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Biochemical Composition of Myctophid Species *Diaphus watasei* and *Myctophum obtusirostre* Caught from Arabian Sea

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Abstract

An attempt was made to evaluate the biochemical composition of myctophid fishes *Diaphus watasei* and *Myctophum obtusirostre* collected from Arabian Sea (8°30′50"N - 9°07′50"N lat and 75°49′20"E - 75°58′60"E long). The moisture content in *D. watasei* was significantly lower (63.19 ± 0.47%) compared to *M. obtusirostre* (71.32%), while fat content was significantly higher in *D. watasei* (15.13%) compared to *M obtusirostre* (3.54%). Protein also comprised significant proportions in these myctophids, contributing 21.40% in *D. watasei* and 22.64% in *M. obtusirostre,* with substantial amount of essential amino acids. The foremost amino acid was glutamic acid in both the species. Ash content was significantly higher in *M. obtusirostre* (3.06%) compared to *D. watasei* (1.33%). The present study indicates that both species contain good quantity of essential amino acids required for human nutrition.

Keywords: Myctophid, *Diaphus watasei, Myctophum obtusirostre*, proximate composition, amino acids

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Introduction

Seafood is significant in human nutrition because of its unique nutritive value related to the presence of proteins, fats, vitamins and minerals. Marine fish muscle contains easily digestible protein and valuable essential amino acids (Venugopal et al., 1996; Yanez, et al., 1976). Myctophids are most widely distributed mesopelagic fishes in the World Oceans. They comprise 230-250 species belonging to 30-35 genera (Paxton, 1972). They perform diurnal migration from surface to depths exceeding 2000 m. Myctophids contribute 65% biomass among mesopelagics with an estimated global biomass of 550-660 million t. They play an important role in open ocean energy dynamics by forming an important link in the food web especially between primary consumers, tertiary consumers and commercially targeted fishes like tuna, sharks as well as cetaceans, pinnepeds and seabirds (Kozlov, 1995; Hulley, 1996; FAO, 1997; Balu & Menon, 2006; Karuppasamy et al., 2007; Cherel et al., 2010). The Arabian Sea alone has around 100 million t of myctophid species (Gjésaeter, 1984; Hussain & Khan, 1987; US GLOBEC, 1993). Out of 55 species of myctophids reported in Arabian Sea and the southern region of Indian Ocean, about 27 species are present in Indian Exclusive Economic Zone (Karuppasamy et al., 2006).

Though myctophid fishes are one of the most abundant marine organisms, they are the least studied and utilized by mankind. Hence, it is important to explore avenues for utilising myctophid species especially in relation to their nutritional value. The purpose of the present study is to investigate the biochemical profile of myctophid species *D. watasei* and *M. obtusirostre* in terms of nutritional benefits.

Materials and Methods

The myctophid species *Diaphus watasei* and *Myctophum obtusirostre* (Fig. 1) were caught from Arabian Sea between 8°30′50"N - 9°07′50"N lat and 75°49′20"E - 75°58′60"E long in the month of February 2011 by trawling at a depth between 200 and 400 m along with other deep sea fishes. Length of *D. watasei and M. obtusirostre* were 139.1 ± 15.6 mm (SL) and 75.4 ± 3.3 mm (SL) and weight, 22.91 ± 5.64 g and 3.93 ± 0.52 g, respectively. Fish samples were

stored in polypropylene bags at -20°C. Species authentification of myctophids was done as per Fischer & Bianchi (1984). Filleted, skinned and homogenized fish samples were used for various biochemical analyses.

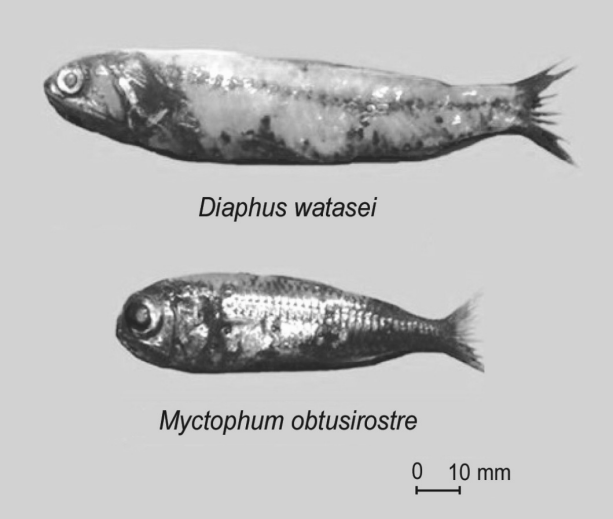

Fig. 1. Myctophid fishes

Moisture content was determined by drying the homogenised sample in an oven at 105ºC overnight until a constant mass was obtained (Horwitz & Latimer, 2000). Crude protein content was determined by Kjeldahl method. The concentration of total nitrogen was measured and conversion factor 6.25 was used to calculate crude protein (Horwitz & Latimer, 2000). Crude fat content of samples was determined with soxhlet apparatus using petroleum ether as extraction solvent (boiling point 40-60°C) (Horwitz & Latimer, 2000). Ash content was determined by heating the sample in muffle furnace at 600°C for 6 - 8 h (Horwitz & Latimer, 2000).

Amino acid composition of both fish samples was determined after hydrolysing the samples in 10 ml 6 N hydrochloric acid at 120°C. Acid was removed by vacuum evaporation, made up to a known volume with 0.05 N HCl and then analysed using Shimadzu (LC-10 AT) Amino acid analyser system equipped with cation exchange column (sulphonated polyvinyl styrene column) and fluorescence detector (Ishida et al., 1981). Tryptophan content of the samples was determined spectrometricaly after alkali hydrolysis (Sastry & Tummuru, 1985).

Analyses were repeated three times, and the results are presented as mean ± standard deviation of determination for triplicate samples.

Results and Discussion

Table 1 shows the proximate composition of myctophid species *D. watasei* and *M. obtusirostre*. The moisture content was significantly lower in *D. watasei* (63.19 ± 0.47%) as compared to *M. obtusirostre* (71.32 ± 0.62%). Variation was observed in the fat content of *D. watasei* (15.13 ± 0.68%) and *M. obtusirostre* (3.54 ± 0.16%). Crude protein content of *D. watasei* and *M. obtusirostre* were 21.40 ± 0.08% and 22.64 ± 0.23%, respectively. Crude ash content in the myctophids were 1.33 ± 0.03% (*D. watasei*) and 3.06 ± 0.06% (*M. obtusirostre*).

Table 1. Proximate composition of *Diaphus watasei* and *Myctophum obtusirostre*

Proximate composition	*D. watasei*	*M. obstusirostre*
Moisture (%)	63.19±0.47	71.32±0.62
Crude fat (%)	15.13±0.18	3.54±0.16
Crude protein (%)	21.40±0.08	22.64±0.23
Total ash (%)	1.33±0.03	3.06±0.06

Values are expressed as mean ± SD of three separate determinations on wet weight basis

Amino acid profiles of *D. watasei* and *M. obtusirostre* are summarized in Table 2. These fish species contain high quantity of non-essential amino acids (51.41% in *D. watasei* and 55.5% in *M. obtusirostre*) and essential amino acids (47.8% in *D. watasei* and 43.16% in *M. obtusirostre*) in a balanced proportion. The most abundant essential amino acid in both fishes was leucine (9.68 ± 0.14% in *D. watasei* and 8.88 ± 0.05% in *M. obtusirostre*), followed by histidine, valine, threonine and isoleucine in reasonable quantities. However, the predominant amino acid in both fishes was non-essential amino acid glutamic acid (15.06% in *D. watasei* and 14.93% in *M. obtusirostre*).

The results clearly indicate nutritional potential of myctophid species for human consumption. In the present study, the proximate analysis of myctophid species showed that both species of fish had good amount of protein and fat content. Amino acid composition of myctophid proteins indicated that these species contain both essential and non-essential amino acids in balanced proportions. Interestingly, the energy yielding amino acid, glutamic acid is the predominant amino acid in both the fish species. In case of essential amino acids,

Table 2. Amino acid profile of *Diaphus watasei* and *Myctophum obtusirostre*

Amino acid	*D. watasei*	*M. obstusirostre*
Threonine	6.23±0.13	6.11±0.20
Valine	6.91±0.21	6.90±0.12
Methionine	0.32±0.01	0.42±0.02
Isoleucine	5.26±0.23	5.11±0.1
Leucine	9.68±0.14	8.88±0.05
Tyrosine	1.07±0.03	0.90±0.03
Phenylalanine	3.93±0.16	3.94±0.12
Histidine	8.64±0.25	6.76±0.18
Lysine	3.56±0.11	2.49±0.12
Tryptophan	1.48±0.03	1.65±0.01
Essential amino acids	47.08	43.16
Aspartic acid	11.21±0.16	10.37±0.13
Serine	7.13±0.02	6.31±0.08
Glutamic acid	15.06±0.14	14.93±0.18
Proline	1.61±0.03	2.00±0.07
Glycine	6.90±0.21	10.84±0.15
Alanine	8.69±0.03	10.16±0.03
Cysteine	0.19±0.01	0.23±0.02
Arginine	0.62±0.02	0.66±0.04
Non-essential amino acids	51.41	55.5

Values are % of total amino acid expressed as mean ±SD of three separate determinations on wet weight basis.

leucine is the major amino acid, which is essential for muscle protein synthesis (Etzel, 2004). Myctophid proteins may therefore be well utilized to complement the amino acid pattern and quality of protein supplement formulations.

D. watasei is a fatty fish containing 15.13% fat, while *M. obtusirostre* is a lean fish with 3.54% fat. This present observation concurs with an earlier reported study (Suriah et al., 1995). Fats are not only energy reservoirs but also act as sources for essential fatty acids required for the structural and functional integrity of organisms. Composition of lipid profiles of fish species varies depending on sex, age, size, maturity, season, food availability, geographical distribution, salinity and water temperature (Stansby, 1981; Piggott & Tucker, 1990). Previous reports have shown that myctophid species are high in protein, fat, mineral and low in carbohydrate content (Neighbors & Nafpaktitis, 1982; Lekshmy et al., 1983; FAO, 1997; Phleger et al., 1999; Lea et al., 2002). Our results have also confirmed the same pattern and indicated a possible role of myctophids in the formulation of novel foods.

Myctophids are not utilized so far for direct human consumption owing to its undesirably high lipid content. The results of the present study indicate that it may be a potential nutrient resource in the formulation of poultry, animal and fish feed as well as crop fertilizers. There are no reports of human consumption of myctophids in India. Also very little documentary evidence is available on the processing and utilization of myctophids. If proper harvest and post-harvest technologies are standardized for the utilization of myctophid resources, it may serve as an economically viable alternative for the depleting fish resource.

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