.al.* (2000), Zhang *et.al.* (2001), Liu *et.al*. (2002) and Abdul Rahman and Reshma (2008) noticed high value of protein and low value of lipid in marine fishes. Similar findings were also observed in the present study.

Seasonally high lipid content was observed during monsoon season in both the species. The seasonal variations of fat content in the present study and earlier studies in other species may be the different spawning periodicities. The lipid content analyzed for the two fishes indicated that *L. spadiceus* was an average fat fish whereas *L. lunaris* was a fat fish.

Carbohydrates formed a minor percentage of the total composition of the muscle. The low values of carbohydrates recorded in the present study could be because glycogen in many marine animals does not contribute much to the reserves in the body. As the water content increases, ash content decreases slightly under conditions of starvation.

The present study indicates that the two species of fish studied are nutritionally equal to any other food fish and they could be used for food and for preparing various fish by-products. Variations in biochemical composition in present study may be governed by spawning cycle and feeding activity.

ACKNOWLEDGMENT

The authors are thankful to the Head, Dept. of Marine Living Resources, Andhra University, Visakhapatnam for providing facilities in the laboratory.

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Table 1: Percentage composition of the biochemical constituents (common values for both male and female) of *L. spadiceus* during Jan 2009 - Dec 2009.

Month	Moisture	Protein	Carbohydrate	Lipid	Ash
January	85.17	9.23 ± 0.6187	0.94 ± 0.0457	3.77 ± 0.5600	0.89
February	75.18	20.72 ± 1.7764	1.15 ± 0.0954	1.77 ± 1.4476	1.20
March	76.78	17.0 ± 1.6808	1.13 ± 0.0697	3.40 ± 1.3084	1.70
April	77.36	16.63 ± 1.8025	1.79 ± 0.0946	1.73 ± 0.2510	2.50
May	-	-	-	-	-
June	70.42	19.43 ± 0.8327	2.42 ± 0.0784	4.62 ± 1.0416	3.13
July	80.51	15.00 ± 1.0244	0.88 ± 0.0491	2.31 ± 0.3121	1.31
August	81.95	11.99 ± 0.8924	1.38 ± 0.0774	3.28 ± 0.4345	1.41
September	71.85	22.74 ± 1.4090	1.52 ± 0.0506	3.06 ± 0.3695	0.85

October	82.99	12.25 ± 1.2776	1.27 ± 0.2038	2.64 ± 0.0363	0.86
November	78.41	15.00 ± 1.1088	2.57 ± 0.1357	2.70 ± 1.0234	1.33
December	82.15	12.22 ± 1.2515	1.42 ± 0.2498	2.94 ± 1.2390	1.28

Table 2: Percentage composition of the biochemical constituents (common value for both male and female) of *L. lunaris* during Jan 2009 - Dec 2009.

Month	**Moisture**	**Protein**	**Carbohydrate**	**Lipid**	**Ash**
January	77.50	10.40 ± 0.2599	1.37 ± 0.1701	8.34 ± 0.3703	2.40
February	77.65	10.65 ± 0.8665	2.80 ± 0.5533	7.00 ± 0.6548	1.90
March	78.32	8.50 ± 0.7210	1.70 ± 0.4677	10.50 ± 0.3737	0.98
April	67.94	15.31 ± 0.7545	3.56 ± 0.4669	10.67 ± 0.6050	2.54
May	-	-	-	-	-
June	64.99	15.14 ± 0.0635	3.40 ± 0.0693	12.62 ± 0.4466	3.86
July	65.89	13.93 ± 0.1234	2.42 ± 0.0839	15.62 ± 0.1044	2.15
August	80.54	13.05 ± 0.0290	1.21 ± 0.0505	3.80 ± 0.2206	1.41

September	70.63	14.70 ± 0.1747	1.82 ± 0.1631	12.00 ± 0.2666	0.85
October	68.15	14.26 ± 0.2381	3.51 ± 0.1738	9.56 ± 0.2342	4.53
November	69.25	13.73 ± 0.0698	2.65 ± 0.1646	8.71 ± 0.2971	5.66
December	77.58	12.93 ± 0.0113	1.08 ± 0.0878	3.99 ± 0.2263	4.44

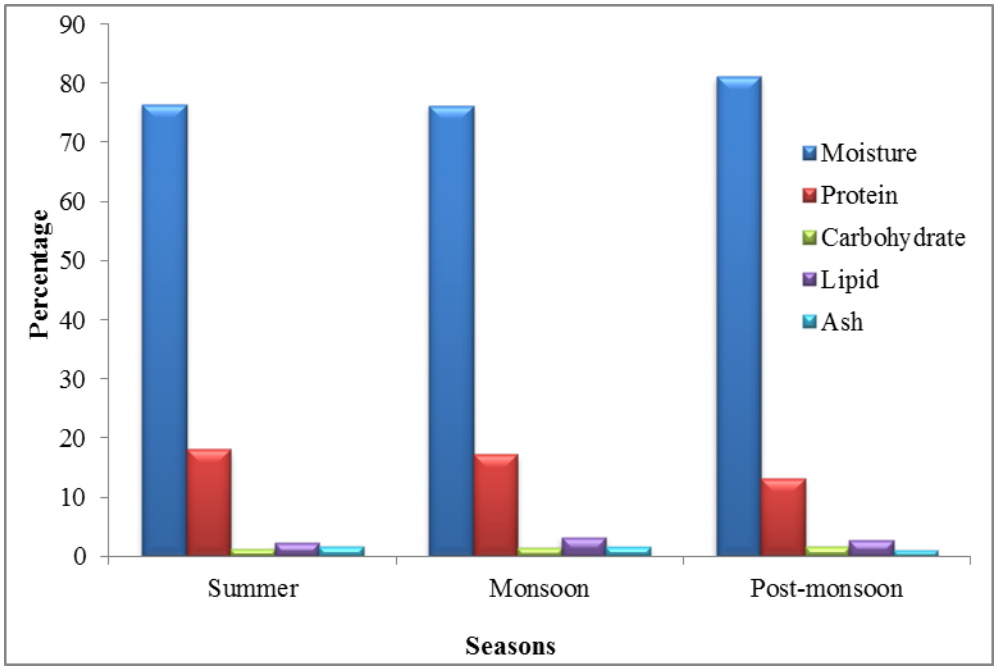

Figure 1: Percentage composition of the biochemical constituents in *L. spadiceus* during Jan 2009 -Dec 2009.

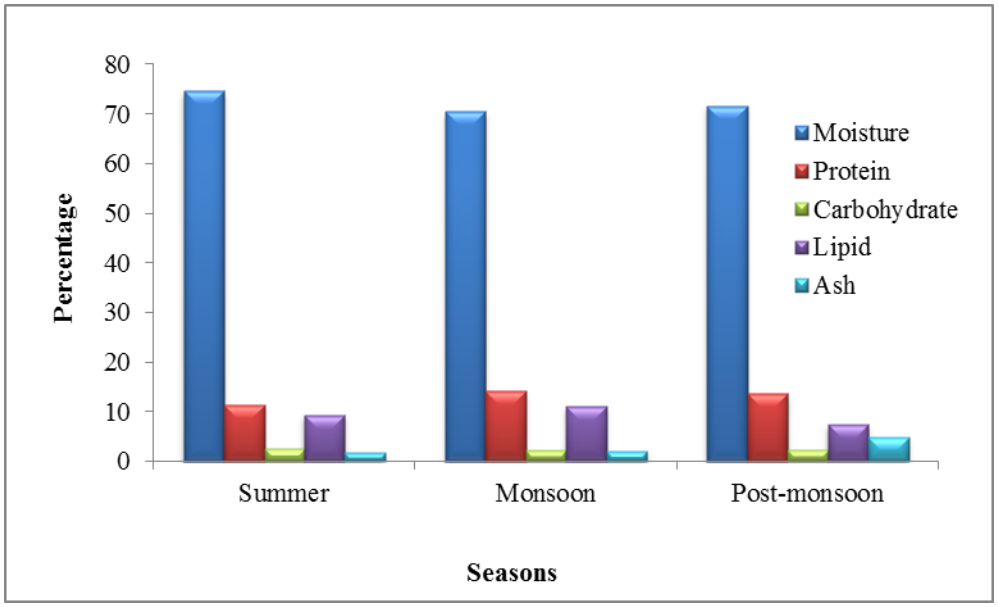

Figure 2: Percentage composition of the biochemical constituents in *L. lunaris* during Jan 2009 -Dec 2009.

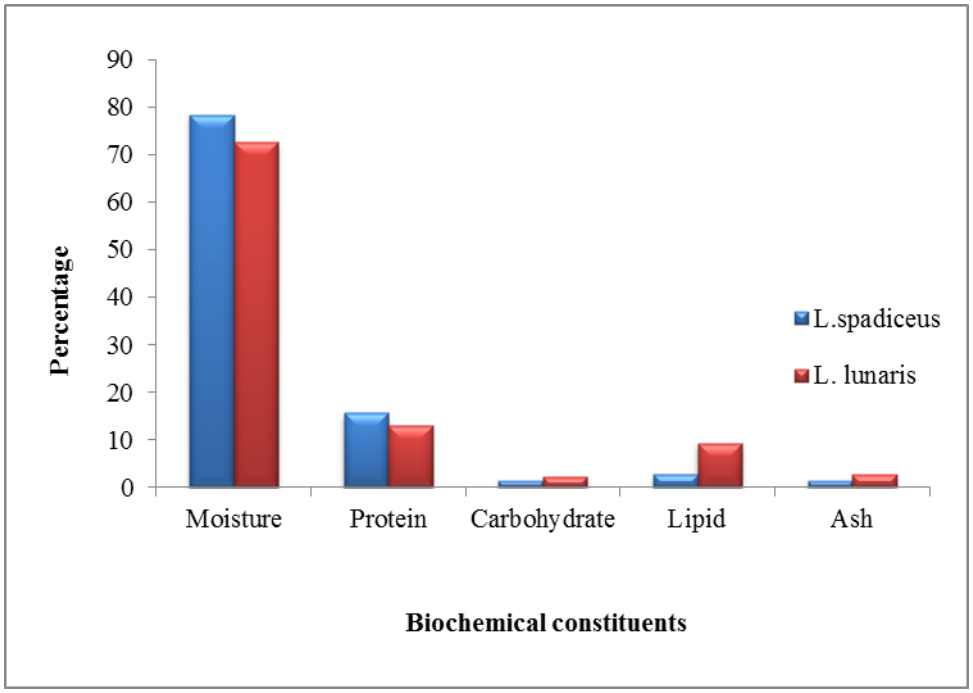

Figure 3: Percentage composition of the mean values of the biochemical constituents in *L. spadiceus* and *L. lunaris* during Jan - Dec 2009.