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Lipids, Fatty Acids, and Fucoxanthin Content from Temperate and Tropical Brown Seaweeds

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Abstract

Brown seaweeds lipid fraction contains several bioactive components such as Fx, polyphenol and n-3 PUFA. In this research, total lipids, Fx and FA compositions of brown seaweeds harvested from cold waters and warm waters were evaluated. The seven brown seaweeds studied were collected in different months from two different geographical areas, viz. cold waters (Japan) and warm waters (Indonesia). The result show that total lipid and Fucoxanthin in temperate brown seaweeds were higher than tropical brown seaweeds. The major PUFA from warm water seaweeds were 16:0, 18:1n-9, 20:4n-6, and cold water continued dominantly 16:0, 20:4n-6, 20:5n-3. Temperate brown seaweeds [*S. horneri* (Turner) J. Agardh] was rich in fucoxanthin and n-3 PUFA especially EPA.

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1. Introduction

Seaweeds, especially brown seaweeds, are part of the staple diets in Japan, Korea (Miyashita and Hosokawa, 2009; Miyashita et al., 2013) and South-East Asian Countries (Muradian et al., 2015). Brown seaweeds contain, polysaccharide, minerals, protein, and lipid (Rodrigues et al., 2015; Murakami et al., 2012).

Even though lipid in brown seaweeds very small, the lipid fraction contains several bioactive components such as Fucoxanthin (Fx), polyphenol and omega-3 Polyunsaturated fatty acids (n-3 PUFA) (Airanthi et al., 2012). These components showed many beneficial effects to human health such as antioxidant activity (Airanthi et al., 2011), anti-obesity (Maeda et al., 2005; Miyashita, 2009) and anti-inflammatory (Siriwardhana et al., 2012; Calder, 2006). Lipids of brown seaweeds could be used as an alternative of marine lipid source because of its abundance among coastal water seaweeds (Nomura et al., 2013).

In previous study Terasaki et al. (2009), examined 15 brown seaweeds from Nesaki and Shinori, Hakodate, Japan. From their research, it was found that TL, Fx and FAs content varied in different seaweeds and therefore is species specific (Terasaki et al., 2009; Mori et al., 2004; Noviendri et al., 2011; Zailanie and Purnomo, 2011). Four different brown seaweeds cultivated in deep seawater showed that Fx was varied in all species (Mori et al., 2004). Brown seaweeds from tropical area (Malacca, Malaysia); *S. binderi* and *S. duplicatum*, were also reported to contain Fx more than $0.7 \text{ mg} \cdot \text{g}^{-1} \text{ DW}$ and PUFA greater than 33 % of total fatty acid (FA) (Noviendri et al., 2011). Fx was also found in five different brown seaweeds from East Java, Indonesia; with variation in Fx content (Zailanie and Purnomo, 2011). The results of these studies indicated that brown seaweeds from temperate and tropical areas could potentially be used as Fx and PUFA sources.

In order to enable the practical use of brown seaweeds as Fx and n-3 PUFA source, it is important to first obtain information on their contents in brown seaweeds from temperate and tropical region. In the present study, we analyzed total lipids, Fx and fatty acids (FA) composition brown seaweeds from temperate and tropical areas. This is the first report that presents comparison of total lipids, Fx and FA in brown seaweeds of cold and warm water origins.

2. Material and methods

The brown seaweeds studied were collected in different months from two different geographical areas, viz. cold waters (Japan) and warm waters (Indonesia) (see Table 1).

In the case of seaweeds collected from cold waters (1-4), the samples were transported to the laboratory in frozen condition. Immediately after the frozen seaweeds were transported to the laboratory, they were washed with fresh water to eliminate any presence of salt, and remove tiny particles also ephyphites. The cleaned seaweeds were next cut and dried with a paper towel. About 1 kg of the cleaned seaweeds were collected in polyethylene plastic bags and was then stored in the freezer ($-30 \text{ }^{\circ}\text{C}$) until used for analysis.

Table 1. Seaweeds from cold waters and warm waters

No	Seaweeds	Common Name	Site of collection	Time of Collection
1	<i>Sargassum horneri</i> (Turner) J. Agardh	Akamoku	Yamada Iwate Pref. Japan	April 2012
2	<i>Cystoseira Hakodatensis</i> (Yendo) Fensholt	Uganomoku	Fukushima, Hokkaido Pref., Japan	May 2013
3	<i>Sargassum siliquastrum</i> (Mertens ex Turner) C. Agardh	Yoremoku	Rishiri island, Hokkaido Pref., Japan	June 2013
4	<i>Ecklonia kurome</i> Okamura	Kurome	Sekisaki, Oita Pref., Japan	October 2012
5	<i>Sargassum crassifolium</i> J. Agardh	n.a	Jepara, Indonesia	April 2012

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