

Characteristics of Pistachio Kernel Oils from Iranian Cultivars

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ABSTRACT

Ten pistachio samples from various Iranian cultivars were examined for some botanical features of their nuts and oil characteristics of their kernels. The wt of 100 nuts varied from 78.5 to 136.9 g. The nuts contained 44.1-58.9% kernel. Moisture of the kernels was low, 2.5-4.1%, and the kernels contained 55.2-60.5% oil. Unsaponifiable matter (0.72-0.96%), saponification value (189.0-193.6), refractive index (1.4635-1.4643), and iodine value (98.1-100.5) showed little differences in various samples. Fatty acids detectable by gas chromatographic analysis were: traces of myristic; 9.2-13.4%, palmitic; 0.5-1.1%, stearic; traces of arachidic; 0.5-1.0%; palmitoleic; 56.1-64.0%, oleic; 22.6-31.0%, linoleic; and 0.1-0.4%, linolenic. There were no significant differences due to origin and/or cultivar of the samples.

INTRODUCTION

Fatty acid composition and other fat characteristics of kernel oils of various *Pistacia* species from different origins are reported (1-7). Also a single sample of Iranian pistachio nuts has been studied recently (8). There are several cultivars of *Pistacia* grown in different regions of Iran. To establish oil characteristics of their kernels, 10 different samples of various important cultivars from 3 principal regions were examined in this investigation. Furthermore, we tried to determine possible varietal differences with regard to the oil characteristics. In addition, a comparison of the data resulting from this study with those reported elsewhere indicate possible differences due to origin and/or cultivar.

MATERIALS AND METHODS

Ten samples of pistachio fruits were collected from 10 different trees of various cultivars and different origins. After drying in the shade, the pericarps were removed and the nuts were examined.

From each sample, 100 nuts were weighed 3 times and the mean wt of 100 nuts determined. The nuts then were shelled, their shells and kernels were weighed separately, and the ratios of kernels to whole nuts were calculated.

The moisture contents of the kernels were determined according to the following procedure. Kernels (50 g) were weighed and ground to coarse particles in a mortar. This was transferred into a drying dish; particles and oil remaining on the pestle and in the mortar were washed with

petroleum ether and added to the ground sample. The combined sample was dried in an air forced oven at 103 ± 2 C for 3 hr, cooled in a desiccator, and weighed. The dried sample was ground once more, dried again for 1 hr, cooled, and weighed. This was repeated until the difference between 2 successive weighings was < 5 mg.

For determination of oil content, 50 g kernels of each sample were ground and extracted in Soxhlet apparatus with petroleum ether for 4 hr. The residue was ground to a fine powder, and extracted once more overnight. The extracts were combined, and solvent was removed by Büchi vacuum distillation apparatus at low temperatures. The remainder was dried at 103 ± 2 C for 20 min, cooled, and weighed.

Oil characteristics were examined in fresh oils extracted with petroleum ether for 30 min. The analyses were carried out mostly in duplicate. Unsaponifiable matter (ether extract) and saponification value were determined according to AOCs methods Ca-6b-53 and Cd-3-35 (9,10). Refractive index (n_D) was determined by a Zeiss-Abbe refractometer at 40 C. Iodine value (IV) (Hanus) was determined according to AOAC method 28.019 (11). Preparation of fatty acid methyl esters for gas chromatographic analysis was carried out according to AOAC method 26.052a (12).

Fatty acid methyl esters were analyzed by a 4 mm inside diameter (ID) x 2 m copper column packed with 20% diethyleneglycol succinate on Chromosorb W acid washed 60-80 mesh under the following operation conditions. Temperatures were 190 C for column and 210 C for detector and inlet ovens. The flow rate of carrier gas (N_2) was 45 ml/min. 35 ml H_2 /min and 350 ml air/min were used for the flame of the ionization detector. The identification of the components was based on their retention time. This was determined previously by analysis of standard mixtures under the above conditions. The most suitable shape of the peaks was achieved by a chart speed of 6 in./hr. The proportion of the individual fatty acids to the total was calculated by normalizing of the surface areas of the peaks (13). These were measured by ht x width at half ht of each peak.

RESULTS AND DISCUSSION

The local name of the cultivars and some botanical features of the pistachio nuts are presented in Table I. The wt of 100 nuts showed great variation, from 78.5 g (sample 4) to 136.2 g (sample 5). The ratio of kernels to whole nuts, 44.1-58.9%, also varied considerably in different samples, and moisture contents of the kernels were low, 2.5-4.1%. Their oil contents ranging from 55.2 to 60.5%

TABLE I

Characteristics of Pistachio Nuts

Sample number	Local name	Shape	Origin	Wt of 100 nuts (g)	Kernel/nut (%)	Moisture/kernel (%)	Oil/kernel ^a (%)
1	Ba da mee	almond	Rafsanjan	116.5	55.3	3.9	55.6
2	Oha dee	hazelnut	Rafsanjan	110.1	58.9	3.1	58.4
3	Mom taz	almond	Rafsanjan	135.5	52.7	2.7	60.5
4	Ba da mee S. ^b	almond	Rafsanjan	81.1	51.1	2.5	60.4
5	Shah pa sand	almond	Damghan	136.2	55.4	3.3	57.6
6	Jow zee	hazelnut	Damghan	125.1	44.1	4.1	56.0
7	Khan ja ree	almond	Damghan	122.8	50.1	3.9	58.0
8	Nogh lee	hazelnut	Damghan	85.4	50.8	3.1	58.0
9	Kal leh pa zee	almond	Ghazvin	78.5	48.8	4.0	55.2
10	Standard 2	mixed	Rafsanjan	---	57.1	4.0	57.4

^aContaining low moisture (previous column).

^bS. = small.

with a mean value of 57.7%, showed low variation in different samples.

Ranges, with means in parentheses, of the values obtained for oil characteristics were 0.72-0.96% (0.81%) for unsaponifiable matter, 189.0-193.6 (192.1) for saponification value, 1.4635-1.4643 (1.46384) for refractive index, and 98.1-100.5 (99.0) for IV. Thus, the variation was low in different samples.

In fatty acid analysis traces of myristic were determined in various samples, as was 9.2-13.4% (11.2%) palmitic, 0.5-1.1% (0.8%) stearic, traces of arachidic, 0.5-1.0% (0.7%) palmitoleic, 56.1-64.0% (59.1%) oleic, 22.6-31.0% (26.7%) linoleic, and 0.1-0.4 (0.3%) linolenic acids. These fatty acids have been observed by other workers (1-8). $C_{20:1}$ reported in a study on an Iranian pistachio oil (8), is not mentioned elsewhere (1-7). We could not detect this component in our investigation either.

The variation in oil characteristics of different samples were inconsiderable, except for fatty acid composition in samples 5 and 9. They contained considerably less linoleic and more oleic acid than the other samples. Regarding the region and cultivar of the other samples, the above mentioned differences cannot be considered due to these factors.

The ranges of values reported in the literature (1-8) or in this study for oil characteristics do not agree with each other in some cases. Our results exceed in some cases the limits of the ranges reported in literature.

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