Stereospecific Analysis of Triglycerides from Apple Seed Endosperm

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ABSTRACT

Triglyceride composition and stereospecific distribution of fatty acids in apple seed oil are reported. Results are compared with proposed distribution theories.

INTRODUCTION

The stereospecificity of fatty acid distribution in a number of triglycerides (TGs) rich in linoleic acid was investigated (1,2). The aim of this study was to determine the TG composition and fatty acid distribution in apple seed oil, for which no data are available in the literature.

MATERIALS AND METHODS

TGs were isolated by column chromatography from the light petroleum extract of apple seed endosperm (3). Stereospecific distribution of fatty acids was determined as described by Christie and Moor (4). The purity of initial TG as well as the products of lipase hydrolysis monoglycerides, diglycerides, and fatty acids was checked by thin layer chromatography (benzene/diethyl ether/acetic acid (60:40:2). Methyl esters were prepared with diazomethane or by methanolysis. For gas chromatographic analyses, a 2 m x 2 mm column of 10% DEGS on chrom-

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osorb W was employed using methyl arachidate as an internal standard. The fatty acid distribution in different positions was expressed by distribution indexes (DI) (5). They were calculated as ratio A_x/A_t where A_x and A_t are the relative mole concentrations of a fatty acid in a given position "x" or in the total ("t") triglycerides.

The TG groups were resolved by preparative argentation (5% $AgNO_3$) thin layer chromatography (6) by continuous development in an open tank (light petroleum/acetone 100:4) (7). The relative amounts of each TG group were determined as described by Roehm and Privett (8).

RESULTS AND DISCUSSION

The TG group composition of the oil is compared in Table I with that calculated according to 1,3-random-2-random (9) and 1-random, 2-random, 3-random (10) hypotheses. Some serious deviations are clearly seen for the groups D_3, D_2M, D_2S and especially DMS. The results of duplicate analyses of the triglycerides was checked by comparing the composition directly found by GLC fatty acid analysis with that, calculated from the groups as shown in Table II.

The positional distribution of fatty acids found here shows that unsaturated acids occupy almost entirely sn-2 position. However, the DI of 1,3 for linoleic acid proves its preference for sn-2 position as compared with oleic acid. On the other hand, a well defined asymmetry for the distribution in sn-1 and sn-3 position exists. Thus, the

TABLE I

Triglyceride Composition of Apple Seed Endosperm Oil
(Mole %)

Triglyceride Type	Found	Calculated according to	
		Brockerhoff (10)	Van der Wal (9)
D_3^a	16.3	19.9	21.6
D_2M	42.6	30.5	30.1
D_2S	21.1	17.9	14.4
DM_2	11.8	13.4	13.3
DMS	3.4	12.4	12.6
M_3	0.9	1.8	1.8
DS_2	1.1	0.6	0.8
M_2S	1.8	1.1	2.2
MS_2	1.0	1.9	2.7
S_3	--	0.02	0.03

aAcyl groups in TGs: S- saturated, M- monoene, D- diene.

TABLE II

Stereospecific Analysis of Apple Seed Triglycerides
(in Mole %)

Acids	Total triglycerides		Distribution for position		
	Found	Calculated[a]	I	II	III
16:0	10.2	10.2	22.2 (2.2)[b]	0.4 (0.03)	8.0 (0.8)
18:0	2.0		5.7 (2.9)	0.1 (0.05)	0.2 (0.1)
18:1	26.7	25.6	33.9 (1.3)	21.6 (0.8)	24.6 (0.9)
18:2	61.1	64.2	38.2 (0.6)	77.9 (1.3)	67.2 (1.1)

[a]Calculated from table I; for example, for monoene $(18:1) = \dfrac{D_2M}{3} + \dfrac{2DM_2}{3} + \dfrac{DMS}{3} + M_3 + \dfrac{2M_2S}{3} + \dfrac{MS_2}{3}$

[b]Figures in parentheses are the distribution indexes calculated as explained in the text.

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saturated and oleic acid are predominantly positioned at sn-1.

The specificity at sn-1 position is saturated > 18:1 > 18:2. Exactly the opposite order of preference is valid for the sn-2 position if notice is taken to the DI values. The situation in position sn-3 is similar to that of sn-2 but not as clearly expressed. In this respect apple seed oil triglycerides do not follow the 1,3-random-2-random or 1-random-2-random-3-random distribution hypotheses.

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