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LETTER TO THE EDITOR

Positional Distribution of Fatty Acids in Perilla (*Perilla frutescens* L.) Oil

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Sir,

Perilla (*Perilla frutescens* L.) is an annual plant also known as wild sesame. The perilla seed is known to possess a high content of oil up to 47.8% on a dry weight basis [1], and perilla leaves are used as a source of natural antioxidants [2, 3]. Perilla seed oil (or perilla oil) has long been used for edible purpose in Asian countries including Korea, China, Japan and India [4, 5]. The characteristics of perilla oil have been well elucidated and exclusively reviewed elsewhere [6, 7]. It is reported that neutral lipids (more than 90%) are a major lipid class in perilla oil, of which about 90% are triacylglycerols. The unique characteristic of perilla oil is its high content of linolenic acid, ranging from 53.6 to 64%, which is regarded as one of the very high linolenic acid contents found in natural resources. This is why perilla oil is considered one of the potential functional lipids for human usage. The high content of linolenic acid, however, also has limited its practical and commercial-scale utilization as an edible oil because of its high susceptibility to lipid oxidation during processing and transportation of perilla oil [8].

The chemical, physical and biological characteristics of lipids are largely dependent upon the composition and positional distribution of fatty acid on the glycerol backbone; thus, the stereospecific analysis of fatty acids in the triacylglycerol was considered important to be able to use the lipid for both dietary and industrial purposes [9]. It has been reported that the major fatty acid present at the *sn*-2 position of triacylglycerols of perilla oil is linolenic acid, although no information was available regarding the fatty acid composition of perilla oil at individual *sn*-1 and *sn*-3 positions [10].

We determined the positional fatty acid distribution of perilla oil at stereospecific positions, the *sn*-1, 2 and 3 positions in the triacylglycerols of perilla oil.

The analytical procedure was essentially identical to that of Kim et al. [11]. Perilla seeds were water-washed and air-drifted oven dried at 40 °C for 24 h. The moisture content after drying was about 20%. Total lipid was extracted in a Soxhlet apparatus using a mixture of chloroform and methanol (2:1, v/v) in a water bath at 40 °C for 3 h. Stereospecific analysis of perilla oil was carried out consecutively. The total fatty acid composition of perilla oil was analyzed by GC. Perilla oil was hydrolyzed by pancreatic lipase, and the reaction mixture was applied to TLC to separate 2-monoacyl-*sn*-glycerol and diacylglycerol. A band of 2-monoacyl-*sn*-glycerol was scraped for fatty acid analysis at the *sn*-2 position. The diacylglycerol band was scraped and extracted with anhydrous diethyl ether followed by phosphorylation by $PPhCl_2$. Phosphorylated diacylglycerol was hydrolyzed by phospholipase A_2, and the resulting 1-monoacyl-*sn*-glycero-3-phosphatidic was scraped from TLC plate for fatty acid analysis at the *sn*-1 position. The composition at the *sn*-3 position was calculated as $3 \times [TG] - [sn\text{-}1 + sn\text{-}2$ position].

The total lipid content of perilla seed was 45.6% (average of triplicate) on a dry weight basis. The major fatty acids of the perilla oil were identified as linolenic (53%), oleic (20.9%), linoleic (15.4%), palmitic (7.3%) and stearic (2.5%) acids, in decreasing order (Table 1), while myristic acid was detected as a minor component that could not be quantified. The total lipid composition obtained was similar to the results shown in previous reports [1–3, 6, 7, 10]. The linoleic acid content of perilla

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Table 1 Positional fatty acid distribution of perilla oil

	Total	*sn*-1	*sn*-2	*sn*-3
Palmitic acid	7.3	10.3	3.6	8.2
Stearic acid	3.3	6.7	2.1	1.1
Oleic acid	20.9	13.8	26.5	22.5
Linoleic acid	15.4	7.1	16.0	23.2
Linolenic acid	53.0	62.1	51.9	45.0

The perilla used was *Perilla frutescens* (L.) Britt, and the variety was Suwon 8. Perilla seeds used were grown in Kyunggi-Do, Korea, and obtained from a local market in Seoul, Korea. All values were the triplicate average, and the standard deviations were less than 1% unless otherwise specified

oil is much greater than that of any other vegetable oils, such as rapeseed, canola, soybean, flaxseed or citrus seed oil (1.8–9.6%) [12]. Perilla oil, with its large percentage of linolenic acid, is relatively unstable and susceptible to oxidation [8].

The positional fatty acid distribution of perilla oil is shown in Table 1. Linolenic acid was the major fatty acid in the *sn*-1, 2 and 3 positions. The percentage composition of fatty acids in the all positions showed the same pattern as in total fatty acid composition; however, the concentration at each stereospecific position was slightly different. In most vegetable oils, unsaturated fatty acids occupy the *sn*-2 position, and saturated fatty acids are located more in the *sn*-1 and *sn*-3 positions. The preponderance of more unsaturated fatty acids at the *sn*-2 position is well known in vegetable oils [9, 13, 14]. The distribution of saturated fatty acids (palmitic and stearic acids) was more pronounced at *sn*-1 and 3 rather than at *sn*-2, which is in agreement with data reported earlier. In contrast, however, it has also been reported that palmitic and stearic acids were found at *sn*-1 and 3, but not at the *sn*-2 position in perilla triglycerides [10], even though all fatty acids found at *sn*-2 are unsaturated fatty acids, which follows the general pattern of fatty acid distribution in plant lipids.

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