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Proximate Composition and Fatty Acid Profiling of Indian Mackerel (*Rastrelliger kanagurta*) off Ratnagiri, West Coast of India

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ABSTRACT

In the present study proximate composition and fatty acid profile of Indian mackerel were analyzed. The percentage of moisture, protein, fat and ash content were 72.24%, 19.14%, 8.19% and 1.42 respectively. MUFA was most abundant (50%) fatty acid followed by PUFA (32.61%) and rest (17%) was SFA. Almost 17 major fatty acids were found in oil extracted from Mackerel. Overall, the most abundant fatty acids were C16:1, C18:1 and C20:5, which constituent about 28.93 %, 21.46 % and 20.65 % respectively. The nutritionally important PUFA was almost 32.61 % of the total fatty acid in which, n-3 fatty acids (EPA and DHA) were most abundant (32.57 % of the total fatty acid). The EPA was the dominated fatty acid in the n-3 fatty acid 20.65 % of the total fatty acids. SFA was 15.95 % in the total fatty acids with higher quantity of myristic acid. MUFA was 51.42 % in total fatty acids with higher quantity of palmitoleic acid. The present study demonstrates that mackerel is a cheap source of protein, rich in fat content and availability of different fatty acids which are considered as beneficial to human health.

Key words: *Proximate composition, Fatty acid profile, Indian mackerel, EPA, DHA*

INTRODUCTION

The Indian mackerel (*Rastrelliger kanagurta*) is an important fish caught along the West Coast of India and constitutes major fishery resource of this region. Nearly 90% of the world production is constituted by India and that of 70% is obtained from West Coast of India. During the year 2015-16, about 2.49 lakh tons mackerel were caught along the entire Coast of India.[1] Locally fresh mackerel is consumed and exported in internal markets in the form of frozen, dried and canned. Fresh and value added Mackerel is exported to Southeast Asian countries.

The proximate composition of any fish is good indicator of quality of fish. Fish is considered as one of the cheapest source of protein, essential amino acid and unsaturated fatty acids in human diets. The chemical composition of fish varies greatly with species, sex, age, environment and season.

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The polyunsaturated fatty acids (PUFAs) are considered as the physiologically active factor being actively participates in gonad maturation, egg quality [2] and larval growth of fish[3]. The fatty acid composition of fish oils is different from vegetable oils and animal fats. The major difference is bearing a wider range of chain lengths (from 12-24 carbons), a higher degree of unsaturation (up to 6 double bonds), and a lower in branched and odd numbered chains. Additionally, the fatty acid composition in seafood bears relatively low content of saturated fatty acids (SFA). The link between SFA consumption and the development of cardiovascular disease (CVD) has generally been assumed and hence low intake of SFA is recommended[4]. Fish oil constitutes most beneficial bioactive long chained PUFA i e. EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). However, the EPA content is different in various fishes, while the DHA variations content are very smaller[5].

Considering human health, consumption of fish can reduce the risk of mortality from coronary heart disease and that of consuming EPA and DHA may reduce the risk of mortality from cardiovascular disease, anti-inflammatory, ant-thrombotic effects, reduction of blood cholesterol level and prevention of cancer. Understanding the importance of EPA and DHA, there has been an increasing interest in the effects of EPA and DHA in human nutrition over the last 40 years [6]. Realizing the importance of fatty acid profile, the present study was aimed at analysis of proximate composition and characterization of fatty acid.

MATERIAL AND METHODS

In the present study Indian mackerel (*Rastrellliger kanagurta*) was used from Ratnagiri, West Coast of India. The fresh samples were collected from Mirkarwada landing center, Ratnagiri in isolated ice box and brought to laboratory. The average length and weight was 21cm and 175gm respectively, excluding very small sized fishes. Immediately, fishes were cleaned with chlorinated water. The meat was separated from bone, skin and fins manually. The obtained meat was macerated by using mortar-pastle for estimation of proximate composition and fatty acids.

Proximate composition Analysis: The meat was analyzed for proximate composition which includes moisture, crude protein, fat and ash by following standard methods of AOAC[7]. The moisture content was estimated by moisture analyzer (Milton Model – Mm113.11). Crude protein was estimated by using Kjeldahl method (Kel Plus Classic DX, Pelican, India). Fat content was determined by Soxhlet method (Sosc Pus-SCS 2, Pelican, India). Ash content was estimated by using muffle furnace (Classic Scientific, India). All used chemicals were of analytical grade. All results were calculated in percentage on wet weight basis.

Fatty acid analysis: Lipid content of meat was extracted by following Folch method[8]. Fatty acid analysis was carried out with two consecutive steps, firstly, preparation of fatty acid methyl ester (FAME) and then chromatographic analysis[9]. FAME was prepared from the isolated lipids by firstly heating with the methanolic NaOH following BF_3 methanol for esterification. To recover the methyl esters in organic phase 5 ml n-heptane was added. The mixture was washed with saturated NaCl solution and by using a separated funnel two phases were separated. The upper n-heptane phase was pipetted out and stored in 10 ml glass vials until further analysis.

Fatty acid methyl esters were separated by using gas Chromatography-mass Spectrometer (GSMS; Shimadzu QP2010 quadrupoleMS, M/s Shimadzu, Kyoto, Japan) equipped with a Carbowax (30 m x 0.25 mm ID; 0.25 μm film thickness) capillary column (M/s Cromlab, USA) with helium as a carrier gas. Injection was performed in split mode (1:15) being injector and detector temperature set at 250 ^{0}C. The column temperature was programmed initially at 50 ^{0}C for 2 min and then ramped at a rate of 10 ^{0}C per min to a

final temperature of 230 ^{0}C. FAME was separated at constant pressure (23.1 kpa) and peaks were identified by comparing standard mass spectral data and by comparing retention time. The obtained peak area was quantified and expressed in percentage of total fatty acids.

RESULTS AND DISCUSSION

Proximate composition estimated from mackerel is shown in Fig 1. Moisture content and fat content is inversely proportional to each other indicating that fatty fishes have relatively less moisture content. Hence, it is confirmed in the present study that moisture and fat content was 72.24 % and 8.19 % respectively. Estimated protein content was 19.14% which indicates that Mackerel is a good source of cheap protein. Ash content was 1.42% which is at its normal level. The moisture content in the present investigation on the same species is almost similar to earlier research[10,11]. Following proximate compositions were different than previous studies, namely, fat content[10,11], protein and ash content[10], However, the present study showed that fat content and ash content is almost similar to that of previous studies[11].

Fatty acid composition of mackerel oil is presented in Table 1. MUFA (monounsaturated fatty acid) was most abundant (50%) fatty acid followed by PUFA (32.61%) and rest (17%) was SFA (Fig. 2). Almost 17 major fatty acids were found in oil extracted from Mackerel (Table 1). Among these, C14:0 and C16:0 from SFA, C16:1 and C18:1 (n-9) from MUFA, C20:5 (n-3) and C22:6 (n-3) from PUFA were most abundant. Overall, the most abundant fatty acids were C16:1, C18:1 and C20:5, which constituent about 28.93 %, 21.46 % and 20.65 % respectively. The nutritionally important PUFA was almost 32.61 % of the total fatty acid in which, n-3 fatty acids (EPA and DHA) were most abundant (32.57 % of the total fatty acid). The EPA was the dominated fatty acid in the n-3 fatty acid 20.65 % of the total fatty acids. SFA was 15.95 % in the total fatty acids with higher quantity of myristic acid. MUFA was 51.42 % in total fatty acids with higher quantity of palmitoleic acid.

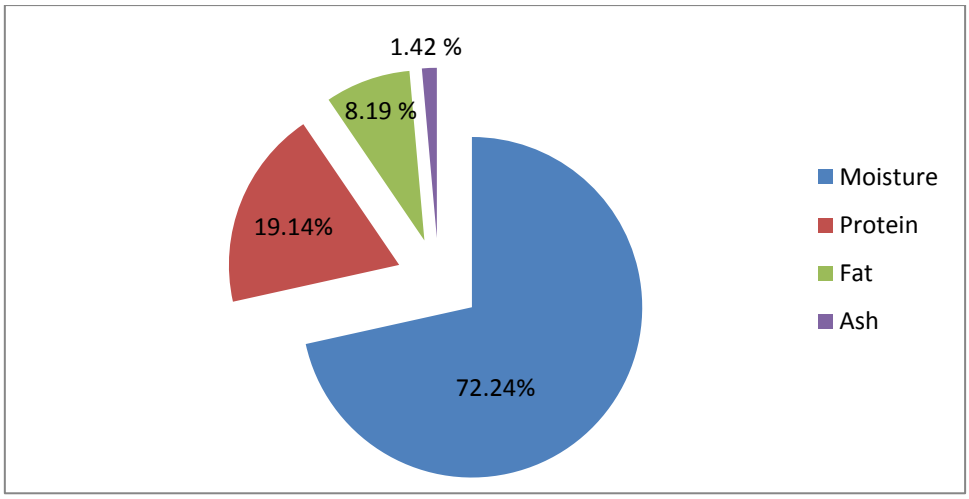

Fig. 1: Proximate composition in mackerel

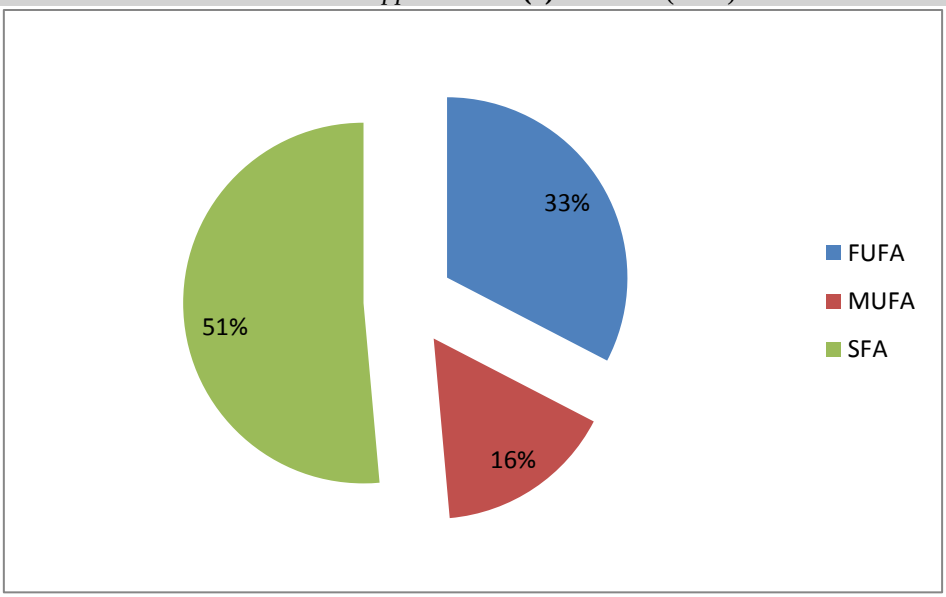

Fig. 2: Fatty acid Composition in mackerel

MUFA, PUFA and SFA were different than earlier studies on the same species[12,13]. Marichamy *et al.*[12] reported that Palmetic (28.94 %) and stearic acid (11.36 %) were most abundant among SFA, Oleic acid (11.40 %) among MUFA and archidonic acid (23.74 %) among PUFA. Nurjanah *et al.*[13] reported that palmitic acid (16.1 %), oleic acid (4.41 %) and DHA (15.54 %) were most abundant among SFA, MUFA and PUFA respectively. However, in the present study myristic acid was most abundant among SFA, palmetoleic acid among MUFA and EPA among PUFA. This comparison shows that fatty acid composition varies with season, area of availability, maturity and feeding habit of species[14].

Table 1: Gas chromatographic analysis of fatty acids

Fatty Acids	Common Name	Mackerel body oil (%)
Saturated fatty acid		
C12	Lauric acid	0.16
C13	Tridecylic acid	0.05
C14	Myristic acid	**11.95**
C15	Pentadecylic acid	0.16
C16	Palmitic acid	1.24
C17	Margaric acid	1.86
C18	Stearic acid	0.07
C19	Nonadecylic acid	0.46
Mono unsaturated fatty acid		
C16:1 (n-7)	Palmetoleic acid	**28.93**
C18:1 (n-9)	Oleic acid	21.46
C18:1 (n-7)	Vaccenic acid	0.06
C20:1 (n-9)	Gondoic acid	0.05
C24:1 (n-9)	Nervonic acid	0.92
Poly unsaturated fatty acid		
C18:2 (n-6)	Linoleic acid	0.06
C20:4 (n-6)	Archidonic acid	0.08
C20:5 (n-3)	Eicosapentanic acid	**20.65**
C22:6 (n-3)	Docosahexonic acid	11.82

Hence, it can be concluded with the present study that Mackerel is a cheap source of protein, rich in fat content and availability of different fatty acids which are considered as beneficial to human health.

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REFERENCES

1 CMFRI. CMFRI Annual Report 2016-2017. Central Marine Fisheries Research Institute, Kochi: (2017).

2 Izquierdo M.S, Fernandez-Palacios H, Tacon A.G.J. Effect of brood stock nutrition on reproductive performance of fish. *Aquaculture*; **197:** 25-42 (2001).

3 Tulli F, Tibaldi E. Changes in amino acids and essential fatty acids during early larval rearing of dentex. *Aquaculture International*; **5:** 229-236 (1997).

4 Hamed ., Ozogul F, Ozogul Y, Regenstein J. M. Marine Bioactive Compounds and Their Health Benefits: A Review. *Comparative Reviews in Food Science and Food Safety*; **14:** 445-465 (2015).

5 Allen D.A, Fish oil compositions, in Fish oil Technology, Nutrition and Marketing, R.J. Hamilton and R.D. Rice, Editors, PJ Barnes and Associates: Hull, UK: (2007).

6 Hernandez-Ledesma B, Herrero M. Bioactive compounds from marine foods : plant and animal sources / Blanca Hernandez-Ledesma. John Wiley & Sons: (2014).

7 AOAC. In: *Official Methods of Analysis of AOAC International* Association of Official Analytical Chemist., Horwitz, W. (Ed.). AOAC International,Maryland-Gaithersburg, USA. (2005).

8 Folch J, Lees M, Sloane Stanley G.H. A simple method for the isolation and purification of total lipids from animal tissues. *Journal of Biological Chemistry*; **226(1):** 497-509 (1957).

9 Metcalfe L.D, Schmitz A.A, Pelka J.R. Rapid preparation of fatty acid esters from lipids for gas chromatographic analysis. *Analytical chemistry*; **38(3):** 514-515 (1966).

10 Sumi E.S, Vijayan D.K, Jayarani R, Navaneethan R, Anandan R, Mathew S. Biochemical Composition of Indian Common Small Pelagic Fishes Indicates Richness in Nutrients Capable of Ameliorating Malnutrition and Age-Associated Disorders. *Journal of Chemical Biology and Therapeutics*; **1(2):** 112 (2016).

11 Venkataraman R, Chari S.T. Seasonal variation in the chemical composition of mackerel *(Rastrelliger kanagurta* Russel). *Proceedings: Plant Sciences*; **33(3):** 126-134 (1951).

12 Marichamy G, Raja P.S, Veerasingam S, Rajagopal, Venkatachalapathy . Fatty acids composition of Indian mackerel (*Rastrilliger kanagurta*) under different cooking methods. *Current Research Journal of Biological Science*; **1:** 109-112 (2009).

13 Nurjanah N, Nurilmala M, Hidayat T, Azri R.Y.I. Fatty Acid Composition and Cholesterol Indian Mackerel (*Rastrelliger kanagurta*) Due Frying Process. *International Journal of Materials Chemistry and Physics*; **2(2):** 54-61 (2016).

14 Ozogul Y, Ozogul F. fatty acids profiles of commercially important from the Mediterian, Aegean and Black Seas. *Food Chemistry;* **100:** 1634-1638: (2007).