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Fatty acid composition of *Beroe ovata* (Bosc, 1802)

Beroe ovata (Bosc, 1802)'nın yağ asidi kompozisyonu

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Abstract

Beroe ovata was collected from Kumkapı, İstanbul, Sea of Marmara. Fatty acids composition of *Beroe ovata* were determined using GC/MS. Total lipid amount was found as 0.98±0.05 mg/g (n=6).

Total saturated; monounsaturated and polyunsaturated fatty acids percentages were 35.78, 14.11 and 37.09, respectively. Eicosapentaenoic acid (EPA, 20:5n-3) percentage was 9.75 and docosahexaenoic acid (DHA, 22:6n-3) percentage was 23.01. Docosapentaenoic acid was not detected in *Beroe ovata*. EPA/DHA ratio was found as 0.42.

The difference of fatty acids between the *Beroe ovata* with *Beroe cucumis* and *Beroe forskalii* were detection of 21:0 ve 17:1n-7 in only *Beroe ovata*

This paper is the first study on the fatty acid composition of *Beroe ovata*.

Keywords: *Beroe ovata*, fatty acid composition, Sea of Marmara

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Introduction

Ctenophores are important members of the gelatinous marine zooplankton and significant predators in planktonic food chains (Thorson, 1971). The genus *Beroe* feed primarily on other ctenophores. It was first observed in the Black Sea in 1997 (Konsulov and Kamburska, 1998), in Sea of Marmara in summer 1992 (Shiganova *et al.*, 1995) and the subject was discussed by İşinibilir *et al.*, (2004).

Beroe significantly affected the population of *Mnemiopsis leidyi* that appeared in the Black Sea in 1982 (Pereladov, 1988) and damaged the fish population by feeding at high rates on zooplankton, fish eggs and larvae (Caddy and Griffith, 1990, Shiganova, 1997).

Beroe cucumis actively seeks prey by a specialized swimming behavior (Tamm and Tamm, 1991).Fatty acid compositions were investigated in *Beroe cucumis* from Arctic Ocean (Clarke *et al.*, 1987; Falk-Petersen *et al.*, 2002), Antarctic Ocean (Phleger *et al.*, 1998; Nelson *et al.*, 2000) and in *Beroe forskalii* (Nelson *et al.*, 2000) from Antarctic Ocean. A few literature exist on total lipid amount of *Beroe ovata* from the Black Sea was studied by Finenko *et al.* (2001) and Anninsky *et al.* (2005).

This paper is first report on fatty acid composition of *Beroe ovata*.

Materials and Methods

Beroe ovata was collected from Kumkapı, Istanbul, the Sea of Marmara. Individuals were sampled carefully near the sea surface using a wide-mouthed plastic bottle or hand net (500 μm mesh) in August 2003. The samples were taken and transported in a deep freeze to the laboratory.

40 g (20 samples) of fresh tissues was homogenized and dehydrated with 20 g anhydrous sodium sulfate and extracted with dichloromethane in Soxhlet for 4 h. The extract was distilled at 36 °C and the residue was weighted to determine lipid content. Fatty acid methyl esters were prepared with 14% BF_3 in methanol (Joseph and Ackman, 1992) and analyzed using HP6890 Series GC System (Wilmington, DE, USA) with an electronic pressure control and HP5972A mass selective detection (ionizating energy, 70 eV; source temperature, 300 °C) on a DB-WAXETR column (30m x 0.25 mm i.d.; split ratio, 1:50; J&W Scientific Inc., Folsom, CA, USA). The temperature of the injector port and detector was held at 250 and 300 °C respectively. Initial oven temperature was 150 °C for 4 min and then raised to 230 °C at 2 °C min^{-1}, final hold of 15 min. Helium was used as the carrier

gas (1 mL min^{-1}). Standard curve of fatty acids were plotted using fatty acid methyl ester mixture (Sigma, St. Louis, MA, USA, Product number: 189-19). Identification was made with reference compounds and also using GC/MS memory. The amount of each fatty acid was determined by comparing the signal areas in the sample with that of the corresponding standards.

All solvents and reagents used in the study were analytical grade (Merck, Darmstadt, Germany).

Results

Total lipid amount was found for *Beroe ovata* 0.98±0.05 mg/g (n=6).

The GC/MS chromatogram of fatty acids of *Beroe ovata* is shown in Figure 1. Fatty acid compositions of *Beroe ovata* found in this work is compared with *B. cucumis* (Clarke *et al.*, 1987, Phleger *et al.*, 1998, Nelson *et al.*, 2000; Falk-Petersen *et al.*, 2002) and *B.forskalii* (Nelson *et al.*, 2000) in Table 1. Total saturated fatty acid (SFA) for *Beroe ovata* is 35.78%. The principal SFA were 16:0 (21.64%), 18:0 (8.45%), 17:0 (1.75%) and 14:0 (1.42%). Total monounsaturated fatty acids (MUFA) represent 14.11%. The major MUFA were included 18:1n-9*(c)* (7.35%), 16:1n-7 (2.80%), 18:1n-9 *(t)* (1.67%) and 20:1n-9 (1.03%). Eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3), major polyunsaturated fatty acids (PUFA), were found as 9.75% and 23.01%, respectively. Docosapentaenoic acid (DPA, 22:5n-3) was not found in *Beroe ovata*. Total PUFA corresponds to 37.09%. EPA/DHA ratio was 0.42

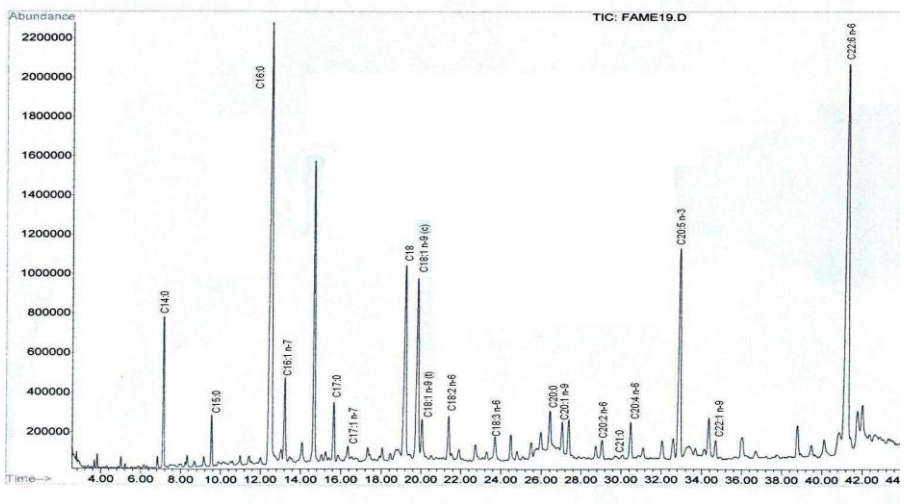

Figure 1. GC/MS chromatogram of *Beroe ovata*

Table 1. Fatty acid compositions (% of total fatty acids) of *Beroe* spp.

Sample / **Fatty acid**	*Beroe ovata*[a]*	*Beroe cucumis*[b]	*Beroe cucumis*[c]	*Beroe cucumis*[d]	*Beroe cucumis*[e]	*Beroe forskalii*[c]
Saturated:						
12:0	NSA	1.9	0.1	ND	ND	0.3
13:0	NSA	0.1	ND	ND	ND	ND
14:0	1.42±0.01	7.4	4.4	16.8	8.5	4.5
15:0	1.09±0.01	0.5	0.7	ND	ND	0.7
16:0	21.64±0.02	14.3	19.9	20.2	11	23.4
17:0	1.75±0.01	0.3	ND	ND	ND	ND
18:0	8.45±0.02	3.3	4.6	1.5	6.7	9.9
19:0	ND	0.2	ND	ND	ND	ND
20:0	1.20±0.01	0.1	ND	ND	ND	ND
21:0	0.23±0.01	ND	ND	ND	ND	ND
Total SFA	35.78±0.03	26.1	29.7	40.3	27.7	38.8
Monoenoic:						
14:1n-7	ND	0.1	ND	ND	ND	ND
14:1n-5	ND	0.2	ND	ND	ND	ND
16:1n-7	2.80±0.01	1.1	1.8	Σ 5.8	1.7	2.3
16:1n-5	ND	0.2	ND		ND	ND
16:1	ND	ND	ND		ND	ND
17:1n-7	0.64±0.01	ND	ND	ND	ND	ND
18:1n-9 *(c)*	7.35±0.01	10.4	6	Σ 10.2	Σ 5.7	8.8
18:1n-9 *(t)*	1.67±0.01	ND	ND			ND
18:1n-7	ND	6.4 *(c)*	2.1*(c)*		1	3.2
18:1n-5 *(c)*	ND	0.6	0.3		ND	0.5
18:1	ND	ND	ND		ND	ND
19:1	ND	ND	1.2	ND	ND	0.8
20:1n-11	ND	0.1	ND	Σ 4.3	ND	ND
20:1n-9	1.03±0.01	1.9	2.8		1.1	2.2
20:1n-7 *(c)*	ND	1.8	4.2		ND	1.7
20:1	ND	ND	ND		ND	ND
22:1n-11*(c)*	ND	ND	ND	Σ 2.8	ND	ND
22:1n-9	0.62±0.00	0.6	2.1		ND	1.3
22:1n-7	ND	ND	0.2		ND	0.4
Total MUFA	14.11±0.01	23.1	20.7	24.2	14.7	21.2

Polyenoic (n-6):						
18:2n-6	1.56±0.01	2.2	1.4	1.2	0.9	1.3
18:3n-6	0.92±0.00	ND	ND	Σ 2.0	ND	ND
20:2n-6	0.47±0.01	0.7	0.6	ND	ND	0.6
20:3n-6	ND	0.1	ND	ND	ND	ND
20:4n-6	1.38±0.01	ND	2	ND	0.3	1.5
22:5n-6	ND	ND	ND	ND	0.3	ND
Total n-6	4.33±0.02	3	4	3.2	1.9	3.4
Polyenoic (n-3)						
18:3n-3	ND	0.4	0.2	ND	1.3	NSA
18:4n-3	ND	1.1	0.3	10.3	2.4	0.7
20:4n-3	ND	0.7	ND	ND	1.2	ND
20:5n-3	9.75±0.01	18.6	17.4	6.3	16.9	14.6
22:5n-3	ND	0.4	0.2	ND	0.3	0.2
22:6n-3	23.01±0.02	25.7	24.8	4.3	30.4	18
Total n-3	32.76±0.03	46.9	42.9	20.9	52.5	33.5
Total PUFA	37.09±0.02	50.1	47.3	24.6	ND	37.1
EPA/DHA	0.42	0.72	0.7	0.63	0.45	0.81

*: n=6,
± Standard Deviation; ND: None detected; NSA: No significant amount (<0.01)
a: Present work; b: Phleger *et al.*, 1998; c: Nelson *et al.*, 2000; d :Clarke *et al.*, 1987 ; e : Falk-Peterson *et al.* 2002

Discussion

The papers published on fatty acid compositions were *Beroe cucumis* (Clarke *et al.*, 1987, Phleger *et al.*, 1998, Nelson *et al.*, 2000, Falk-Petersen *et al.*, 2002) and *Beroe forskalii* (Nelson *et al.*, 2000). But only total lipid amount of *Beroe ovata* was given by Finenko *et al.* (2003) and Anninsky *et al.*, (2005). Total lipid amount of *Beroe spp.* were as 0.98±0.05 mg/g in *Beroe ovata* (present study*)* taken from the Sea of Marmara. Anninsky *et al.* (2005) and Finenko *et al.* (2001) was detected total lipid amount of *Beroe ovata* in the Black Sea as 0.31±0.13 mg/g and 0.26±0.04 mg/g respectively. It was found as 2.2 % in *Beroe forskalii* from Antarctic Ocean by Nelson *et al.* (2000), 9.64 mg/g in *Beroe cucumis* from Arctic Ocean by Clarke *et al.* (1987) and 0.2 mg/g in *Beroe cucumis* from Arctic Ocean by Phleger *et al.* (1998). Thus *Beroe ovata* from the Sea of Marmara contains more fatty acids than that from the Black Sea and also Arctic and Antarctic samples of *Beroe cucumis*.

Table 1 shows differentiation the fatty acid compositions of *Beroe spp*.

In this study we did not determine the fatty acids of 19:0, 14:1n-7, 14:1n-5, 16:1n-5, 18:1n-7(*c*), 18:1n-5, 19:1, 20:1n-7, 22:1n-7, 18:3n-3, 18:4n-3, 20:4n-3, 22:5n-6 and 22:5n-3 in *Beroe ovata*.

The difference of fatty acids between the *Beroe ovata* with *Beroe cucumis* and *Beroe forskalii* were detection of 21:0 ve 17:1n-7 in only *Beroe ovata*

The total level of MUFA in *Beroe ovata* was lower than in *Beroe cucumis* and *Beroe forskalii* (Phleger *et al.*, 1998; Nelson *et al.*, 2000). There is an inverse relationship between n-3 PUFA and MUFA as previously observed other *Beroe* species (Nelson *et al.*, 2000). The ratio of EPA/DHA in *Beroe ovata* was lower than in other *Beroe spp.*

Finally, the fatty acid compositions of *Beroe* species showed some differences. The causes of the variation of fatty acid content are due to ecological constraints of sea.

Özet

Marmara Denizinin kıyı bölgelerinden toplanan *Beroe ovata*'nın toplam lipid miktarı 0.98±0.05 mg/g (n=6) olarak tespit edildi. *Beroe ovata*'nın yağ asidi bileşenleri gaz kromatografisi-kütle spektrometresi ile tayin edildi. Toplam doymuş, tek ve çok doymamış yağ asidi yüzdeleri sırasıyla 35.78, 14.11 ve 37.09 olarak bulundu. Eikozapentaenoik asit (EPA, 20:5n-3) ve dokozahekzaenoik asit (DHA, 22:6n-3) miktarları sırasıyla 9.75% ve 23.01% olarak bulundu. Dokozapentaenoik asit Marmara Denizi'nde bulunan *Beroe ovata*'da bulunmadı. EPA/DHA oranı 0.42 olarak bulundu.

Bu çalışmada *Beroe ovata* ile literatürde kayıtlı diğer *Beroe* türlerinin yağ asitlerinin içeriği incelenmiş ve bunlar arasında yalnız *Beroe ovata'* nın 21:0 ve 17:1n-7 yağ asitleri içerdiği tespit edilmiştir.

Bu *Beroe ovata*'nın yağ asidi kompozisyonu üzerine ilk çalışmadır.

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