IJBI 2 (2), (DECEMBER 2020) 165-173

International Journal of Biological Innovations

Available online: http://ijbi.org.in | http://www.gesa.org.in/journals.php

DOI:https://doi.org/10.46505/IJBI.2020.2213

Research Article

E-ISSN: 2582-1032

NUTRIENT COMPOSITION OF SOME MARINE EDIBLE FISH SPECIES FROM KASIMEDU FISH LANDING CENTRE, CHENNAI (TN), INDIA

S. Syed Raffic Ali[1*], E. Syed Abdhakir[1], R. Muthukkaruppan[1], M. Asrar Sheriff[1] and K. Ambasankar[2]

[1]Postgraduate and Research Department of Zoology
The New College Chennai (Tamil Nadu), India
[2]Central Institute of Brackishwater Aquaculture, ICAR
R. A. Puram, Chennai (Tamil Nadu), India
Corresponding author: syedraffic699@gmail.com

Received: 09.07.2020 **Accepted:** 10.08.2020 **Published:** 14.08.2020

Abstract: The objective of this study was to determine the morphometric characters, body indices, proximate and mineral composition of seven commercially important marine edible fish species from the Chennai coast, India. The results showed that the morphometric characters varied widely among the fishes studied. The average moisture content ranges from 68.2 to 75.1 %. Majority of fishes had average crude protein content between 51.1 and 74.8 % with highest in *Trichiurus lepturus* (74.8%). The fat content varied widely from 1.49 to 21.5 % with *Arius dussumieri* being the fattiest fish (21.5%). The total ash content ranges from 14.1 to 36.4 %. *Leiognathus equulus* and *Liza macrolepis* had high values of total ash with 36.4 and 28.5 % respectively. Similarly highest carbohydrate was observed in *L. macrolepis* (6.51%). Body indices showed significant differences ($P < 0.05$) among the fishes. *A. dussumieri* and *Terapon jarbua* had high values of hepatosomatic index (2.36 %). Similarly highest viscerosomatic index was observed in *L. macrolepis* (11.1%). Condition factor showed wide variations from 0.06 to 1.53k. The analysis of minerals showed significant differences ($P < 0.05$). Phosphorus content was found to be highest in *T. jarbua* and *T. lepturus*. Similarly highest calcium and iron were recorded in *L. macrolepis* and *A. dussumieri*. The results showed that fish samples were good sources of nutrients and minerals and could provide multi-health benefits if consumed in recommended amounts.

Keywords: Kasimedu coast, Minerals, Morphometric characters, Nutrient composition, Seafood.

INTRODUCTION

Seafood is globally popular because of health, economic, environmental and social benefits as a means of food security (Ali *et al.,* 2020). As compared to red meat (mutton, chicken and beef) fish is one of the most important components of feed for animals and human beings, because of their excellent nutritional profile and easily digestible characteristics (Soundarapandian *et al.,* 2013). It provides high-quality rich protein, lipids, vitamins, minerals, essential amino acids, fatty acids and various extractable compounds required for the growth, development and maintenance of a healthy human body and prevents several nutritional deficiency diseases (Nurnadia *et al.,* 2013). Fishes are also richest sources of ω3 polyunsaturated fatty acids, eicosapentaenoic acid (EPA or 20:5ω3) and docosahexaenoic acid (DHA or 22:6ω3) (Rasoarahona *et al.,* 2005). Regular consumption of fish can reduce the risk of Dementia, Alzheimer's disease and cancer including colon, breast and prostate and prevent the cardiovascular diseases (Palanikumar *et al*., 2014). Minerals play an important role in maintaining body functions because they maintain acid–base balance, and help in haemoglobin formation (Ali *et al*., 2010). Minerals such as calcium, phosphorus iron, copper, zinc and manganese are essential and play important roles in biological systems (Nurnadia *et al.,* 2013). The deficiency of these mineral elements causes diseases, such as inability of blood to clot, osteoporosis, anaemia etc. (Njinkoue *et al.,* 2002).

Proximate composition is traditionally used as an indicator of nutritional quality of food materials. The fishes have moisture, protein, fat and ash in abundance; carbohydrate in minute quantity and other constituents like vitamins and minerals in reasonable quantity (Mumba and Jose, 2005). In fishes, variation in body chemical composition is related closely with feed intake (Oyelese, 2006). The higher the percentage of moisture in the composition is a good indicator of the relative energy, protein and lipid content; the lower the percentage of moisture, the greater the lipids and protein content and the higher the energy density of the fish (Aberoumad and Pourshafi, 2010). Proteins are not only necessary for hormonal and enzyme development but also an important source of energy (Hossain *et al.,* 2002). Fats provide much energy and essential fatty acids while minerals are the major component of bones, blood, and play an important role in osmoregulation (Gatlin, 2010).

Studies on the nutrient composition of fishes from Kasimedu landing centre Chennai were very limited hence authors took the opportunity to explore. In the present study, authors tried to assess the morphometric characters, body indices, proximate and mineral composition of commercially important marine fishes from the Chennai coast.

MATERIALS AND METHODS

Source of fishes

The samples of all the seven fish species *namely Arius dussumieri*, *Liza parsia*, *Liza macrolepis*, *Leiognathus equlus*, *Upenues moluccensis*, *Terapon jarbua* and *Trichiurus lepturus* (Fig. 2) were procured and selected from the fish landing centre Kasimedu (Fig. 1). Fish samples were mixed with soft ice, put in ice box and transported to Nutrition Laboratory of Central Institute of Brackishwater Aquaculture (Indian Council of Agricultural Research) Chennai (TN). The fishes were washed well to remove foreign objects for further analysis.

Morphometric Characters

The morphometric characters are measurable features such as length, breath of the body and so on, by using the divider the linear dimensions of the various morphometric parameters. These were determined and measured on a scale in cm (Ali *et al.,* 2020).

1. **Total length:** It is the maximum elongation of the body from end to end *i.e.* from the anterior projecting part of the head to the posterior most tip of the caudal fin.
2. **Standard length**: It is the distance from the anterior most part of the head to the end of the vertebral column (*i.e*. caudal peduncle).
3. **Fork length**: It is the distance from the anterior most part from the tip of the snout to the cleft of the caudal fin.
4. **Length of head**: It is the distance from the tip of the snout to the posterior edge of operculum.
5. **Diameter of eye**: It is the distance from the anterior aspect of the eye to the posterior aspect of the eye.
6. **Pre orbital length**: It is the distance from the tip of the snout to the anterior aspect of the eye.

7. **Post orbital length**: It is the distance from the posterior aspect of the eye to the end of the head.

8. **Length of dorsal fin (dorsal fin base):** It is the distance from the anterior aspect of dorsal fin to its posterior aspect along its basal region.

9 **Length of pectoral fin**: It is the distance from the base of pectoral fin to the tip of it.

10. **Length of anal fin (anal fin base)**: It is the distance from the anterior to posterior aspect of the anal fin to its posterior aspect along its basal region.

11. **Depth of body (width):** It is the linear length of fish from the base of the dorsal fin to the ventral aspect of the body.

Sample preparation

After measuring the morphometric characters, fishes were dissected out and the digestive tract, liver and gonads were separated and weighed for body indices. The fish samples were cut into small pieces and minced in an electrical grinder and transferred in to an oven set to 105 °C for 12h to dry. Finally, all dried samples were grinded and stored at −18 °C for chemical analysis.

Body indices

These include condition factor (CF), hepato somatic index (HSI), viscero somatic index (VSI) and gonado somatic index (GSI) that were measured following the standardized protocols (Ali *et al.,* 2017).

$$CF = [(\text{Live weight, g}) / (\text{Length, cm})^3] \times 100$$

$$HSI = (\text{Liver weight/body weight}) \times 100$$

$$VSI = (\text{Visceral weight/body weight}) \times 100$$

$$GSI = (\text{Gonad weight/body weight}) \times 100$$

Proximate analysis

Moisture content was determined using the hot air oven, by drying the sample at 105 °C for 12h. Crude protein content was determined by converting the nitrogen content obtained by Kjeldahl's method (Nx6.25). Crude lipid was calculated gravimetrically after extraction with petroleum ether in a soxhlet system (SOCS, Pelican, India). Total ash content was determined after combustion for 6 h at 600 °C in muffle furnace. Total carbohydrate was determined by subtracting the sum of fat content, protein content, ash content and moisture from 100 (AOAC, 1990).

Mineral analysis

Accurately weighted ash samples were treated with HNO_3, $HClO_4$ and deionized water. Mineral content of the digested samples was determined by flame atomic absorption spectrophotometry using a BUCK Scientific 200A apparatus for calcium and iron (Benton and Case, 1990) and by spectrophotometric colorimetric method using a UV spectrophotometer for phosphorus (AOAC, 1990).

Statistical analysis

All the results expressed are the mean of three observations. Data were presented as mean ± standard deviation. One way ANOVA was performed to compare significant differences ($P <$ 0.05). The data were analyzed using SPSS version 16.0 software.

RESULTS AND DISCUSSION

The various morphometric parameters of commercially important marine edible fishes from the Chennai coast are presented in table 1. The results showed that the morphometric characters varied widely among the seven fish species. Morphometric characteristics are measurable characteristics of a species commonly used in fishery biology for measuring discreteness, relationship among various taxonomic categories and also useful in growth studies (Ara *et al*., 2019). The wide variations in morphometric parameters were there due to the taxonomical differences in fish species rather than environmental factors (Ismot and Nabi, 2018a).

The body indices of commercially important seven edible fish species studied is shown in table 3. The results showed that there was a significant difference ($P < 0.05$) in condition factor, hepatosomatic index, viscera somatic index and gonado somatic index. HSI, VSI and GSI showed the highest values in *A. dussumieri* and *T. jarbua*. Condition factor was found to be highest in *T. jarbua*. HSI is directly related to metabolism because glycogen and lipids can be stored in the liver (Nandakumar *et al.,* 2013). GSI is a useful tool to indicate changes in the reproductive cycle. The relative reproductive condition of the fishes of different sizes is measured by determination of gonad index (Ali *et al.,* 2020). The condition factor is used in order to compare the 'condition', 'fatness' or 'wellbeing' of fish, which is based on the hypothesis that heavier fish of a particular length, are in a better physiological condition (Bagenal and Tesch, 1978).

The proximate composition of seven edible marine fish species studied is presented in table 4.

Table 1: Morphometric parameters of seven edible fish species from the Chennai marine coast.

Sl. No.	Parameters/ fishes	*A. dussumieri*	*L. parsia*	*L. macrolepis*	*L. equulus*	*U. moluccensis*	*T. jarbua*	*T. lepturus*
1.	Total weight (g)	61.8	56.1	108.2	22.6	16.4	61.8	63.1
2.	Total length (cm)	21.2	16.8	27.0	11.4	11.4	15.9	46.1
3.	Standard length (cm)	16.0	13.6	17.6	9.2	9.4	13.0	39.0
4.	Fork length (cm)	17.1	16.0	20.1	9.8	10.5	14	-
5.	Head length (cm)	4.5	2.7	3.7	2.7	3.0	3.1	6.0
6.	Diameter of eye (cm)	0.9	0.9	1.3	1.2	0.9	1.3	1.2
7.	Pre orbital eye (cm)	1.9	0.7	1.0	0.7	0.8	0.9	2.2
8.	Post orbital eye (cm)	2.2	1.9	2.5	1.2	1.4	1.6	2.8
9.	Length of 1st dorsal fin (cm)	2.7	-	1.8	2.3	1.6	3.9	25
10.	Length of 2nd dorsal fin (cm)	1.7	1.8	1.7	3.1	1.2	2.6	-
11.	Length of pectoral fin (cm)	3.8	3.2	3.4	2.2	2.2	2.1	2.1
12.	Length of pelvic fin (cm)	3.0	1.7	2.8	1.9	1.5	2.4	-
13.	Length of anal fin (cm)	0.6	0.3	0.3	0.7	0.5	0.3	0.3
14.	Depth of the body (cm)	3.6	3.9	5.4	4.7	2.8	5.2	2.8

Table 2: Food and feeding habits of seven edible fish species from the Chennai marine coast.

S.No	Family	Fish Species	Common name	Feeding habits	Type of feeding
1.	Ariidae	*Arius dussumieri*	Cat fish	Carnivores	Bottom feeder
2.	Mugilidae	*Liza parsia*	Mullet	Plankton feeder	Bottom feeder
3.	Mugilidae	*Liza macrolepis*	Mullet	Plankton feeder	Bottom feeder
4.	Leiognathidae	*Leiognathus equulus*	Silver belly	Carnivores	Bottom feeder
5.	Mullidae	*Upenues moluccensis*	Goat fish	Zooplankton feeder	Bottom feeder
6.	Terapontidae	*Terapon jarbua*	Crescent perch	Omnivores	Surface feeder
7.	Trichiuridae	*Trichiurus lepturus*	Ribbon fish	Carnivores	Surface feeder

Table 3: Body indices of seven edible fish species from the Chennai marine coast.

S.No	Fish Species	HSI (%)	VSI (%)	GSI (%)	CF (k)
1.	*A. dussumieri*	2.36 ±0.06	7.74±0.02	-	0.64±0.07
2.	*L. parsia*	0.81 ±0.02	5.32±0.06	2.39±0.15	1.18±0.05
3.	*L. macrolepis*	1.15±0.04	11.1±0.16	1.27±0.24	0.54±0.03
4.	*L. equulus*	0.73±.0.06	3.23±0.08	1.91±0.34	1.53±0.01
5.	*U. moluccensis*	0.38±0.12	7.66±0.03	-	1.11±0.02
6.	*T. jarbua*	2.36±0.04	7.70±0.11	-	1.53±0.19
7.	*T. lepturus*	0.97±0.08	1.48±0.09	-	0.06±0.10

Notes: All values are mean ± SE of three observations.

Table 4: Proximate composition (% dry matter) of seven edible fish species from the Chennai marine coast.

S.No	Fish Species	Moisture	Crude protein	Crude lipid	Total Ash	Carbohydrates
1.	*A. dussumieri*	68.20±0.40	51.12±0.33	21.58±0.09	24.39±0.17	2.91±0.23
2.	*L. parsia*	69.15±0.47	61.98±0.94	16.55±0.03	19.17±0.46	2.30±0.34
3.	*L. macrolepis*	69.29±0.77	57.38±0.10	7.53±0.08	28.58±0.27	6.51±0.27
4.	*L. equulus*	70.89±0.59	60.51±0.36	1.49±.0.09	36.46±0.35	1.60±0.50
5.	*U. moluccensis*	73.95±0.53	69.03±0.48	9.89±0.12	16.23±0.43	4.85±1.05
6.	*T. jarbua*	72.23±0.57	65.52±0.94	9.11±0.08	22.49±0.86	2.88±0.11
7.	*T. lepturus*	75.10±0.54	74.84±0.71	9.70±0.05	14.11±0.74	1.39±0.47

Notes: All values are mean ± SE of three observation.

Highest moisture content was observed in *T. leptrus* (75.1%) and lowest in *A. dussumieri* (68.2%). Results clearly indicated a marked fluctuation of protein content in all the seven fish species. Highest crude protein content was observed in *T. leptrus* (74.8%) and lowest (51.1%) in *A. dussumieri.* Crude lipid content of different fish species also varied considerably. The highest lipid content was observed in *A. dussumieri* (21.5%) and lowest in *L. equulus* (1.49 %). The total ash content was highest in *L.macrolepis* (28.5%) and lowest in *T. leptrus* (14.11). Highest carbohydrates were observed in *L. macrolepis* (6.51%) and lowest in *T. leptrus* (1.39 %).

The major constituents in the edible portion of the fishes are moisture, protein, fat, ash and carbohydrates (Ismot, 2013). Moisture (water), a major component in the body of fish is essential for all living organisms. The body fluid acts as medium of transport for nutrients and metabolites etc. The proportion of moisture in fish varies widely from 65-90 %, although it is normally in the range of 70-75 % (Barua *et al.*, 2012). Fish protein is easily digestible and contains most of the essential amino acids in required proportions (Pirestani *et al.,* 2009). It is also rich in non-protein amino acid taurine, which has unique role in neurotransmission (Hossain *et al.,* 2002). The protein content of fish muscle ranges between 16 and 21 % and the protein content < 15 % in the body of fish signifies low protein. Studies have shown that the fat content is inversely proportional to the moisture content (Ara *et al.*, 2019). Variations in age and maturity within the same species may also contribute to the differences in the fat contents (Ismot and Nabi 2018b). Ash is the white residue left after ashing the fish sample. The ash content of fish also varies from 0.5-5 %. Fish is a good source of minerals and the total mineral content in wet fish meat ranges from 0.6 to 1.5 % (Ravichandran *et al.,* 2012).

The mineral content of commercially important marine edible fishes is shown in fig. 3-5. The results showed that there was a significant difference among the fishes in minerals like calcium, phosphorus and iron. Highest calcium content was recorded in *L. macrolepis,* highest phosphorus in *T. jarbua* and *T. leptrus;* highest iron in *A. dussumieri*. Seafood is rich source of various minerals since many of the elements take part in some metabolic processes (Sivaperumal *et*

Fig. 1: Fish landing center Kasimedu, Chennai.

(A) Cat fish, *Arius dussumieri*

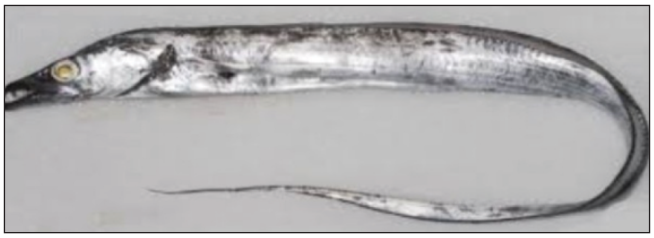
(B) Gold-spot mullet, *Liza parsia*

(C) Large scale mullet, *Liza macrolepis*

(D) Silver belly, *Leiognathus equlus*

(E) Goat fish, *Upenues moluccensis*

(F) Crescent perch, *Terapon jarbua*



(G) Ribbon fish, *Trichiurus lepturus*

Fig. 2: Seven Fish species collected and studied from fish landing center Kasimedu, Chennai.

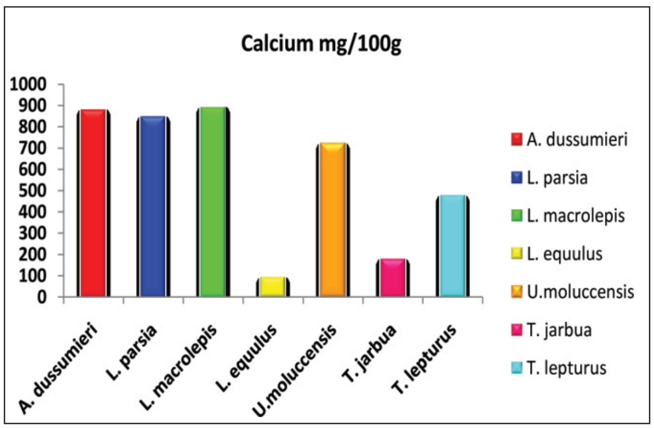


Fig. 3: Calcium content of seven edible fish species from Chennai marine coast.

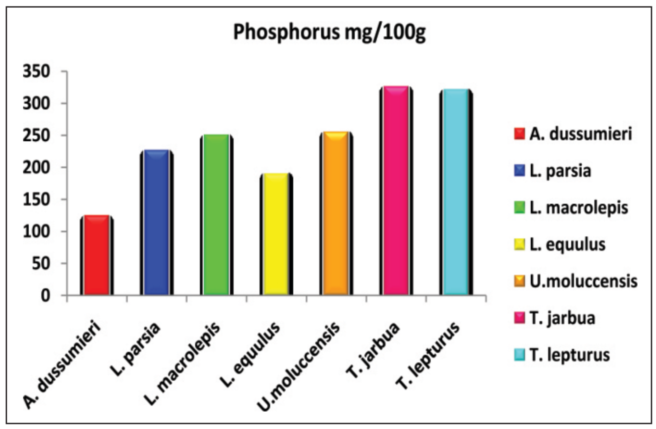


Fig. 4: Phosphorus content of seven edible fish species from Chennai marine coast.

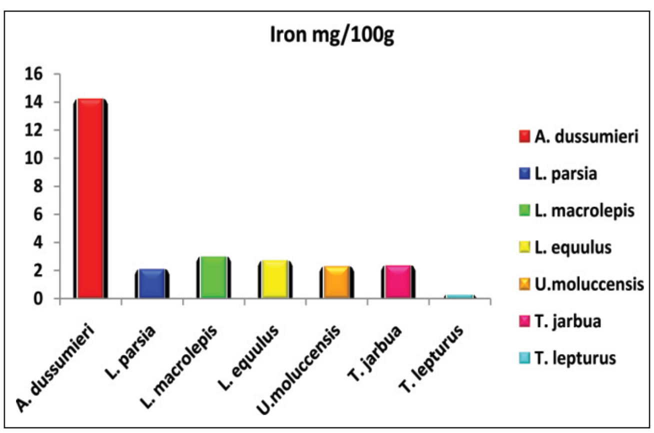


Fig. 5: Iron content of seven edible fish species from Chennai marine coast.

al., 2007). The body usually contains small amount of these minerals, some of which are essential nutrients and contribute to the growth of the fish (Alasalvar *et al.*, 2002). The total content of minerals in raw flesh of marine fish is in the range of 0.6 –1.5 % of wet weight (Nurnadia *et al.*, 2013). However, wide variation in mineral composition of seafood's can occur due to seasonal variations like area of catch, processing method, food source and biological differences like species, size, body color, age, sex, sexual maturity and environmental conditions like pH, salinity, temperature, dissolved oxygen and turbidity etc. (Turhan *et al.*, 2004).

The present study revealed that the analyzed fish species are good source of major nutrients and essential elements therefore recommended to consume these fish species regularly for better human health.

ACKNOWLEDGEMENTS
The authors express their sincere thanks to Dr. K. K. Vijayan Director, Central Institute of Brackish water Aquaculture (ICAR) Chennai (TN), India for providing necessary laboratory facilities for carrying out this work.

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