Short Paper

Fatty Acid Composition of Malaysian Marine *Chlorella*

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Much work¹⁻³⁾ has pointed out the importance of n-3 series of fatty acids as essential fatty acids (EFA) for fish, especially marine species. In the seed production of fish, *Nannochloropsis* sp. which is a marine type of alga and contains large amounts of eicosapentaenoic acid (20:5n-3), has been widely used as an algal diet for the rotifer *Brachionus plicatilis*, most important food for fish larvae. In tropical countries, however, *Nannochloropsis* is not always an ideal organism because atmospheric temperatures are sometimes too high to cultivate this alga. The culture of Japanese *Nannochloropsis* at high temperatures (more than 28°C) has also been shown to result in the decrease in 20:5n-3 levels in the cells.⁴⁾ Recently, the members of Universiti Pertanian Malaysia, Malaysia, isolated a marine type of *Chlorella* (Malaysian *Chlorella*) which grows well at high temperatures (30–35°C) and supports good growth of the rotifer (S. H. Cheah, personal communication). In the present study, the fatty acid composition of Malaysian *Chlorella* was investigated and compared with that of Japanese *Nannochloropsis*. This paper also deals with the effect of water temperature on the fatty acid levels of these algae.

Specimens of the algae were cultured in a polycarbonate tank (30 l) set up indoors near windows. Water temperature was controlled by a heater with a thermostat. The culture medium containing the following fertilizers (g/l) in sea water (salinity 34‰) was used as previously⁴⁾: ammonium sulfate, 150; superphosphate, 15; urea, 10; Clewat-32 (Teikoku-Kagaku

Sangyo Co. Ltd., Osaka), 30. *Chlorella* cells were centrifuged off for lipid analysis after 5–7 days when the cell concentration reached $12\text{--}20 \times 10^6$ cells/ml. Lipids were extracted from the algal cells and fatty acid methylesters were prepared in a similar manner to that mentioned previously.⁴⁾ Fatty acid analysis was conducted by gas-liquid chromatography (GLC) using an open-tubular column (50 m $\times$ 0.25 mm, FS-WCOT CP-Sil 88; Chrompack).⁵⁾ The Japanese *Nannochloropsis* contained 20:5n-3, EFA for marine fish and others, as the major fatty acids¹⁻³⁾ (Table 1). On the other hand, the major n-3 and n-6 fatty acids of Malaysian *Chlorella* were 18:2n-6 and 18:3n-3, which are EFA for some freshwater fish such as the carp.^{2,3)} Interestingly, the 18:2n-6 and 18:3n-3 contents in the Malaysian *Chlorella* increased and decreased, respectively, with the increase of water temperature. The 20:5n-3 and 22:6n-3 contents of Malaysian *Chlorella* were lower regardless of water temperatures than those of the Japanese *Nannochloropsis*. The Malaysian *Chlorella* contained substantial amounts of 18:3n-6 which was a trace component in the Japanese *Nannochloropsis*. We suspect that the Malaysian *Chlorella* is a useful algal diet for production of the rotifer as larval feeds of some freshwater fish which require 18:2n-6 and/or 18:3n-3 as EFA.

References

- 1) S. Teshima: in "Fish Culture and Dietary Lipids" (ed. by Japan. Soc. Sci. Fish.), Suisangaku Series No. 22, Koseisha-koseikaku, Tokyo, 1978, pp. 60–77.
- 2) T. Watanabe: *Comp. Biochem. Physiol.*, **73B**, 3–15 (1982).
- 3) S. Teshima: in "Fish Nutrition and Diets" (ed. by Y. Yone), Suisangaku Series No. 54, Koseisha-koseikaku, Tokyo, 1985, pp. 20–30.
- 4) S. Teshima, S. Yamasaki, A. Kanazawa, and H. Hirata: *Nippon Suisan Gakkaishi*, **49**, 805 (1983).
- 5) S. Teshima, A. Kanazawa, S. Koshio, and H. Mukai: *Mem. Fac. Fish. Kagoshima Univ.*, **39**, 137–147 (1990).

Table 1. Fatty acid content (mg/g dry wt.) of Malaysian *Chlorella* and Japanese *Nannochloropsis* cultured at different water temperatures

Fatty acids	Malaysian <i>Chlorella</i>				Japanese <i>Nannochloropsis</i>		
	20°C	25°C	30°C	35°C	20°C	25°C	30°C
14:0	0.1	0.2	0.1	0.2	2.8	4.3	7.0
16:0	7.2	10.4	9.3	13.6	7.9	13.2	28.9
16:1	4.8	6.7	3.5	3.5	13.4	14.4	20.0
18:1	8.8	10.9	8.8	8.9	2.0	1.9	2.5
18:2n-6	5.5	10.6	13.0	13.3	2.7	2.4	2.2
18:3n-6	9.5	9.0	8.0	8.2	Tr*	Tr	Tr
18:3n-3	22.0	20.7	9.2	6.7	Tr	0.1	0.1
20:4n-6	0.2	0.2	0.3	Tr	5.4	5.9	4.1
20:5n-3	0.2	0.2	0.1	Tr	36.2	36.5	28.6
22:6n-3	Tr	Tr	Tr	Tr	0.4	0.7	0.4
Total lipid	119	116	106	103	176	187	199

* Less than 0.1%.

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