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Fatty acid profile from mangrove archeaogastropod *Nerita* (*Dostia*) *crepidularia* Lamarck, 1822

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ABSTRACT

The fatty acid composition of *N. crepidularia* collected from mangroves of Vellar estuary (Lat. N 11º 29.45' Long. 79º 46.28'), Southeast coast of India was determined. In the present study, 13 different fatty acids were identified, seven were saturated (SFA), four were monounsaturated (MUFA) and two were polyunsaturated fatty acids (PUFA). Among the SFAs pentadecyclic acid (C15:0) and palmitic acid (C16:0) were the major acids. In MUFA octadecenoic acid (C18:1n-7) and in PUFA Arachidonic acid (C20:4ω6C) were the major acids found. The percentage of SFA, MUFA and PUFA was reported as 58.05%, 28.82% and 8.28% respectively in *N. crepidularia*. Hence in the present study notify potential position of this gastropod in the field of aquaculture and human nutrition.
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KEYWORDS

SFA;
MUFA;
PUFA;
Mangroves;
Nerita (*Dostia*) *crepidularia*;
Vellar estuary.

INTRODUCTION

Gastropod molluscs comprise major marine fishery resources that also include Bivalvia and Cephalopoda. In addition, molluscs are excellent sources of polyunsaturated fatty acids (PUFAs) such as 20:5n-3 and 22:6n-3. In recent years, these PUFAs have been recognized as effective factors in human health and nutrition, especially for cardiovascular diseases[7,13,19,20]. It is important, therefore, to determine the fatty acid composition of those marine invertebrates intended for human consumption. Marine invertebrates have been reported to be rich in ether glycerophospholipids including alkenylacyl glycerophospholipids (plasmalogens) and alkylacyl glycerophospholipids[11,28,30]. Some studies have been conducted on the analysis of the alkenyl and alkyl chains on the *sn*-1 positions of glycerol moieties[32]. However, little information has been made of fatty acyl chain compositions on the *sn*-2 positions of glycerol moieties.

EFA deficiency is common in the United States, particularly Omega-3 deficiency. An ideal intake ratio of Omega-6 to Omega-3 fatty acids is between 1:1 and 4:1, with most Americans only obtaining a ratio between 10:1 and 25:1. The minimum healthy intake for both linolenic (Omega-3) and linoleic (Omega-6) acid via diet, per adult per day, is 1.5 grams of each. One tablespoon of flaxseed oil can provide this amount, or larger amounts of other linolenic-rich foods. Because high heat destroys linolenic acid, cooking in linolenic-

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TABLE 1 : Fatty acid profile of *N. crepidularia*

S. No.	Name of the fatty acids	Number of carbon atom	Percentage (%)
	Saturated fatty acids		
1	Lauric acid	C12:0	3.0
2	Myristic acid	C14:0	3.47
3	Pentadecyclic acid	C15:0	18.27
4	Palmitic acid	C16:0	17.66
5	Margaric acid	C17:0	2.11
6	Stearic acid	C18:0	6.12
7	Nonadecanoic acid	C19:0	7.42
	Total		**58.05**
	Monounsaturated fatty acid (mufa)		
8	Olicic acid	C18:1	4.10
9	Octadecenoic acid	C18:1n-7	13.21
10	Nonadecelic acid	C19:1	11.51
	Total		**28.82**
	Polyunsaturated fatty acid (PUFA)		
11	α-Linolenic acid	C18:3n -6	3.60
12	Arachidonic acid	C20:4n-6	4.68
	Total		**8.28**

rich oils or eating cooked linolenic-rich fish is unlikely to provide a sufficient amount. EFA deficiency and Omega 6/3 imbalance is linked with serious health conditions, such as heart attacks, cancer, insulin resistance, asthma, lupus, schizophrenia, depression, postpartum depression, accelerated aging, stroke, obesity, diabetes, arthritis, ADHD, and Alzheimer's Disease, among others. In order to fulfill the demand for malnutrition and medicinal point of view, the present study was carried out to analyze the fatty acid composition of the gastropod *Nerita* (*Dostia*) *crepidularia*.

MATERIALS AND METHODS

Specimens of *N. crepidularia* were collected from mangroves of Vellar estuary (Lat. N 11º 29.45' Long. 79º 46.28'). The animals were isolated by removing the shells and kept for complete drying. The dried tissue materials were finely powered to estimation of fatty acid content. An extraction procedure for fatty acid analysis, the samples was homogenized with chloroform: methanol (2: 1 v/v) mixture and they were extracted using the method of Bligh and Dyre[6]. After the fat was extracted, they were esterified with 1% H_2SO_4 and fatty acid methyl esters were prepared by following the procedure of AOAC[3]. The identification and quantification of fatty acids was done using Gas chromatography (Hewlett Packard 5890 model).

RESULTS

In *N. crepidularia*, 13 different fatty acids were identified; out of which seven were saturated fatty acids (SFA), four were monounsaturated fatty acids (MUFA) and two polyunsaturated fatty acids (PUFA). Among the SFAs, C15:0 and C16:0 were the major acids. In MUFA C19: 1 and in PUFA C18:3ω6C were the major acids found. The percentage availability of SFA content was 58.05% in *N. crepidularia.* The percentage of MUFA and PUFA contents are given in TABLE 1.

DISCUSSION

In the present study, among the 13 different fatty acids identified, seven were saturated fatty acids (SFA), four were monounsaturated fatty acids (MUFA) and two were polyunsaturated fatty acids (PUFA). Among the SFAs C16:0 were the major acids. In MUFA C19: 1 and in PUFA C18:3ω6C were the major acids found. The percentage availability of SFA, MUFA and PUFA contents was 50.08, 28.82 and 4.68% respectively in *N. crepidularia*.

Polyunsaturated fatty acids are energy sources and also function in the body as components of membranes, modulators of gene expression and precursors for eicosanoids (self-healing agents). Arachidonic acid (AA; 20:4n-6) is the primary precursor of eicosanoids in mammals and fish, and is released from membrane phospholipids in relation to several stimuli during the well documented "arachidonic cascade"[31].

Further PUFA tends to reduce the blood cholesterol levels and is considered a "good" fat. In the present study, arachidonic acid (C 20:4) contributed 4.68% of the total PUFA content. Among the various nutrients supplied by the diet, PUFA with 20 and 22 carbons and more than three double bonds, which are sparingly, or not at all, biosynthesized by neritids, are essential for survival, growth and reproduction of the mollusks[10,23,33]. These 20- or 22-carbon PUFA, notably 22:6(n-3), 20:5(n-3) and 20:4(n-6), are of particular importance in membrane phospholipids.

Further some of the polyunsaturated fatty acids are found to be needed for better growth and survival of the cultivably important finfishes. A tropical herbivore, *Tilapia zilli* was found to require ω6 rather than ω3 fatty acids. The dietary requirement of 18:2ω6 or 20:4ω6 was about 1% in the diet[18]. In the present study, 4.68% of 20:46 fatty acids were reported in *N. crepidularia* and hence it could be suggested that *N. crepidularia* is a good source of these polyunsaturated fatty acids which could be used as good seafood for fisherfolk and also in the field of aquaculture for formulating feed. Coldwater fish are likely to be more demanding in ω3 and ω6 requirements for essential fatty acids than warm water fish because constraints imposed in maintaining membrane fluidity are greater at low temperature[14].

Holman[15] described ω3FA deficiency in patients with neuropathy, while in an interesting review article Yoshida et al.[35] reported low DHA levels in patients suffering from schizophrenia, depression, dementia, parkinsonism and other behavioural disorders. They described that in some of the cases ω3FA supplementation had positive effects on the neurological symptoms. Hence dietary intake of omega-3 fatty acids is helpful in pronouncing less inflammatory responses towards bronchial asthma, lupus erythematosus, multiple sclerosis, psoriasis and kidney diseases and also inhibit the In *N. crepidularia*, ω3FA contributed 3.60% and so the intake this animal as in Singapore[34], supplement ω3FA deficiency that may help to solve neurological problems as reported by Holman[15].

In the present study, the arachidonic acid was found only 4.68%. Further the arachidonic acid has been proved effective in improving egg quality[29] and survival at the early life stages of fish[5,8,21]. The marine animals are the richest sources of PUFA. Total PUFA may account for about 15.25% of the total fatty acids, where 20:5 and 22:6 acids together accounted for about 90% of the total PUFA[25]. In the earlier study on *P. canaliculus*, out of the 30 individual fatty acids identified, the PUFA were the dominant fatty acids in both freeze-dried (FD) and frozen samples (40-41% of total PUFA) which is lying on conforming with the results of the present study[25].

Zhokova and Stetashve[36] studied the five species (*Megangulus zyonoesis, M. venulosus, Argopecten purpuratus, C. gigas, Placopecten magellanicus*) of bivalves, the sum of saturated fatty acids observed was ranging from 16.8 to 22.5%. Among the individual components, 16:0 and 18:0 were found dominant. Whereas in the present study saturated fatty acids were recorded still higher (58.05%) with a contribution of 17.66% by the 16:0 fatty acids. The variation in SFA level in the various body parts can be attributed to seasonal variations, diets and adaptation to habitat changes[36]. The saturated fatty acids were the next most common fatty acids - 26% in the Freeze dried and 25% in the frozen Green Lipped mussels of *P. canaliculus* also[24].

In *Tapes decussates* and *T. philippinarum*, 14:0 and 16:0 fatty acids in triacylglycerols and 18:0 in phospholipids were found to be dominating[4]. Whereas the Palmitic acid (16:0), EPA ($20:5n^{-3}$) and DHA ($22:6n^{-3}$) were the most abundant fatty acids found in the lipids of *O. vulgaris*, as also has been reported for many cephalopod species[9,16,26]. In the present study, *N. crepidularia* showed the dominance of 16:0 and 19:0 fatty acids which constituted 17.66 and 7.42% respectively, which is very well agreeing the fact that the 16:0 was found to be a major fatty acid in gastropods[1,17].

The water soluble esters of lauric acid and of palmitic acid (Tween 20 - polyoxyethylene sorbitan monolaurate), G2144 and Tween 40 (polyoxyethylene sorbitan monopalmitate) exhibited appreciable bacteriostatic and bactericidal activity against tubercle bacilli in concentrations of 0.01 to 0.001%, but esters of stearic and oleic acid, Tween 60 (polyoxyethylene sorbitan monostearate) and Tween 80 (PSM, polyoxyethylene sorbitan monoleate) were found inhibitory only at higher concentrations[12]. In this study lauric and palmitic acids were recorded as 3.0 and 17.66% respectively that may again give a lead regarding the better nutritive quality of *N. crepidularia*.

The MUFA content was reported as 23% in the freeze dried (FD) and frozen green lipped mussel *P. canaliculus*[24]. But in the present study, MUFA was recorded as 32.68%. The MUFA levels in various gastropods examined by Johns et al.[17] were more or less equal when compared with that of the results of the present study.

Oleic acid (18:1) contributed more than 10% in *Chlamys tehuecha*[27]. In the present observation, *N. crepidularia* showed the 18:1 acid level as 13.21%. The 20:1 (Monoenoic acid) is considered as typically

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marine and a large number of marine invertebrate species, chiefly molluscs, are known to have significant quantities upto 15%[1]. But in the present study 20:1 acids were not detectable.

Ajaya Bhaskar[2] estimated the fatty acid profile in *P. viridis*, *C. madrasensis* and *M. casta* and reported that SFA, MUFA and PUFA accounted for 44.06%, 20.47% & 33.74%, 48.4%, 24.04% & 22.15% and 45.94%, 23.40% & 26.97% respectively. On comparison, *N. crepidularia* showed higher amount of SFA (58.08%) (Particularly 16:0 and 19:0) & MUFA (38.68) and lower amount of PUFA (4.68%). Hence it could be concluded that the results of the present study is not only helping the aquaculture feed industry but also helping the malnutrition problem in our country can be overcome by effective utilization of nutrient rich molluscan seafood.

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