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Seasonal impact studies on proximate composition of some selected food fishes

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Abstract
Valuable source of high-quality protein in human diet is fish which is the most wanted food stuff for the popular societies in the world. A study was made up for one year (January 2015- December 2015) to understand the proximate composition in different seasons. Three different fishes such as *Oreochromis mossambicus, Mugil cephalus and Lates calcarifer* were collected from different regions of the study area and their proximate composition was analyzed in different seasons. Pre-monsoon season proved to be the best in all composition in three species of fishes. Protein content showed highest 20.46±0.26% in *Lates calcarifer* then 15.65±0.29% in *Oreochromis mossambicus* and 18.59±0.29% in *Mugil cephalus*.

Keywords: seasons, *Oreochromis mossambicus, Mugil cephalus, Lates calcarifer*, proximate composition

Introduction
Priceless sources of high grade protein and other whole products are fish. Fishes are consumed as food by many human societies. This poor man's diet is rich in protein, omega-3 fatty acids, vitamins and minerals. Percentage of moisture, protein and fat of fish is imperative for all mankind.
Biochemical analysis of fish muscle used as a marker of dietetic value of food materials (Suleiman and Abdullahi, 2009) [14]. Importance of nutrients in the flesh of fishes draws attention of many consumers (Murray and Butt, 2001; Mridha *et al*., 2005; Kiren, B.R and Puttaih, 2005; Kiran, B.R., 2018; John Kiran *et al*., 2017; Joycy Jay Manoharam and subbulakshmi, 2016) [12, 11, 8, 6, 7]. Influence of season and the proximate composition of fishes are scanty (John Kiran *et al*., 2017, Zi-XuanUu *et al*., 2019; Kiren, 2018; Ashwini, *et al*., 2016; Ganeshwade *et al*., 2017) [6, 8, 2]. Hence a study was made to examine this aspect.

Materials and Methods
Oreochromis mossambicus were collected from Sendakottai, near Pattukottai. *Mugil cephalus* were collected from Agniar estuary and *Lates calcarifer* from Mallipattinam. Collected samples were brought to the laboratory in iced condition. Samples were collected from January 2015- December 2015 covering different seasons of the year. (Pre-monsoon, Monsoon, Post-monsoon, Summer respectively).
The moisture content was determined by oven drying method. (AOAC, 2000). Edible muscle free from skin and scales was dissected from the dorsal region below the dorsal fin, dried and powdered for detailed study.
Carbohydrate was measured by Anthrone method (Hedge, *et al*.,1968). Lowry method (Lowry, *et al.,* 1981) for protein and lipid was estimated by Folch method (Folch, *et al.,* 1957) [4]. Results obtained were subjected to mean and standard deviation.

Results and Discussion
Results of the present study of *Oreochromis mossambicus, Mugil cephalus and Lates calcarifer* were presented in Table 1, 2 and 3 respectively. Figure 1 represents the percentage of moisture in *Oreochromis mossambicus, Mugil cephalus and Lates calcarifer* in four different seasons. Moisture was less during pre-monsoon season in all the three fishes studied. High moisture content was observed during summer season. The results coincides with the study *Istiophorus platypterus* (John Kiran *et.al*, 2017) [6]. *Salmophasia untrahi* (Day) (Kiran 2018) [8] and *Labeo boga* (Roopma Gandotra *et. al*., 2017) [13].

Table 1: Proximate composition (%) of *Oreochromis mossambicus* in four different seasons

Seasons	Moisture	Protein	Carbohydrates	Lipid
Pre-monsoon	77.60 ± 0.38	18.59 ±0.29	3.31 ±0.15	1.85 ±0.13
Monsoon	79.23 ± 0.43	17.60 ±0.22	2.46 ±0.20	2.12 ±0.08
Post monsoon	81.64 ± 0.29	16.67 ±0.29	2.67 ±0.19	1.27 ±0.75
Summer	80.39 ± 0.22	17.54 ±0.24	3.17 ±0.11	1.76 ± 0.14

Table 2: Proximate composition (%) of *Mugil cephalus* in four different seasons

Seasons	Moisture	Protein	Carbohydrates	Lipid
Pre-monsoon	73.66 ± 0.55	15.65 ± 0.29	2.36 ± 0.23	1.77 ± 0.99
Monsoon	74.89 ± 027	14.46 ± 0.24	1.86 ± 0.08	1.95 ± 0.13
Post monsoon	76.54 ± 0.23	13.58 ± 0.29	2.10 ± 0.11	1.51 ± 0.08
Summer	75.61 ±0.24	14.60 ± 0.29	2.26 ± 0.21	1.72 ± 0.17

Table 3: Proximate composition (%) of *Lates calcarifer* in four different seasons

Seasons	Moisture	Protein	Carbohydrates	Lipid
Pre-monsoon	66.62±0.27	20.46±0.26	1.51±0.08	3.32±0.19
Monsoon	68.38±0.43	18.84±0.56	1.04±0.06	3.71±0.15
Post monsoon	70.37±0.15	17.51±0.31	1.26±0.05	3.07±0.07
Summer	69.75±0.16	18.19±0.54	1.34±0.03	3.19±0.14

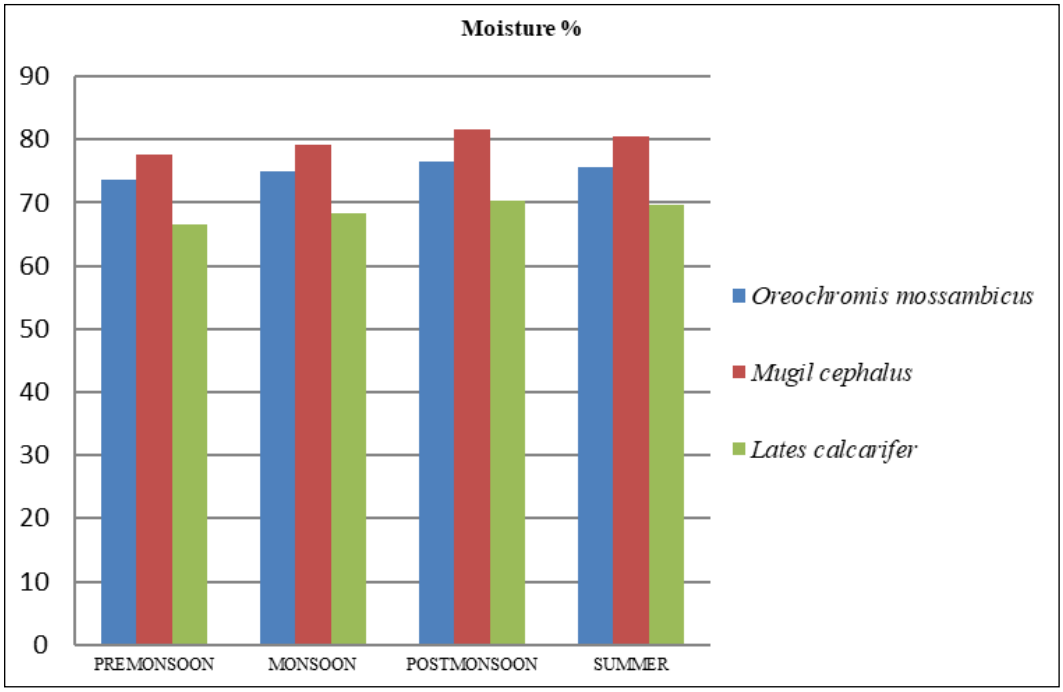

Fig 1: Moisture content % of *Oreochromis mossambicus*, *Mugil cephalus* and *Lates calcarifer* in four seasons

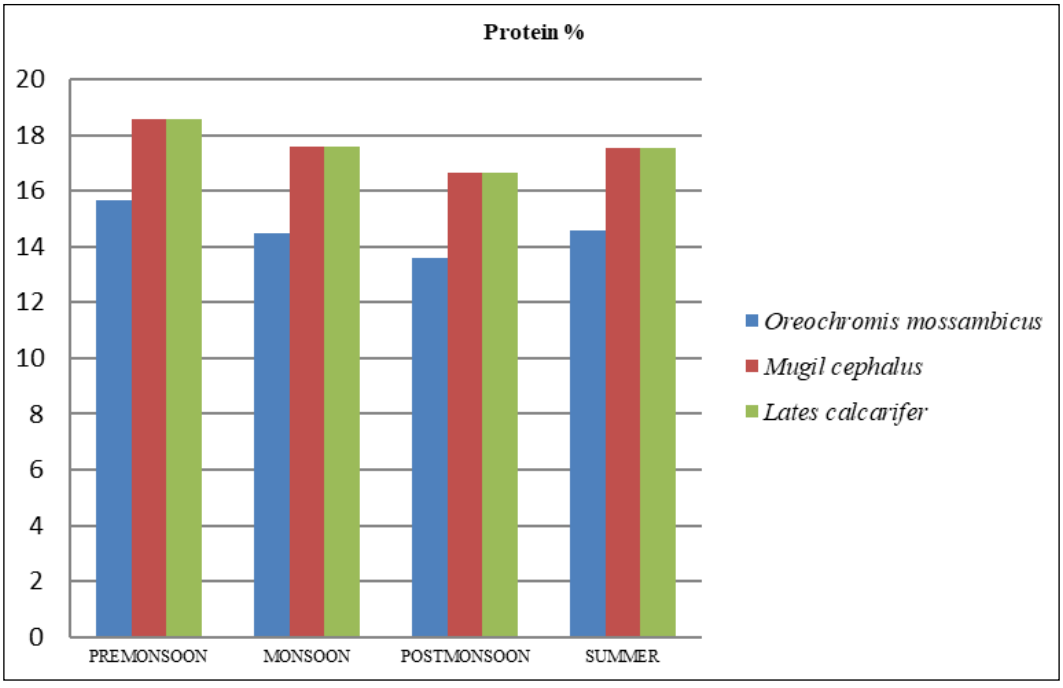

Fig 2: Protein content % of *Oreochromis mossambicus*, *Mugil cephalus* and *Lates calcarifer* in four seasons

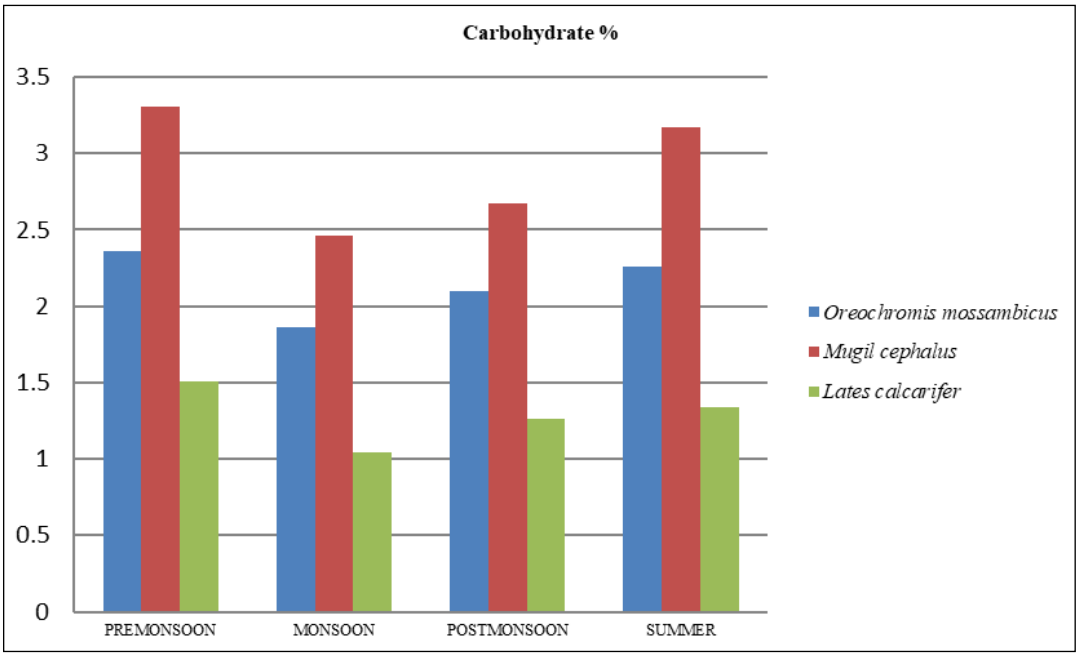

Fig 3: Carbohydrate content % of *Oreochromis mossambicus*, *Mugil cephalus* and *Lates calcarifer* in four seasons

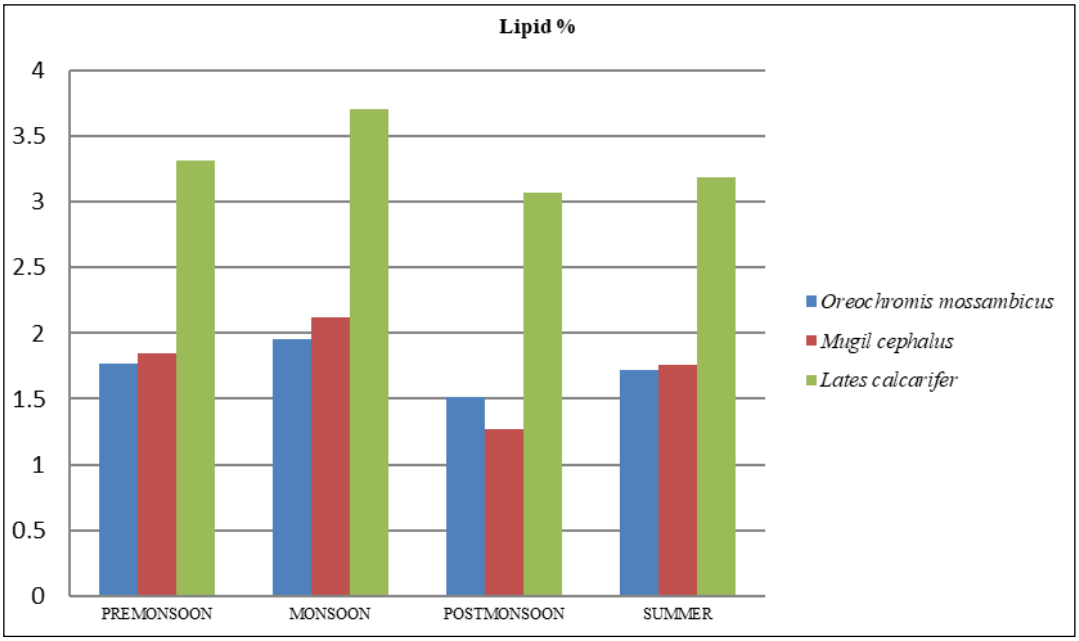

Fig 4: Lipid content % of *Oreochromis mossambicus*, *Mugil cephalus* and *Lates calcarifer* in four seasons

Protein percentage of the three fishes studied showed highest during pre-monsoon 18.59±0.29%, 15.65± 0.29% and 20.46±0.26% and lowest during post- monsoon 13.58±0.29%, 16.67±0.24% and 17.51±0.31 in *Oreochromis mossambicus*, *Mugil cephalus* and *Lates calcalifer* respectively. The findings coincides with the results of *Istiophorus platypterus* (John Kiran *et.al*, 2017) [6]. *Salmophasia untrahi* (Day) (Kiran 2018) [8] and *Labeo boga* (Roopma Gandotra *et. al*., 2017) [13].

Carbohydrate percentage was peak during pre-monsoon (3.31±0.15% in *Oreochromis mossambicus*, 2.36±0.23% in *Mugil cephalus* and 1.51±0.08% in *Lates calcalifer*) and lowest during monsoon (2.46±0.26%,1.86±0.08% and 1.04±0.06%) in all the three species of fishes. Liquid content was high during monsoon (2.12±0.08%, 1.95±0.13% and3.71±0.15%) and less during post- monsoon season 1.27±0.75% in *Oreochromis mossambicus*, 1.51±0.08% in *Mugil cephalus* and 3.07 ± 0.07% in *Lates calcalifer*.

The moisture content is a major criterion in the quality of flesh in fishes (Ebanasar and Jayaprakas, 1996) [3]. According to the quality of flesh would be the best during pre-monsoon season than others. The protein content was too high during pre-monsoon in all the fishes studied. The same result prevails in the carbohydrate and lipid content of fishes. Fishes conserve energy prevailing nutrients during pre-monsoon and utilize the reserves for monsoon and summer seasons. That may be the reason for their high percentage during pre-monsoon.

Conclusion

Of the fishes studied *Oreochromis mossambicus* is a fresh water fish and *Mugil cephalus* and *Lates calcalifer* occupy estuary and sea respectively. During pre-monsoon season these fishes irrespective of their habitat conserve nutrients which utilized during the other seasons. That may be the reason for the changes of nutrient percentage. Nutritional and edible value of species could be assessed with the proximate composition of the species. Variations in content may be due to fishing ground or habitat, season, age, sex and their reproductive status. This study reveals that pre-monsoon season proved to be the best flesh quality since the fishes conserve energy and nutrients to overcome the heavy package of loss during other seasons. The fishes studied were from different environment which too plays vital role in the conservation of nutrients.

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