

# Chemical Studies of the Oil from Pistacia Nuts Growing Wild in Iran

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## ABSTRACT

Large populations of Pistacia grow wild in different parts of Iran. The fruits of two species, namely, *Pistacia atlantica* Subsp. *mutica* and *P. atlantica* Subsp. *kurdica* are consumed by the natives because of the high content of oil in kernels and outer skin layers. The kernels of both species are rich in oil (over 50%), and the oil content in the outer skin layer of *P. atlantica* Subsp. *kurdica* is 63% and in the other variety 30%. Unsaponifiable matter and fatty acid compositions of the oils were determined and the results compared with the oil from *Pistacia vera* L.

## INTRODUCTION

*Pistacia* species are indigenous to Iran. Composition of the oil of kernels of the cultivated variety (*P. vera* L.) and the structure of the glycerides have been determined (1-4). *Pistacia atlantica* Subsp. *kurdica* and *P. atlantica* Subsp. *mutica*, grow in large populations in the western, central and eastern parts of Iran (5). The nuts from these plants are used by the natives as food after grinding and mixing with other ingredients.

In this paper we report the chemical investigation of the fixed oil of the kernels and outer skin of the two species. Comparison is made of the data from this study with that of *P. vera* L.

## MATERIALS AND METHODS

The samples of *Pistacia atlantica* Subsp. *kurdica* were collected from Shahabad Gharb in Kermanshah province and *P. atlantica* Subsp. *mutica* from Zahedan in Baluchestan province. The voucher specimens were prepared and authenticated as *P. atlantica* Subsp. *kurdica* and *mutica*. The herbarium samples were kept in the School of Pharmacy, University of Tehran, Iran.

The nuts were frozen. The outer skins were removed and weighed. The hard shells were crushed and the kernels were weighed separately. The ratio of the kernels to shells and outer skins were calculated. After moisture determination, the dried sample was used for ash determination. The completely white ash was tested for solubility in 1 N HCl. For determination of oil, 100 g of the outer skins and 100 g

of the kernels from each sample were ground and extracted in a Soxhlet apparatus with petroleum ether (bp 40-60 C) for 6 hr. The residues were ground again to a fine powder and extracted for 6 hr. The two extracts were combined and the solvents removed under reduced pressure at 38 C, then cooled and weighed.

Fatty acid methyl esters were formed from the extracted triglycerides by transesterification in methanol with *p*-toluenesulfonic acid as catalyst (6). These fatty acid methyl esters were analyzed using a Varian Aerograph 2800 gas chromatograph equipped with a flame ionization detector and a 3 mm internal diameter x 3 m stainless steel coiled tube, packed with 20% DEGS on Chromosorb W acid-washed, 60-80 mesh and operated under the following conditions: temperature of the column 185 C, detector 220 C, and inlet oven 210 C. The flow rate of carrier gas (N<sub>2</sub>) was 20 ml/min. The identification of fatty acids were based on their retention time. This was determined previously by analysis of standard mixtures under the above conditions.

## RESULTS AND DISCUSSION

The common names for both species of Pistacia used in this study are Bene and Chatlangush, but in every region the natives use local names. The nuts of *Pistacia atlantica* Subsp. *mutica* are round to oval, somewhat flat, 0.5-0.9 mm x 0.5-0.7 mm in diameter, covered with a rather dry skin which could be easily removed by pressing between fingers.

The colors were dark green (good quality) to brown (low quality). The nuts of *P. atlantica* Subsp. *kurdica* are small, round; 0.5 mm in diameter. The color of the nuts was dark green, and the outer skin was soft and oily. Table I shows the composition of the outer skin and kernel oil of both species.

The moisture content of the kernels was low, 2.6-2.7%; the ash content was 2.7%, completely soluble in N HCl. The outer skin of *P. atlantica* Subsp. *kurdica* comprised 30% of the whole nuts, and yielded up to 63% oil. The nuts without the outer skin contained 50.5% kernels and 49.5% shells. The kernels of this species yielded 54% oil, and therefore the total oil obtained from whole nuts was 48%. *Pistacia atlantica* Subsp. *mutica* contained 25.4% kernels and 50.9% shells. The kernels of this variety contained 57% oil, and the total oil in the nuts was 31.5%. The hard shells

TABLE I

Characteristics of Pistacia Nuts

Name	Shape	Wt. of 100 nuts (g)	Kernel (%)	Moisture in kernel (%)	Ash in kernel (%)	Oil content		Unsaponifiable content of oils	
						Kernel (%)	Outer skin (%)	Kernel (%)	Outer skin (%)
<i>P. atlantica</i> Subsp. <i>mutica</i>	Hazlenut	5.51	25.40	2.70	2.70	57	30.10	0.49	1.58
<i>P. atlantica</i> Subsp. <i>kurdica</i>	Hazlenut	6.56	18.73	2.60	2.70	54	63	0.49	1.54
<i>P. vera</i> L. (1)	Almond	78-136	48-55	3.3-4	---	55-57	---	0.54	---
<i>P. vera</i> L. (1)	Hazlenut	85-125	44-50	3.1-4.1	---	56-58	---	---	---

## WILD PISTACIA OIL

TABLE II

Fatty Acid Composition of Kernels and Outer Skin Oil of  
*Pistacia atlantica* Subsp. *mutica* and *kurdica*

Acid	<i>Pistacia atlantica</i> subsp. <i>mutica</i>		<i>Pistacia atlantica</i> subsp. <i>kurdica</i>	
	Kernels	Outer skin	Kernels	Outer skin
C14:0	0.06%	0.03%	0.07%	0.01%
C16:0	12.20	24	12.48	24.50
C18:0	2.20	2.10	2.50	2.20
C20:0	Trace	Trace	---	Trace
C16:1	1.90	12.80	1.53	6.80
C18:1	50.40	55.80	57	54.79
C20:1	---	0.10	---	---
C18:2	32.80	4.50	25.80	11.30
C18:3	0.40	0.70	0.50	0.40

of both species were free of oil.

The fatty acid composition of the oils is presented in Table II. The fatty acid composition of species of other varieties of *Pistacia* nuts has been reported elsewhere (4,7,8). In Table I the amount of unsaponifiable matter of individual oils has been listed along with that of the oil from *P. vera* L. The differences in the amounts of saponifiable matter in the kernel and outer skin oils were not significant between varieties. The unsaponifiable matter in outer skin oils of both species was high, approximately three times that of kernel oil.

The oils from kernels of both species were similar in fatty acid composition, but the concentrations of unsaturated fatty acids, namely oleic and linoleic, were somewhat different (Table II). The oils from the outer skin of both species were similar in fatty acid compositions, but the concentration of palmitoleic in the oil of *P. atlantica* Subsp. *mutica* was twice than the subsp. *kurdica*, and the linoleic acid content in the latter species was more than twice that of the former species.

The oil from outer skin of both species contained twice the palmitic acid content of the kernel oil. The differences in palmitoleic acid content in kernel oil and outer skin oils were significant. Kernel oil is rich in linoleic acid, and the concentration of this acid in outer skin oil is lower.

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