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Quality Factors and Functional Components in the Edible Seaweeds
I. Distribution of n-3 Fatty Acids in 10 Species of Seaweeds by Their Habitats

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Abstract

Total lipid contents from 10 species of marine algae (2 green, 5 brown, and 3 red algae) collected from different places in Korea were examined and their fatty acid compositions were compared among species and habitats. Total lipid (TL) was prominent in green laver (about 7.3~10.1%) of the green algae, in sea mustard and seaweed *fusiforme* (about 3.1~4.8%) of the brown algae and purple laver (about 4.9~6.4%) of the red algae. Sea mustard and seaweed *fusiforme* collected at Chungmu contained a relatively high level of TL compared with those collected at Kijang and Yosu, whereas green laver at Chungmu revealed a lower level of TL than that at Yosu and Kijang. The TL content of purple laver showed the highest portion in that collected at Nakdong. Green algae comprised the majority of n-3 fatty acids (29.0~66.3%), which mainly consisted of 16 : 4 (n-3) (or 16 : 3 (n-3)), 18 : 3 (n-3) and 18 : 4 (n-3). Brown algae accounted for a low level of n-3 fatty acids (17.9~36.5%) mainly 18 : 4 (n-3), 18 : 3 (n-3) and 20 : 5 (n-3), whereas the brown algae contained a significant level of n-6 fatty acids (7.23~26.5%) such as 20 : 4 (n-6) and 18 : 2 (n-6). In the case of red algae, the n-3 fatty acids consisted mostly of 20 : 5 (n-3) which scored 53% of polyenoic acids in purple laver collected at Nakdong. The proportion of n-3 fatty acids in algae belonging to the same species was higher in algae of high TL contents. Consequently, TL and n-3 fatty acid levels from the seaweeds studied in this paper were different from their habitats.

Key words : seaweed, fatty acid compositions, n-3 fatty acids

INTRODUCTION

Seaweed, a cryptogam that lives in seawater, differs from terrestrial plants by environmental conditions such as temperature and light, so that they often have their own peculiar components or metabolism. It has been well known that seaweed contains much more functional components such as n-3 fatty acids for prevention of adult diseases compared with terrestrial plants[1]. Nowadays, they have been recognized as potential sources of valuable components in medical and pharmaceutical science, as well as in the food industry. In Korea dried seaweeds (a good source of polysaccharides and minerals) is available in national food service markets year round. However, little information is known about the lipid in Korean seaweed due to the lipid's relatively low content[2-4].

In general, lipid contents of seaweed differ according to their environmental conditions and species-specificity. Lipid contents were remarkably reduced with an increase in the depth of growth of grown algae[5,6]. In the study of the relationship between light intensity and fatty acid composition *Porphyra*, the algae grown in organic medium in the dark had a greater amount of polyunsaturated fatty acids than that grown in the light[7]. The acetone soluble lipid contents of 17 species of marine benthic algae were relatively rich in the brown algae compared with the red algae[8]. Also, Kayama et al.[9] studied the effect of water temperature on the fatty acid composition of a red algae *Porphyra* sp., and they pointed out that the cooler environment could produce more unsaturated fatty acid. There were also significant differences in the contents of 16:0 and 20:5 (n-

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3). Moreover, they suggested that *Porphyra* would be able to desaturate not only from 18:1(n-9) to 18:3(n-3) along the conversion pathway of the plant, but also from 18:3(n-3) to 20:5(n-3) by way of the animal type. This was demonstrated in their latter study on the de nove syntheses and conversion of fatty acids in *Porphyra*[10].

In the present study, the fatty acids in 10 species of seaweeds were analyzed, and their n-3 fatty acid compositions were discussed with respect to their species-specificity and habitats.

MATERIALS AND METHODS

Seaweeds

Ten species of seaweeds (2 green algae, 5 brown algae, and 3 red algae) used in this study were described in Table 1. Seaweeds were washed thoroughly with fresh water and then air dried in a dark place for about 2 days, during which their moisture contents reached about 10 to 20%. We used a commercially dried laver for purple laver.

Lipid extraction

Dried samples were crushed to about 60 mesh with a cutter. Moisture content of the crushed samples was about 80% by adding water, and then total lipid (TL) was extracted according to the procedure of Bligh and Dyer[11]. The TL contents were gravimetrically determined.

Analysis of fatty acid compositions

About 200mg of TL were saponified with 1N KOH in ethanol at 85°C and then methylated with BF_3-methanol. The fatty acid compositions of TL were analyzed by gas-liquid chromatography using a Shimadzu GC 14A instrument (Shimadzu Seisakusho Co. Ltd., Kyoto, Japan) equipped with a Supelcowax-10 fused silica wall-coated open-tubular column (30m×0.25mm, i.d., Supelco Japan Ltd., Tokyo). The injector and detector were kept at 250°C and the column at 210°C. The split ratio was 1:50. Helium was used as the carrier gas at a constant inlet pressure of 1.5kg/cm^2. The fatty acids were identified by comparing the equivalent chain length and the retention time of the standards[12].

RESULTS AND DISCUSSIC

Total lipid contents

As shown in Table 1, the percentage of TL ranged between 2.0 to 10.1% in green algae, between 2.0 to 6.1% in brown algae, and between 1.6 to 6.4% in red algae. In green algae, TL content of green laver was about 2~5times more than that of sea staghorn. The highest level in green laver collected at Yosu was 10.1% and the lowest level in Chungmu 7.3%. Seaweed *fulvescens* contained about 2% more than the mean value (4.2%) of TL contents of the estimated brown algae, whereas sea tangle was about 2% less. TL contents of sea mustard and seaweed *fusiforme* was highest in those collected at Chungmu, followed by those at Kijang and at Yosu.

In case of red algae, TL contents ranged from 4.9 to 6.4% in purple laver, from 1.6 to 2.5% in typicus, and 1.6% in ceylon moss. Purple laver collected at Nakdong had the highest TL content (6.4%) of the analyzed purple lavers. Those at Kochang and Shinan were at the same level (5.5%), and those at Wando had the lowest level (4.9%). The TL content in typicus was higher than in ceylon mosses, and lower than those in purple laver. These results coincided with those reported previously[2~4,13,14]. Russel-Wells[5] found that the petroleum ether extractable components decreased remarkably with an increase in depth of growth. The crude lipid content did not vary in 4 species of seaweed grown in a depth of 1 to 3 meters, while it decreased in the same algae grown in a depth under 3 meters[6]. The TL content, from 17 species of algae ranged from 1 to 4% in seaweeds, which is comparable to those from the higher plants comprising 1 to 9%[8]. In this study, the same species of seaweeds contained a similar amount of TL. However, the species from different habitats showed variable TL contents. These results, therefore, were considered mainly to come from differences in the nutritional source of their habitats, because almost all the seaweeds

Table 1. The total lipid contents of marine algae (%, dry basis)

Species		Collection		Total lipid*
Common name (Korean name)	Scientific name	Place	Date	
Green algae				
Green laver	*Entromorpha linza*	Kijang	Feb. '92	9.63
(Parae)	*Entromorpha compressa*	Chungmu	Feb. '92	7.28
	Entromorpha linza	Yosu	Jan. '92	10.10
Sea staghorn	*Codium fragile*	Kijang	May '92	3.29
(Cheongak)		Yosu	Jul. '92	2.01
Brown algae				
Sea mustard	*Undaria pinnatifida*	Kijang	Feb. '92	4.17
(Miyeok)		Chungmu	Feb. '92	4.82
		Yosu	Jan. '92	3.99
Seaweed *fusiforme*	*Hizikia fusiforme*	Kijang	Feb. '92	3.85
(Tots)		Chungmu	Feb. '92	4.02
		Yosu	Jan. '92	3.14
Gulf weed (Mozaban)	*Myagropsis yendoi*	Chungmu	Feb. '92	5.84
Seaweed *fulvescens* (Maesangi)	*Capsosophon fulvescens*	Yosu	Jan. '92	6.10
Sea tangle (Dashima)	*Laminaria japonica*	Kijang	Jul. '92	2.04
Red algae				
Purple laver	*Porphyra tenera*	Nakdong	Dec. '91	6.36
(Gim)		Kochang	Dec. '91	5.45
		Shinan	Jan. '92	5.45
		Wando	Jan. '92	4.85
Ceylon moss	*Gloipeltis complanata*	Kijang	Mar. '92	1.58
(Gasari)		Yosu	Jan. '92	1.58
Typicus	*Halimeniopsis dilatata*	Kijang	Mar. '92	2.52
(Dobak)		Yosu	Jan. '92	1.58

*Average value of repeated experiment

studied were collected in the same season, which is different environmental conditions, expect nutritional condition, in their habitats.

Fatty acid compositions of green algae

The prominent fatty acids of green laver were 18:3 (n-3), 16:4 (n-3), 16:0, 18:4 (n-3) and 18:1 (n-7), and those of sea staghorn were 16:3 (n-3), 16:0, 18:3 (n-3), 14:0 and 18:2 (n-6) (Table 2). These results are similar to the report from Jamieson and Reid[15] and Takagi et al.[16], whereas different from those by Ha[2] and Hong et al.[4]. In sea staghorn, 16:3 (n-3) (33.0%) was found as the highest fatty acid, but 16:4 (n-3) and 18:4 (n-3) were found as minor components which was the elementary fatty acid in green laver. These difference in both algae were supposed to be due to the species-specificity of their fatty acid biosynthesis. It is of interest that 16:3 (n-3) often appears as one of the principal fatty acids in diadoms[17], that being the most abundant one in sea staghorn. The percentages of these prominent fatty acids displayed differences according to their habitats ; particularly, 16:4 (n-3) had the highest level (24.7%) in green laver collected at Yosu, but the lowest level (15.0%) in that collected in Chungmu. The n-3 fatty acids having relatively shorter chains such as 16:3 (n-3), 16:4 (n-3), 18:4 (n-3), and 18:3 (n-3) compared to 20:5 (n-3) (EPA) and 22:6 (n-3) (DHA) had a higher percentage in green algae, accounting for 54.8~66.3% in green laver and 29.0~48.4% in sea staghorn. However, the n-6 fatty acids were low level, scoring 2.9 and 10.4% in both algae. As prev-

Table 2. The fatty acid composition of TL in green algae (area %)

Fatty acid	Green laver			Sea staghorn	
	Kijang*	Chungmu	Yosu	Kijang	Yosu
12 : 0	-	-	-	3.82	4.83
14 : 0	0.74	1.88	1.73	4.28	4.75
15 : 0 iso	-	-	-	0.71	0.25
15 : 0	0.20	0.17	0.69	1.35	0.77
16 : 0	18.80	25.20	20.30	32.60	16.20
17 : 0 iso	2.42	2.31	3.31	0.58	0.75
17 : 0 anteiso	0.44	0.30	0.48	4.25	7.30
17 : 0	0.18	0.12	0.19	0.22	-
18 : 0	0.22	0.41	0.24	1.89	0.56
19 : 0	0.36	0.89	0.51	0.07	3.59
20 : 0	-	-	-	0.29	-
22 : 0	-	-	-	0.79	-
Saturated	22.36	31.28	28.16	50.85	39.00
14 : 1 (n-5)	0.04	0.13	0.19	0.74	-
14 : 1	0.06	0.26	-	-	0.48
15 : 1 (n-8)	0.07	0.42	0.53	1.63	-
16 : 1 (n-7)	0.85	0.95	0.87	7.31	2.57
18 : 1 (n-9)	0.33	-	0.21	9.12	2.10
18 : 1 (n-7)	4.75	7.46	4.23	2.05	0.09
Monoenoic	6.10	9.43	6.03	21.33	5.24
16 : 2 (n-4)	0.06	-	-	0.49	0.32
16 : 3 (n-3)	3.75	3.42	4.44	14.90	33.00
16 : 4 (n-3)	21.50	15.00	24.70	0.30	0.24
17 : 2 (n-8)	-	0.06	0.10	-	-
18 : 2 (n-7)	-	0.10	-	-	-
18 : 2 (n-6)	2.48	2.85	2.40	7.98	4.14
18 : 3 (n-4) + 19 : 1	-	0.36	-	-	-
18 : 3	-	0.40	-	-	-
18 : 3 (n-3)	22.30	18.10	20.70	12.30	13.20
18 : 4 (n-3)	16.40	15.50	12.50	-	1.20
20 : 2	0.01	1.11	-	-	-
20 : 2 (n-6)	0.22	0.56	0.93	1.10	2.29
20 : 3 (n-6)	0.10	-	-	-	-
20 : 4 (n-6)	0.14	0.37	-	1.36	0.66
20 : 3 (n-3)	-	0.83	-	-	-
20 : 4 (n-3)	0.83	-	-	-	-
20 : 5 (n-3)	1.52	0.93	0.81	0.51	0.74
22 : 6 (n-3)	-	0.97	-	-	-
Polyenoic	72.28	60.56	68.43	40.14	55.79
n-3 family	66.30	54.75	63.15	28.01	48.38
n-6 family	2.94	3.78	3.33	10.44	7.09

*Sample collection area located in southeast Korea and on the southern coast

iously mentioned by Erwin and Bloch[18], and Hayashi et al.[8], it was recognized that the green algae have a γ-linolenate pathway in the direction of desaturation of their fatty acids.

Fatty acid compositions of brown algae

The primary fatty acids in brown algae were relatively 16:0, 18:4 (n-3), 20:4 (n-6), 18:1 (n-9), 14:0, 18:3 (n-3), 18:2 (n-6), 20:5 (n-3) and 16:1 (n-7) (Table 3). Brown algae had affluent of 14:0, 18:1 (n-9), 18:2 (n-6), and 20:5 (n-3) which were found as slight levels in green algae. These results agree with those of Hayashi et al.[8] and Jamieson and Reid[15]. The percentages of the elementary fatty acids also showed indicative differences by their habitats. That is, the percentages of 18:4 (n-3) in sea mustard from Yosu, Kijang, and Chungmu were 9.9, 13.8%, and 20.0%, respectively, and that of 20:4 (n-6) in seaweed *fusiforme* from Kijang, Chungmu, and Yosu was 2.2, 8.4, and 10.2%, respectively. Total portion of the n-3 fatty acids in brown algae ranged from 17.9 to 36.5%, which was lower than that in green algae ; however, the former had higher levels of 20:5 (n-3) compared with that of the latter. Brown

Table 3. The fatty acid compositions of TL in brown algae (area %)

Fatty acid	Sea mustard			Seaweed *fusiforme*			Gulf weed	Seaweed *fulvescens*	Sea tangle
	Kijang*	Chungmu	Yosu	Kijang	Chungmu	Yosu	Chungmu	Yosu	Kijang
14 : 0	7.75	11.40	9.47	10.60	6.74	6.14	11.43	11.30	12.70
15 : 0 anteiso	0.09	–	–	–	–	0.14	–	0.66	1.42
15 : 0	0.59	0.86	1.60	1.90	0.95	1.01	0.44	0.64	0.88
16 : 0	28.20	21.70	28.90	28.00	36.40	32.00	21.20	29.50	24.80
17 : 0 iso	2.52	3.80	2.74	1.67	1.87	1.83	1.09	2.93	0.75
17 : 0 anteiso	0.17	0.23	0.28	0.53	0.45	0.15	0.40	0.20	2.15
17 : 0	0.13	0.34	0.83	2.61	0.26	0.96	–	0.14	0.43
18 : 0 iso	0.24	–	–	1.35	0.70	–	–	–	–
18 : 0	1.14	0.46	1.03	2.52	1.01	0.45	0.21	0.72	1.69
19 : 0	1.57	3.10	1.67	3.06	1.41	0.56	2.58	0.61	–
20 : 0	0.14	–	–	–	–	–	–	0.41	0.22
Saturated	42.54	41.89	47.87	52.24	49.93	43.24	38.56	47.11	45.04
14 : 1 (n – 5)	0.07	0.25	0.46	0.74	0.25	–	–	–	–
14 : 1	–	–	0.23	–	–	–	–	–	–
15 : 1 (n – 8)	0.25	0.66	1.60	1.63	0.68	–	–	–	0.14
16 : 1 (n – 7)	1.37	1.78	2.76	7.31	3.48	5.66	4.72	4.57	5.63
16 : 1 (n – 5)	–	–	–	–	–	–	–	–	0.54
17 : 1 (n – 8)	–	–	–	–	–	0.23	0.49	0.35	–
18 : 1 (n – 9)	9.37	3.31	8.62	9.12	4.54	6.23	3.31	11.60	1.01
18 : 1 (n – 7)	0.29	0.86	0.80	2.05	1.28	0.27	0.58	0.39	–
18 : 1 (n – 5)	–	–	–	–	–	0.19	–	–	–
20 : 1 (n – 11)	–	–	–	–	0.84	0.88	0.32	–	–
20 : 1 (n – 7)	0.64	0.84	–	1.56	1.26	–	0.20	0.46	–
22 : 1 (n – 9)	–	–	–	–	–	0.24	–	–	–
Monoenoic	11.94	7.93	16.03	23.25	12.75	13.90	9.62	17.40	7.32
16 : 2 (n – 4)	–	–	–	–	–	–	1.28	0.21	–
16 : 3 (n – 3)	0.21	0.42	0.27	0.29	0.16	0.30	0.21	0.32	0.41
16 : 3 (n – 1)	–	0.54	1.11	–	–	–	–	–	–
16 : 4 (n – 3)	–	0.17	0.64	–	–	–	–	20.34	–
17 : 2 (n – 8)	–	0.18	0.18	–	–	0.33	0.55	0.17	0.20
18 : 2 (n – 7)	–	0.21	–	–	–	–	0.04	10.10	–
18 : 2 (n – 6)	6.57	5.74	7.07	3.09	2.71	4.65	4.09	5.49	18.40
18 : 2 (n – 4)	–	–	–	–	–	0.20	0.17	0.14	–
18 : 3 (n – 3)	7.28	29.48	4.89	5.54	27.73	29.80	–	25.44	9.44
18 : 4 (n – 3)	13.80	20.00	9.88	8.32	18.88	18.29	15.40	18.59	16.26
20 : 2	–	0.39	–	–	0.73	0.62	0.17	–	0.82
20 : 2 (n – 6)	0.20	0.49	2.52	1.96	0.45	1.31	0.79	0.17	–
20 : 3 (n – 6)	0.33	–	0.36	–	0.23	0.28	0.80	0.28	0.25
20 : 4 (n – 6)	11.00	6.50	7.38	2.18	8.37	10.20	17.30	4.70	7.88
20 : 3 (n – 3)	–	–	–	–	–	–	0.24	–	–
20 : 4 (n – 3)	–	–	–	0.38	0.47	–	0.74	0.70	–
20 : 5 (n – 3)	6.19	5.37	4.64	3.62	8.22	7.05	3.96	8.88	3.97
Polyenoic	47.07	49.85	38.32	26.34	38.48	45.33	51.52	46.35	47.63
n – 3 family	27.20	36.50	20.30	17.90	25.30	25.10	27.80	24.00	20.10
n – 6 family	18.10	12.70	17.30	7.23	11.80	16.50	22.90	10.60	26.50

*Refer to the footnote of Table 2

algae also contained a significant degree of the n-6 fatty acids such as 18:2(n-6) and 20:4(n-6) accounting for 7.2 to 22.9%, respectively.

Hitherto, it was recognized that brown algae has a relatively strong α-linolenate pathway in the direction of desaturation of their fatty acid[17], as well as γ-linolenate pathway, because of having significant levels of both n-6 and n-3 fatty acid, such as, 20:4 (n-6), 18:2(n-6), 18:4(n-3), 18:3(n-3), and 20:5(n-3).

Fatty acid compositions of red algae

The major fatty acids in purple laver were 20:5 (n-3) and 16:0 ; the percentage of both fatty acids ranged from 63.1% at Wando to 82.7% at Nakdong (Table 4). Ceylon moss also had a similar fatty acid pattern to purple laver, but 14:0 and 18:1 (n-9) distributed notable measure in the latter. On the other hand, typicus contained a significant percentage of unusual fatty acids such as 15:0 and iso-18:0. Studies on the fatty acid compositions of purple

Table 4. The fatty acid composition of TL in red algae (area %)

Fatty acid	Purple laver				Ceylon moss		Typicus
	Nakdong*	Kochang	Shinan	Wando	Kijang	Yosu	Kijang
12 : 0	–	–	–	–	–	–	2.44
14 : 0	0.28	0.75	0.44	0.92	7.24	5.26	16.90
15 : 0 iso	–	–	–	–	0.32	0.37	–
15 : 0	0.17	0.24	0.30	0.26	0.75	0.66	11.80
16 : 0	29.70	35.90	38.20	38.00	39.20	39.20	23.40
17 : 0 iso	–	–	–	0.15	0.76	0.55	0.77
17 : 0 anteiso	–	–	–	–	–	–	2.90
17 : 0	–	–	–	0.15	0.15	0.23	1.69
18 : 0 iso	–	–	–	1.95	–	–	7.22
18 : 0	0.47	0.37	0.58	0.47	0.64	0.74	1.97
19 : 0	0.35	0.82	0.50	0.53	0.71	0.45	–
Saturated	31.00	38.10	40.00	42.40	50.40	47.50	69.10
16 : 1 (n − 9)	0.29	0.43	0.47	0.76	–	–	0.84
16 : 1 (n − 7)	2.82	7.05	5.20	4.41	3.63	7.81	–
17 : 1 (n − 8)	–	–	–	–	0.41	0.56	–
18 : 1 (n − 11)	–	–	–	–	–	0.11	–
18 : 1 (n − 9)	2.04	1.28	0.09	1.46	5.97	6.52	1.88
18 : 1 (n − 7)	0.36	0.34	1.85	2.31	3.13	5.42	–
18 : 1 (n − 5)	–	–	0.69	–	–	–	0.45
20 : 1 (n − 9)	1.98	0.23	1.62	1.04	0.48	0.08	0.99
20 : 1 (n − 7)	–	–	–	–	–	0.77	–
Monoenoic	7.49	9.33	9.92	9.98	13.72	21.72	4.16
16 : 2 (n − 4)	–	–	–	–	0.57	0.31	–
16 : 4 (n − 3)	0.21	0.25	0.43	6.28	0.66	0.44	0.58
17 : 2 (n − 8)	–	–	0.40	–	–	–	–
18 : 2 (n − 6)	1.95	1.43	1.91	1.90	2.61	2.62	2.22
18 : 2 (n − 4)	–	–	–	–	0.09	0.35	–
18 : 3 (n − 3)	0.16	0.21	0.11	6.40	1.18	0.42	1.47
18 : 4 (n − 3)	0.21	0.25	0.31	4.74	0.25	0.29	10.61
20 : 2 MID	–	–	–	–	0.06	0.17	–
20 : 2 (n − 6)	0.79	0.40	0.72	0.45	0.34	0.24	–
20 : 3 (n − 6)	1.67	1.88	2.26	1.18	0.49	0.80	–
20 : 4 (n − 6)	3.21	2.29	1.13	1.08	2.24	0.90	–
20 : 4 (n − 3)	0.31	–	0.40	0.46	–	–	–
20 : 5 (n − 3)	53.00	44.40	42.40	25.10	27.50	24.80	21.80
22 : 6 (n − 3)	–	1.46	–	–	–	–	–
Polyenoic	62.97	53.37	50.07	48.31	35.99	31.34	36.68
n − 3 family	53.90	46.60	43.60	43.00	29.60	25.90	24.50
n − 6 family	7.63	6.00	6.08	4.61	5.68	4.56	2.22

*Refer to the footnote of Table 2

laver have been carried out by many investigators[3,13,19,20], because purple laver (a dried laver) is the most favorite food from seaweeds, particularly in the Orient. The percentage of 20:5 (n-3) of purple laver was variable to their habitats. Purple laver collected at Nakdong contained about 2-times of 20:5 (n-3) than that grown at Wando, and about 10% higher percentage than those collected from Kochang and Shinan. Purple laver from Wando scored a meaningful value of 16:4 (n-3), 18:3 (n-3) and 18:4 (n-3), which were distinctive components in green algae. This result is due to the alteration of small amounts of green laver during production of dried purple laver. In this study, purple laver contained about 50% of 20:5 (n-3) of the total fatty acids. This value should be the highest level of the edible marine algae reported to date. Thus, purple laver might be a commonly available source of 20:5 (n-3). From these fatty acid compositions, it is recognized that red algae have mainly γ-linolenate pathway in the direction of desaturation of fatty acids as described previously[10].

Hitherto, seaweeds had an affluent n-3 fatty acid family. Human beings cannot synthesize 18:2 (n-6) and 18:3 (n-3), the essential fatty acids (EFA or vitamin F). EFA ingested from food are synthesized to longer and more unsaturated fatty acids, such as 20:4 (n-6), 20:5 (n-3), 22:5 (n-3) and 22:6 (n-3), by chain elongation and desaturation in the human body. The n-3 fatty acids, particularly 20:5 (n-3) and 22:6(n-3), have been well known as functional compounds for human health for a decade. These polyunsaturated fatty acids (PUFA) help to prevent thrombosis and atherosclerosis[21], and lower the level of serum triglyceride and cholesterol[22], while promoting better memory[23,24].

Marine organisms, including seaweeds, are the only sources of PUFA. Although seaweeds have been used as food in Korea, relevant information relating to human health is still being researched. From this study, we found that n-3 fatty acids are abundant in the algae having larger amounts of TL content.

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식용 해조류의 품질구성요인과 그 기능성 성분
Ⅰ. 서식지에 따른 10종 해조류의 n-3 지방산의 분포

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요 약

10종 해조류(녹조류 2종, 갈조류 5종, 홍조류 3종)의 n-3 지방산 조성을 우리 나라 남해안의 주요 서식지에 따라 비교하였다. 총지질(TL)은 녹조류 중에서는 파래(약 7~10%), 갈조류 중에서는 미역과 톳(약 3~5%), 그리고 홍조류 중에서는 김(약 5~6%)에서 각각 많았다. 미역과 톳의 TL함량은 충무에서 채취한 것이 기장 및 여수에서 채취된 것들보다 많은 경향이 있었으나, 파래의 경우에는 기장 및 여수에서 채취된 것에서 더 많았다. 녹조류는 16 : 4 (n-3), 18 : 4 (n-3) 및 18 : 3 (n-3)과 같은 비교적 탄소수가 적은 n-3지방산(28.0~66.3%)이 풍부하였다. 갈조류는 녹조류에 비하여 적은 양의 n-3 지방산(17.9~36.5%)을 함유하였으나, n-6 지방산을 상당량 함유하였다. 홍조류의 n-3 지방산은 대부분 20 : 5 (n-3) 지방산으로 구성되었으며, 특히 낙동에서 채취된 것이 53%의 20 : 5 (n-3) 를 함유하였다. 이들 n-3 지방산의 함량은, 동일종에 속하는 해조의 경우, TL함량이 높은 종류에서 더 높은 경향을 보였다. 따라서 시험된 해조류는 TL함량과 n-3 지방산의 함량이 서식지에 따라 다른 결과를 나타내었다.