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Nutritional value of fringe scale sardine, *Sardinella fimbriata* (Cuv. and Val.) from Karwar waters

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Abstract

Today, there is an increasing demand for fish because of their special nutritional qualities. People are aware of healthy eating habits and thus prefer fish as part of diet. Worldwide fish and fish products are important and comparatively cheaper source of animal protein. Hence, the proximate composition of, the fringe scale sardine, *Sardinella fimbriata*, (Cuv. and Val.) has been studied from Karwar waters, Karnataka, from December- 2011 to December- 2012. Onboard fresh fish samples were collected monthly as this fish deteriorates very fast. In *S. fimbriata* average yearly values recorded for moisture, protein, lipid, carbohydrate and ash content were 68.60% and 68.89%; 14.40% and 17.59%; 9.70% and 10.89%; 0.4% and 0.38% and 6.95% and 6.61% for males and females respectively. The calculated calorific value of *S. fimbriata* was 1.75 k cal /gm (Approximately 2 k cal /gm). Present attempt will be useful to fill up the gaps which exist between our knowledge and lesser sardine exploitation.

Keywords: Biochemical composition; Fringe scale sardine; Nutritive value *Sardinella fimbriata*.

1. Introduction

Karwar is one of the major fish landing centers from Uttara Kannada district of Karnataka. It is significant to study the nutritive value of *S. fimbriata* because it is preferred by coastal people either in fresh or salted, dried form. *S. fimbriata*, studied for biochemical composition and nutritive value during the period December- 2011 to December- 2012. Clupeids rank second, amongst the commercial food fishes of the world. In India, clupeid fish contribute about 1/3rd of the total marine fish production, mainly represented by the sardines, anchovies and white baits. The investigation and the work regarding the knowledge about nutritive value of *S. fimbriata* are of commercial importance because it contributes the lucrative fishery. Sardines and lesser sardines form a major fishery resource among the marine pelagic fin fishes of the Indian seas, of which *S. fimbriata* and *S. gibbosa* dominate in the commercial catches landed in and around Karwar.

According to [1] fish serves good source of quality animal proteins, contains majority of easily digestible amino acids. Fish proteins are highly digestible and have high biological and growth promoting value [2]. Proximate composition of various fishes has been studied by different authors, amongst notable ones are by [3-5]. Little attention is paid on the study of this particular aspect at Karwar coast thus by keeping these points in view, a short term study of the nutritive value of the fringed scale sardine, *S. fimbriata* (Cuv. and Val.) from Karwar waters was undertaken.

2. Material and Methods

Karwar is located at 14° 48' N and 74° 07' E. Karwar waters have rich fauna and flora. Karwar has the Kali estuarine complex which undergoes greater fluctuations during the South-West monsoon. The Kali estuary makes the food available in enormous quantities and also provides breeding ground for the commercially important fishes.

Fresh fish samples were collected onboard as well as from the fish landing centers Baithkol and Majali, monthly between December-2011 and December-2012. The specimens ranging from 110 to 160 mm of standard length were selected for the biochemical analysis. Fish were properly cleaned, blotted with blotting paper to remove excess moisture (onboard as well as in the laboratory); then the total length (nearest 1mm) and total weight (nearest 1mg) was taken and fish were dissected for the determination of sex and maturity stages. For biochemical analysis, after removal of skin a portion (five gram) of tissue from the widest part of the body

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(Without bones) was weighed and taken from male and female fish separately for the analysis of moisture, protein, fat, carbohydrates and ash contents.

2.1. Estimation of moisture content

For the estimation of the moisture content pre-weighed (five gram) wet sample was weighed and dried at 60-80 °C for 24 hours in a thermostat until getting the stable weight. Percentage moisture content of the sample was calculated by using following formula:

$$\frac{\text{Wet weight} - \text{Dry weight (mg)}}{\text{Weight of the sample (mg)}} \times 100$$

2.2. Estimation of lipid content

Lipid percent (%) for wet body weight =

$$\frac{\text{Weight of lipid (mg)}}{\text{Weight of the sample (mg)}} \times 100$$

The total lipid estimation was carried out by method of [6]. The lipid content was expressed as percentage by using following formula:

Lipid percent (%) for wet body weight =

$$\frac{\text{Weight of lipid (mg)}}{\text{Weight of the sample (mg)}} \times 100$$

2.3. Estimation of protein

For the estimation of protein [7] method was used.

2.4. Estimation of total carbohydrate

The percentage of total carbohydrates were calculated by simply subtracting the percentage of protein, lipids, moisture and ash from hundred.

$$\text{Percentage of Carbohydrate (\%)} = 100 - (\% \text{ Moisture} + \% \text{ Protein} + \% \text{ Lipids} + \% \text{ Ash})$$

2.5. Estimation of ash content: Porcelain crucibles were heated at 500 °C and weighed. Total 5 gm of dry sample was each taken from each fish in the crucibles and allowed to vaporize at 500-600 °C temperature until getting grey to white residue. Crucibles were kept in to the desiccators to cool and removed and then kept at room temperature for few minutes. The process of heating, desiccating and weighing was repeated till obtaining the constant weight. Final weights of the crucible were taken and deducted from the previous weight. The ash content was expressed on the dry weight basis by using formula:

Percentage ash content (%) =

$$\frac{\text{Mass of Ash content}}{\text{Mass of weight sample}} \times 100$$

3. Results and discussion

Seasonal variation in biochemical composition of males and females of *S. fimbriata* was studied between December- 2011 and December- 2012.

3.1. Moisture

Moisture is the main component; during the study period on an average it contributed 68.60% and 68.89% in males and females respectively. In males and females maximum water content was observed in the month of March (75.33%) and (74.31%); values were varied between 74.81% to 75.85% (±0.52) and 73.5% to 75.12% (±0.81) respectively. In males and females, lowest water content was observed in the month of December 60.16% and November 61.7%; varied between 59.71% to 61.06% (±0.45) and 61.03% to 62.37% (±0.67) respectively. Moisture content showed increase during the spawning season and showed similar trend like that of lipid while showed inverse relation with protein. In both the sexes, soon after the spawning season moisture values showed marked decrease with slight fluctuations and December onwards moisture content showed rising trend coincided with the growth and maturation.

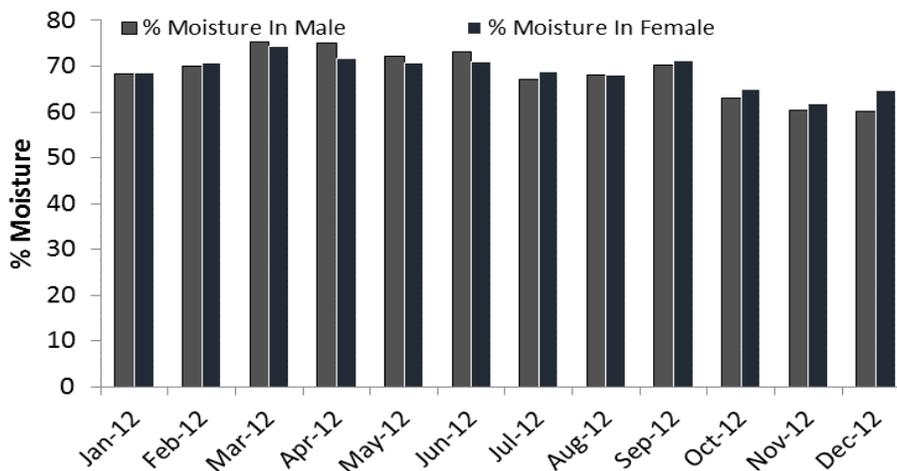


Fig 1: Percentage of moisture content in the tissues of male and female- *S. fimbriata* between January-2012 to December-2012

3.2. Proteins: showed inverse relationship between moisture and lipid content. During the study period on an average it contributed 14.40% and 17.59% in males and females respectively. Comparatively average protein content was higher in females than males. In males and females maximum protein content was observed in the month of November (22.24%) and (20.13%); values were varied between 21.57% to 23.58% (± 0.67) and 19.67% to 20.59% (± 0.46) respectively. In males and females, minimum values for protein were recorded during April 7.45% and 6.85%; varied between 7.11% to 8.13% (± 0.34) and 6.34% to 7.36% (± 0.51) respectively. Protein content showed steady decrease during spawning season. In both the sexes soon after the spawning there was abrupt fall in the protein content. This was followed by steady increase in the protein values as the fish entered in the growth and maturity stages.

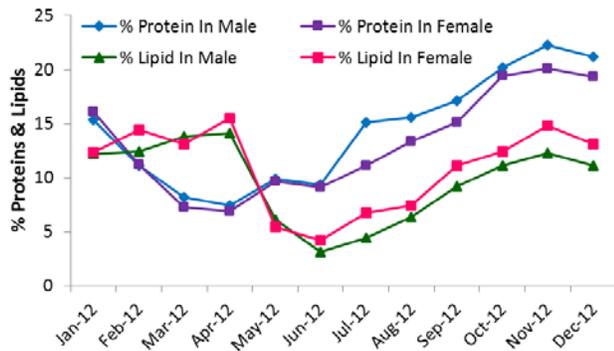


Fig 2: Percentage of protein and lipid content in the tissues of male and female- *S. fimbriata* between January-2012 to December-2012

3.3. Lipid content: showed wide fluctuations during the study period on an average it contributed 9.70% and 10.89% in males and females respectively. Comparatively average recorded lipid content value was higher in females than males. In males and females maximum lipid content was observed in the month of April (14.11%) and (15.52%); values were varied between 13.78% to 14.77% (± 0.33) and 15.21% to 15.83% (± 0.31) respectively. In males and females lower values for lipid content were recorded in the month of June 3.15% and 4.23%; varied between 2.93% to 3.59% (± 0.22) and 4.12% to 4.34% (± 0.11) respectively. Lipid showed inverse trend with protein. In both males and females higher values for lipid content were coincided with the pre-spawning season. In both the sexes soon after the spawning season lipid content showed marked decrease and found to be minimum in the months of May (6.15% and 5.45%); June (3.15% and 4.23%); July (4.43% and 6.73%) and August (6.33% and 7.41%) respectively. Thereafter, lipid content showed steady increase during the growth period and maturation of the fish.

3.4. Carbohydrate

During the study period average carbohydrate values were 0.4% and 0.38% in males and females respectively. In males and females maximum carbohydrate values were observed in the month of July (0.52%) and (0.49%); varied between 0.51% to 0.53% (± 0.01) and 0.47% to 0.51% (± 0.02) respectively. In males and females minimum values for carbohydrate were recorded during April 0.26% and May 0.29%; varied between 0.22% to 0.30% (± 0.03) and 0.26% to 0.32% (± 0.03) respectively. Carbohydrate content showed comparatively less fluctuations throughout the study period.

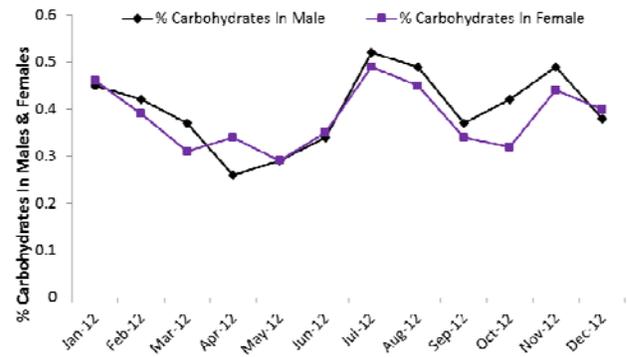


Fig 3: Percentage of carbohydrate content in the tissues of male and female- *S. fimbriata* between January-2012 to December-2012

3.5. Ash content

During the study period average ash content values were 6.95% and 6.61% in males and females respectively. In males and females, maximum ash content values were recorded in the month of July (14.04%) and (15.35%); varied between 14.0% to 14.08% (± 0.04) and 15.33% to 15.37% (± 0.02) respectively. In males minimum values for ash content were recorded during March (2.27%) and September (2.96%) which varied between 2.26% to 2.28% (± 0.01) and 2.94% to 2.98% (± 0.02) and in females during September (2.13%) which varied between 2.12% to 2.14% (± 0.01) respectively. Ash content showed wide fluctuations throughout the study period.

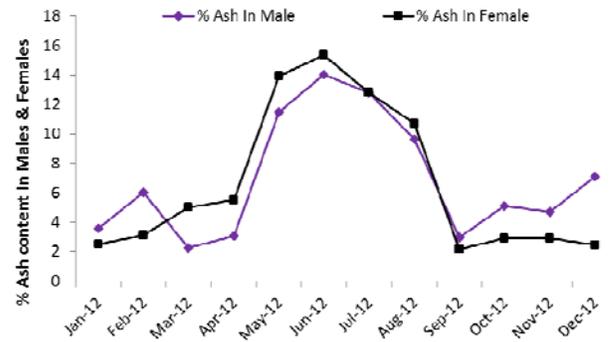


Fig 4: Percentage of ash content in the tissues of male and female- *S. fimbriata* between January-2012 to December-2012

Average values obtained for protein, lipid and carbohydrates during the study period were taken in to consideration (December- 2011 to December- 2012) for computing the food value of *S. fimbriata*. The calculated calorific value of *S. fimbriata* was 1.75 kcal /gm (Approximately 2 kcal /gm). Quality of fish can be determined on the basis of its nutritional value. Seasonal variation in the chemical composition is mainly due to alternate accumulation and utilization of fat and protein [8]. The biochemical composition varies considerably within and between the species as per size, sex, seasons, fish activity, feeding conditions, growth and maturation status [9]. If one of the constituent increases, the other shows a decrease; thus some of these constituents remain constant [3]. Water percentage is good indicator; if water content is low the lipids and protein contents rises [5]. Sum of moisture and lipid content is approximately 80% and remaining components accounts for the 20% [10]. As the size of fish increases, water content decreases and fat content increases [11]. Moisture

content did not differ according to the season ^[2]. Moisture content increases during summer and coincides with the spawning season of the fish ^[12].

Protein is one of the major constituent of the muscles of *S. fimbriata*. Protein values showed increasing trend from June to November. For both males and females, the peak values were recorded in the month of November at this stage maximum number of mature fishes was observed. Thereafter protein values showed decline from December to April (Spawning season), coincided with the post-spawning season. The Relation between feeding and spawning was reported by ^[13]. The depletion of muscle protein during spawning in case of many fishes was noticed by ^[3]. Depletion of protein is might be due to built-up by gonads ^[14]. Comparatively ripe and gravid fishes were with higher fat and protein contents while young and spent fishes were with low fat and protein contents ^[15].

Fat content in the fishes increases due to the consumption of plankton rich food ^[16]. Many authors have reported inverse relationship between the water and protein. Decreases in the protein content lead to the increase in water content ^[17]. Lipid composition gets influenced by seasonal and dilatory variations ^[4]. Lipid content is strong indicator of reproductive potential of fish species ^[18]. Lipid content indicates surplus energy required for the growth, maintenance and reproduction and also stated that good index of future survival of the species ^[19].

Carbohydrates constitute in a minor percentage to the total biochemical composition. Carbohydrates play an important role as energy reserve in animals ^[3]. During spawning activity in fish carbohydrate depletion is negligible as compare to lipid and protein ^[20].

Much more information is available on the biochemical composition of many commercial marine food fishes; few attempts have been made to study the nutritive value of *S. fimbriata*. The present study has been undertaken to add recent information in order to redress the balance.

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