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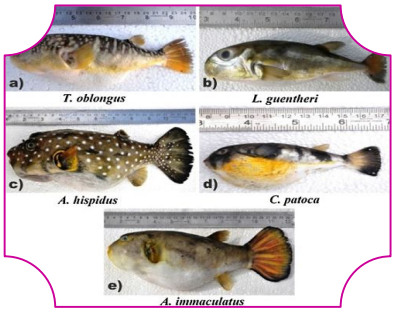
BIOCHEMICAL COMPOSITION OF *SARDINELLA LONGICEPS* DURING DIFFERENT SEASONS AT THOOTHUKUDI COASTAL REGION



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ABSTRACT

Thoothukudi is well known for pearl and fishery. Fish is an important source of multi nutrients providing with cheapest cost. The major constituents of fish muscle are proteins, fats, minerals and ashs. The percentage of water is good indicator of its relative contents of energy, proteins and lipid. Sardinella longiceps is easily available, low cost, and unpalatable having rich protein with alpha fatty acid, and carbohydrate etc. There may be group specific or even species difference in the biochemical composition. Even within a species, variations occur for individual fish or lots of fish taken at different times or under different conditions. Another type of variation in proximate composition occurs between different parts of the same fish. There is generally an increase in the oil content of the muscle from the tail portion towards the head. Similarly the light and red muscle will vary in the biochemical composition. It is against this background that we have to view the data on the biochemical composition of fish. The outcome of this study is expected to help in the elucidation of exact nutritional constituent and the nutritive value available in fish.

KEYWORDS: *Sardinella longiceps, Nutrients, Species, Thoothukudi.*

INTRODUCTION:

Today people are more conscious about health foods and fish has got wide recognition because of its extraordinary nutritional qualities. Information on the biochemical constituents will facilitate a processing technologist to recognize the best potential processing and storage conditions, so that the value is preserved to the maximum degree. The four major constituents in the edible portion of fish are water, protein, lipid and ash. The examination of these four essential components of fish muscle is often referred as proximate analysis. Reliable data on proximate composition of most of the species of fish are difficult to obtain. Stansby had observed that proximate composition was considered to be such an elementary sort of thing that it did not receive due attention from scientist. Even after 40 years, the situation is not different as far as many species of fish are concerned. But this is not the only or basic reason for the absence of accurate and reliable data on biochemical composition of fish. Fishes are very diverse and highly specialized group changed during biochemical adaptation and evolution, consisting roughly of 24,000 species, showing extreme variations in size, shape, appearance etc. The habitat and food intake of these species are equally dissimilar. Some species are exclusively marine while some are limited to fresh water habitats. Some survive in marine as well as fresh water environments. Some marine species migrate to fresh water for spawning. This fish spread over widely different environmental conditions of temperature, salinity, pressure, availability of food etc, profound influence on the biochemical composition. There may be group specific or even species difference in the biochemical composition. Even within a species, variations occur for individual fish or lots of fish taken

at different times or under different conditions. Another type of variation in proximate composition occurs between different parts of the same fish. There is generally an increase in the oil content of the muscle from the tail portion towards the head. Similarly the light and red muscle will vary in the biochemical composition. It is against this background that we have to view the data on the biochemical composition of fish.

Today there is an ever increasing awareness about healthy food and fish is finding more acceptances because of its special nutritional qualities. The vital health benefits of fish is due to the existence of polyunsaturated fatty acid (PUFA), hypocholestermic activity. But when we think about India, the use of these kind of fish are very reduced amount, since the nutritional value of such type of fish has not so far studied completely and deeply. Therefore it is indispensable to make clear the major biochemical components like proximate composition, fatty acid composition and cholesterol content.

Fish generally digests proteins in its muscles. Fish protein has relatively high digestibility and is considered to have high biological and growth promoting value (Shekhar *et al*., 2004). In terms of nutrition, fish is considered as a rich source of protein, good quality fat and micronutrients (Stansby, 1962). Biochemical studies of fish tissue are of considerable interest for their specificity in relation to the food values of the fish and for the evaluation of their physiological needs at different periods of life. It is also necessary to have the data on the composition of fish in order to make the best use of it as food and also to develop the technology of processing fish and fish products. Generally changes in chemical composition of body have been known to reflect storage or depletion of energy reserves. The values of body composition in fishes vary considerably within and between species, with fish size, sexual condition, feeding, time of the year and activity (Weatherly and gill, 1987). Food composition, environment and genetic trait are also known to influence chemical composition of fish (Oni *et al.*, 1983). The raise in human population that lead to lack of animal protein sources all over the world has directed the attention to fish as rapid and healthy compensatory source of good quality animal protein. Fishes are quite different from the other animal food sources, because they provide calories with high quality proteins, which contain all essential amino acids in easily digestable form. So they are beneficial nutrition sources (Weatherley and Gill, 1998).

Health benefits of fish meat has been studied extensively and there are reports which confirm its preventive effects against cardiovascular diseases and some types of cancer, including colon, breast and prostate cancer (Rose and Connoll, 1993; Marchioli, 2001; Sidhu, 2003). These effects are largely attributable to the polyunsaturated fatty acids (PUFA) found in fish oils especially the n-3 family including the eicosapentaenoic acid (EPA or 20:5 n-3), the docosapentaenoic acid (DPA or 22:5 n-3) and the docosahexaenoic acid (DHA or 22:6 n-3) which are not synthesised in the human body but their inclusion in human diets is essential (Alasalvar *et al*., 2002). It is also reported that n-3 PUFA have been recognized as an important component with beneficial properties for the improvement of visual function and also for the prevention of atherosclerosis and thrombosis (Calder, 2003). Moreover bioactive peptides isolated from various fish protein hydrolysates have been shown to exhibit antihypertensive, antithrombotic, immunomodulatory and antioxidative activities (Kim and Mendis, 2006). Proximate composition of a number of marine, freshwater and brackishwater fishes has been reported (Nair and Suseela, 2000; Shekhar *et al*., 2004; Ali *et al.*, 2005; Majumdar and Basu, 2009; Mandal *et al*., 2010; Shamsan and Ansari, 2010b).

Fish constitutes a major source of protein in our diet. Uboma *et al.* (1981) have reported that Nigerians obtain 40% of their animal protein from fish. Fish apart from being important in human diet, its fatty acids are currently under intense scientific investigation because of numerous health benefits attributed to them (Rahman *et al*. 1995 and Clucas & Sutcliffe, 1981). The principal constituents of fish may be divided into five categories, namely; Protein, Lipid, Carbohydrate, Ash and Water. The biochemical analysis of these constituents may vary greatly from species to species and one individual to another depending on age, sex, environment and season (Stansby, 1962, and Love, 1970). According to Kor (1995), the biochemical composition of fish is closely related to feed intake, migratory and sexual changes in relation with spawning. He stated that fish will have starvation periods for natural or physiological reasons such as during spawning, migration or because of external factors like as shortage of food. Higher levels of energy are usually used up by fishes which embark on long migration to spawning grounds. Therefore, fish having

energy reserve in the form of lipids will rely on this. Species performing long migrations before they make specific grounds or rivers may utilize protein in addition to lipids for energy, thus depleting both the lipid and protein reserves, resulting in a general reduction of the biological condition of the fish (Kor, 1995) . Fishes are poikilothermic and live permanently immersed in water, they are directly affected by changes in their ambient medium (Weatherly and Gill, 1987). Body composition is a good indicator of the Physiological condition and nutritional status of a fish but it is qualified time consuming to measure. However, these values (size, sexual condition, feeding season and physical activity) vary considerably within and between species.

A wide variety of proteins occur which are mainly composed of 20 amino acids combined in different arrangement. Ten of the amino acids are classified as essential as they cannot be synthesized by man and therefore fish is important in maintaining a correct dietary balance (Johnwest, 2002) . There is a wealth of literature available on body composition of various fish species (Thronaes and Bremset 2000; Ekpo and Elakhame, 1998 and 2004; Dempson *et al*., 2004; Ali; Igbal; Salam, Iram and Athar 2005a; and Ali, *et al*., 2005b)

MATERIALS AND METHODS

Samples of *Sardinella longiceps* were collected during the period from January 2012 to December 2014. The specimens were appropriately cleaned in the laboratory and the total length, total weight and sex and maturity stages were determined. For biochemical analysis, a segment of head, trunk and tail region after removal of skin was taken from fishes separately and used for moisture, protein, lipid, carbohydrate and ash determination.

Estimation of Moisture content

$$\text{Percentage (\%) of moisture} = \frac{\text{Wetweight – Dryweight}}{\text{Wet weight}} \times 100$$

Estimation of Lipid

Total lipid was estimated by the method of Barnes and Blackstock (1973).

Estimation of protein

Protein was assessed by the method of Lowry *et al.,* (1951).

Estimation of total carbohydrate

The total carbohydrate was estimated by the method of Carroll *et al*., (1956).

Estimation of total Ash

$$\text{Ash \%} = \frac{\text{Weight of dry samples}}{\text{Original weight of the sample}} \times 100$$

Triplicate determinations were carried out on each chemical analysis and mean values were calculated.

RESULTS

The results of present study were tabulated and recorded in Table 1-6. The length and weight of fishes were recorded during different seasons and also the biochemical compositions like moisture content, protein, carbohydrate, lipids and ash content were noted in the different intervals of seasons. The percentage of moisture were observed highest in head region (72.0%) followed trunk and tail region (70.0%) in winter season. While in case of summer season highest percentage of moisture was observed in head region (71%) followed by trunk and tail region (68.66%, 68.57%). In case of protein content tail region

possess (16.21%) highest percentage of protein followed by trunk and head region (14.53%, 15.30%) respectively in winter season. In case of summer season tail possess highest values of protein (15.53%) followed by head region (15.32%) and low in trunk region (11.46%). Lipid percentage was found high in tail region (14.40%) followed by head region (13.23%) and lowest in trunk region (12.43%) in winter season. In summer season, lipid was high in head region (14.20%) and low in tail region (11.04%). In winter season percentage of carbohydrate was observed maximum in trunk region (1.20%) and low in tail region (0.7%). In the case of summer season, the carbohydrate percentage was high in trunk region (1.80%) and low in head region (0.85%). The ash content was found maximum in trunk region (3.2%) during the summer season and low in tail region (1.87%) during winter season. Finally, it was concluded that trunk region of *Sardinella longiceps* is considered excellent and healthier part in terms of nutrition throughout the year.

Table 1. Biochemical composition of head region from *Sardinella longiceps* during winter season

Months	Mean length (cm)	Mean weight (gm)	Moisture (%)	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)
December	20.2	76.5	68	15.30	13.20	0.84	2.33
January	20.5	78	68.30	15.17	12.90	0.88	2.33
February	20.3	70	72	14.36	10.33	0.86	3

Table 2. Biochemical composition of trunk region from *Sardinella longiceps* during winter season

Months	Mean length (cm)	Mean Weight (gm)	Moisture (%)	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)
December	19.2	74	70.58	14.53	12	1.15	2
January	19.4	74	70	14.10	12.18	1.20	2
February	19.5	76	70	14.43	12.46	0.97	2

Table 3. Biochemical composition of tail region from *Sardinella longiceps* during winter season

Months	Mean length (cm)	Mean weight (gm)	Moisture (%)	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)
December	20.1	76.5	66	16.21	14.40	0.82	2.38
January	20.5	78	66.53	15.56	14.25	0.82	2.47
February	20.3	70	70	14.80	11.96	0.70	1.81

Table 4. Biochemical composition of head region from *Sardinella longiceps* during Summer season

Months	Mean length (cm)	Mean weight (gm)	Moisture (%)	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)
April	20.2	76.5	66	15.36	14.20	0.93	2.69
May	20.5	78	66.33	15.25	14.33	0.88	2.70
June	20.4	70	71	14.28	13.86	0.85	2.60

Table 5. Biochemical composition of trunk region from *Sardinella longiceps* during summer season

Months	Mean length (cm)	Mean weight (gm)	Moisture (%)	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)
April	19.1	74	68.33	11.48	12.63	1.44	2
May	19.3	74	68.57	11.46	13.56	1.20	3.2
June	19.5	76	68.33	11.83	13.27	1.80	2.33

Table 6. Biochemical composition of tail region from *Sardinella longiceps* during Summer season

Months	Mean length (cm)	Mean weight (gm)	Moisture (%)	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)
April	19.1	74	68.33	15.53	11.66	0.90	2.33
May	19.3	74	68.66	15.20	12.18	0.91	3
June	19.5	76	68.48	15.34	11.04	0.89	2.33

DISCUSSION

The present study was based on biochemical composition of *Sardinella longiceps* from Tuticorin coast. From the present finding moisture percentage was found between 66.0-72.0%. Numerous researchers also found similar results like Tawfik, (2009) also reported 77.8% of moisture for the *Carangoides fulvoguttatus*. These variations in moisture content may be affected by lipid contents of diet as well as during different stages of life cycle (Sahu *et al*., 2014; Salam and Davies, 1994) these all values are similar with the present findings. Percentage of protein content was observed between 11.46-16.21% in the present study from the fish *Sardinella longiceps.* Some other investigators estimated the crude protein (17.8 and 19.1%) in fish (Susan *et al*., 1999: Hasan *et al*., 2015) reported protein content in *Labeo rohita* ranged from 16.4% to 18.55%.and mean value of protein content was 17.34%. Lipid percentage in the present finding was ranged between 10.33- 14.40 %. the result of different researchers also support the finding like Turan *et al*. (2007), the values obtained for fat in this present study are higher than figures obtained for marine fishes such as *Trigia sp*, *Clupea herengus* etc., with a range of 0.5-2.2%. As the fat content rises, the water content falls and vice versa. (Naeem *et al.,* 2011) reported lipid percentage 6.98-33.83 in *Notopterous notopterous*. Abbasi and Ogar (2012) reported lipid content 17.1 in Snake head fish *Parachanna obscura*. Anusuya and Farzana *et al* (2013) reported fat % 21.3 in *Notopterous notopterous*. Hemalatha (2014) showed percentage of result 12.8% in *Channa straita*. All above results are in accordance with the present findings.

Bhuiyan *et al.* (2003) reported higher fat and protein content in ripe and gravid fish whereas a low level of fat and protein was recorded in spent and young fish. The feeding intensity does not appear to have any effect on the protein content. Well–marked seasonal variations were observed in the concentration of different chemical constituents in *Clarius batrachus* and these changes have been attributed to factors like feeding and gonad maturation. The low values recorded for protein and fat during the spawning period presumably indicate mobilization of these constituents towards gonad development.

Ash content was noticed from 2.0-3.0 % from the fish *Sardinella longiceps*. Similar results were also presented by Ahmed *et al*.,(2015). They researched on wild and pond raised *Catla catla* and reported that higher ash contents were found in head of large sized fish. These scientists' results support our finding. Generally, the ash content Level gives an indication that fish may be good sources of minerals such as calcium, zinc, potassium, magnesium and iron (Bolawa, *et al*., 2011).

Ash content is a reflection of the mineral content in the sample. The values observed in the samples studied are lower than that reported for four Commercial West African Freshwater food fishes, 5.96 ± 0.42 – 6.74 ± 0.95 (Oyedapo; Mosunnola; Oluwayemis; and Ameenal 2005). But the same with reports from Comparative Study of Body Composition of different fish species from brackish water pond and Comparative

study of body composition of four fish species in relation to pond depth from the works of Ali *et al.* (2005a and 2005b).

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