

Fatty Acid Composition of Iranian Citrus Seed Oils

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ABSTRACT

Fatty acid compositions of seed oils from eight Iranian citrus fruits were determined. The ranges of values for major fatty acids were 21.8-29.4% palmitic, 3.1-7.60% stearic, 0.3-1.3% palmitoleic, 23.5-32.3% oleic, 33.5-39.8% linoleic, and 3.1-7.6% linolenic. Low amounts (up to 0.1%) of myristic and arachidic acids and traces of a few unidentified ones constituted minor fatty acids.

INTRODUCTION

Previous investigators (1-11) have reported fat characteristics of seed oils from several citrus species and varieties grown in different regions. The purpose of our investigation was to determine fatty acid composition of seed oils from important citrus species and varieties grown in Iran, and to compare the results with those reported by others.

MATERIALS AND METHODS

Citrus fruits were purchased in the Tehran market. They consisted of two types of orange, one type of sour (or bitter) orange, one type of mandarin (or tangerine), three types of sour lime, and one type of sweet lemon (Table I). Their seeds were separated and dried in the shade. Dried seeds were crushed into coarse particles and extracted with petroleum ether in a Soxhlet apparatus. The solvent was removed by vacuum distillation at low temperatures.

For the gas liquid chromatographic (GLC) analysis, the oils were methylated according to the direct procedure of the AOAC (12). The GLC separation of methyl esters of fatty acids was carried out using 4 mm inside diameter X 2 m copper column packed with 20% diethylene glycol succinate on Chromosorb W acid washed 60-80 mesh with a column temperature of 190°C and inlet and detector temperatures of 210°C. Nitrogen at 45 ml/min was used as carrier gas. Hydrogen at 35 ml/min and air at 350 ml/min were used in the flame ionization detector. Identification of the components was based on their retention times as compared with those obtained for methyl esters of known fatty acids analyzed under the same conditions. The % by wt of the components was calculated by the normalizing procedure of the surface areas of the peaks, measured by an electronic digital integrator.

RESULTS AND DISCUSSION

Compositions of the major fatty acids of the Iranian citrus seed oils are presented in Table I. The saturates consisted of 21.8-29.4% palmitic and 3.1-7.6% stearic, with up to 0.1% myristic and arachidic acids. The unsaturates consisted of 0.3-1.3% palmitoleic, 23.5-32.3% oleic, 33.5-39.8% linoleic, and 3.1-7.6% linolenic acids. In addition, traces of a few other unidentified components were observed in some cases. Nordby and Nagy (5), using highly effective combined thin layer and gas chromatographic techniques, separated and identified over 60 fatty acids, several of them being unusual components not detected by other workers. However, the minor fatty acids (ca. 60) constituted only a small portion (<2%) of the total.

In this investigation, the differences between varieties and species were not greater than those within varieties. For example, fatty acid compositions of sour limes, numbers 5 and 6 as compared with number 7, showed appreciable differences, greater than those observed between sour limes and oranges or sweet lemon; on the other hand, fatty acid composition of sweet lemon and oranges were not much different. An analogous situation has been pointed out also by Hendrickson and Kesterson (4). They found King orange to be more similar to Dancy tangerine than to four other orange varieties with regard to seed oil composition. Additional examples can be indicated by comparison of the results from different investigators. Hendrickson and Kesterson (4) have reported data for Dancy tangerine which are similar to those reported by Nordby and Nagy (5) and Teles et al. (6) for grapefruits. The similarity of our results to those reported by Nordby and Nagy (5) for oranges increases confidence in the kind of data on which such comparisons are based. Thus, only major fatty acid composition of triglycerides of a citrus seed oil cannot definitely indicate its species and/or variety. Studies on composition of minor fatty acids of triglycerides and/or other lipid classes, as suggested by Nordby and Nagy (13,14), may offer more promise.

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TABLE I

Composition (% by wt) of Major Fatty Acids of Iranian Citrus Seed Oils

Number	Type of citrus	Name of variety or cultivar	C _{16:0}	C _{18:0}	C _{16:1}	C _{18:1}	C _{18:2}	C _{18:3}
1	Orange	Shahsavari	26.6	5.5	0.4	27.6	36.4	3.4
2	Orange	Lebanon ^a	27.2	4.8	0.6	27.3	36.9	3.1
3	Mandarin (or tangerine)	North ^b	25.0	4.3	0.6	27.0	39.8	3.1
4	Sour (or bitter) orange	North ^b	24.2	7.6	0.3	25.6	34.8	7.3
5	Lime	Shiraz	29.4	4.4	0.8	25.4	33.5	6.6
6	Lime	Omman	28.6	4.1	1.3	23.5	34.7	7.6
7	Lime	Europe ^a	21.8	4.0	0.4	32.3	34.0	7.4
8	Sweet lemon	North ^b	29.2	3.1	0.7	26.8	36.9	3.4

^aCultivated in various regions of Iran.

^bNorth (=Shomal in Persian); a wide area at Caspian Sea.

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