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Nutrient Contents and Nut Properties of Pistachio (*Pistacia vera* L.) Varieties

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In this study, 11 varieties (Siirt, Kirmizi, Uzun, Sultani, Ketengömlek, Halebi, Ohadi, Kerman, Kaleh Ghochi, Ahmetaga and Ekberi) and 6 promising genotypes of pistachio (*Pistacia vera* L.) were evaluated with respect to fruit and leaf nutrient contents (N, P, K, Ca, Mg, Fe, Mn, Zn and Cu) and some pomological characteristics. Pistachio fruits had a range of 3.44 % (A-13) - 4.21 % (A-8) in N, 1555 ppm (A-15) - 4965 ppm (A-13) in P, 0.301 % (Halebi) -1.244 % (Ohadi) in K, 0.027 % (Kerman) - 0.754 % (Ohadi) in Ca, 0.76 % (KetengömLek) - 2.04 % (A-13) in Mg, 8.46 ppm (A-15) - 405.6 ppm (Sultani) in Fe, 1.25 ppm (Sultani) - 13.15 ppm (A-8) in Mn, 5.28 ppm (Kerman) - 43.57 ppm (A-19) in Zn and 1.90 ppm (Kerman) -17.30 ppm (A-19) in Cu. Their leaf nutrients were 1.40 %(Ohadi) - 2.18 % (Kerman) for N, 346 ppm (Kerman) - 1443 ppm (A-3) for P, 0.115 % (A-3) - 1.674 % (Siirt) for K, 3.83 % (Halebi) - 8.37 % (A-15) for Ca, 2.95 % (A-8) - 4.48 % (A-19) for Mg, 53.4 ppm (A-15) - 335.6 ppm (Kerman) for Fe, 9.2 ppm (A-19) - 52.6 ppm (A-3) for Mn, 13.5 ppm (Kerman) - 22.8 ppm (A-13) for Zn and 10.94 ppm (P-65) - 87.22 ppm (A-3) for Cu. Besides, as nut characteristics of pistachios, nut weight, kernel weight, kernel percentage and leaf stalk length were between 0.84-1.53 g, 0.50-0.82 g, 42-70 %, 3.72-6.50 cm, respectively.

Key Words: Pistachio, Mineral content, Pomology,Variety.

INTRODUCTION

With 40,000 mt annual pistachio production, Turkey comes after Iran ABD and Syria[1]. The edible species *Pistacia vera* L. is commercially grown usually under non-irrigated conditions in Turkey. Therefore, the yield per tree is low[1,2]. On the other hand, it has been predicted that annual pistachio product of Turkey will go up under irrigated conditions in the future, within

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the GAP framework (the Southeast Anatolia Regional Project)[3]. In Turkey, a lot of popular pistachio cultivars such as Siirt, Uzun, Kirmizi, which have the exellent taste, are grown in the southeast Anatolia, the most important production region of pistachio (Gaziantep, Kahramanmaras, Urfa, Diyarbakir, Mardin, Siirt, Adiyaman). Pistachio nuts have a rich source of some biochemical contents such as especially fat, fatty acids, proteins, carbohydrates, which have high nutritive value for human diet. They also contain a lot of minerals (Ca, Mg, K, P, Cu, *etc*.) and vitamins (A, B1, B2, B6, *etc.*)[4] and affect directly the quality of nuts. Several studies have been made on the effects of environmental conditions on nutrient values and biochemical contents of nuts. Many researchers reported that biochemical contents of nuts can be influenced by ecological conditions, variety, location, the geographical origin and technical and cultural practices[1,2,5-7]. The aim of this study was to determine some chemical contents and nut quality characteristics of pistachio (*Pistacia vera* L.) species of Turkey and Iran.

EXPERIMENTAL

The material of this study consisted of nuts of 11 varieties (Siirt, Kirmizi, Uzun, Sultani, Ketengömlek, Halebi, Ohadi, Kerman, Kaleh Ghochi, Ahmetaga and Ekberi) and 6 promising genotypes (P-65, A-3, A-8, A-13, A-15 and A-19) of pistachio (*Pistacia vera* L.). Nuts of pistachio genotypes A-3, A-8, A-13, A-15, A-19 and Siirt variety were collected from Siirt province (Turkey) and nuts of the remaining varieties were obtained from Gaziantep (Turkey). In all pistachios, some fruit characteristics such as nut weight, kernel weight, kernel percentage, leaf stalk length, fruit tip shape, splitting percentage, split opening and shell separation were identified[5,8,9]. For description nut characteristics of pistachios, each variety or genotype were represented by 30 fruit samples that were randomly chosen. Pistachio nuts were harvested in late September. On the other hand, after pistachio nuts were harvested, their kernel samples were oven-dried at 68 ºC for 72 h and then were ground for mineral content analyses. Nitrogen was analyzed determined by Kjeldahl method, phophorous was determined spectrophotometrically by the iodo-phenol-blue method. Potassium, calcium, magnesium, iron, manganese, zinc and coper contents in the extracts were determined by using atomic absorption spectrophotometry. Contents of N, P, K, Na, Ca, Mg, Fe, Zn, Mn ve Cu in fruit and leaf samples were analyzed[6,10].

RESULTS AND DISCUSSION

In pistachio varieties and promising selections, fruit mineral contents were presented in Table-1. Pistachio kernels had a range of 3.44 % (A-13) - 4.21 % (A-8) in N, 1555 % (A-15) - 4965 % (A-13) in P, 0.301 % (Halebi)

TABLE-1
FRUIT MINERAL CONTENTS (AS % AND ppm) IN PISTACHIO VARIETIES AND PROMISING SELECTIONS

Pistachios	N (%)	P (ppm)	K (%)	Ca (%)	Mg (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
P-65	3.75	2677	0.555	0.683	1.32	85.72	6.51	22.98	9.90
Siirt	3.63	3508	0.598	0.503	1.19	71.98	9.37	17.88	7.32
Kirmizi	4.16	1735	0.307	0.420	0.97	30.3	6.55	26.26	12.11
Uzun	3.98	1854	0.914	0.662	1.15	160.20	6.29	16.71	4.26
Sultani	3.94	4010	0.353	0.584	1.22	405.60	1.25	16.87	8.48
Ketengömlek	3.56	1795	0.401	0.336	0.76	27.50	3.10	17.82	8.04
A-3	4.19	4726	0.876	0.744	1.65	74.10	7.02	26.38	10.84
A-8	4.21	1795	0.745	0.632	1.50	94.80	13.15	32.04	12.22
A-13	3.44	4965	0.413	0.617	2.04	286.00	6.78	17.32	8.46
A-15	3.78	1555	0.734	0.531	0.84	8.46	7.47	23.43	10.46
A-19	4.19	3111	0.833	0.706	1.19	80.80	7.02	43.57	17.30
Halebi	3.51	1795	0.301	0.474	1.09	254.10	3.70	17.51	6.72
Ohadi	3.64	1975	1.244	0.754	1.15	108.40	5.41	33.25	12.43
Kerman	3.62	2333	0.658	0.027	0.78	99.80	2.64	5.28	1.90

-1.244 % (Ohadi) in K, 0.027 % (Kerman) - 0.754 % (Ohadi) in Ca, 0.76 % (KetengömLek) - 2.04 % (A-13) in Mg, 8.46 ppm (A-15) - 405.6 ppm (Sultani) in Fe, 1.25 ppm (Sultani) - 13.15 ppm (A-8) in Mn, 5.28 ppm (Kerman) - 43.57 ppm (A-19) in Zn and 1.90 ppm (Kerman) -17.30 ppm (A-19) in Cu. It has been reported that the kernels of Ohadi, Halebi, Uzun, Kirmizi and Siirt varieties contained 684-766 mg/100 g K, 136-146 mg/100 g Mg and 1.19-1.51 mg/100 g Cu, respectively[4]. Malakouti[11] reported that fruits of pistachio varieties grown in calcareous soil in Iran contained 3.2 % N, 0.62 % P, 1.5 % K, 0.14 % Mg, 65 mg/kg Fe, 10 mg/kg Mn and 0.12 mg/kg Zn. Also, Çaglarirmak *et al.*[9] recorded that pistachio kernels contained 116-117 mg/100 g Mg, 633-651 mg/100 g K, 167-175 mg/100 g Ca, 0.72- 0.77 mg/100 g Cu, 2.74- 2.82 mg/100 g Zn and 0.54-0,61 mg/100 g Fe. Based on fruit mineral data, fruits of pistachio varieties and selections usually contained higher Mg and Fe, lower K, Ca and Cu than reported by Çaglarirmak[9], but higher N, K, Mg, Fe, Zn, lower P and Mn than reported by Malakouti[11].

On the other hand, leaf nutrients of all pistachio varieties and selections were 1.40 % (Ohadi) - 2.18 % (Kerman) for N, 346 ppm (Kerman) - 1443 ppm (A-3) for P, 0.115 % (A-3) - 1.674 % (Siirt) for K, 3.83 % (Halebi) - 8.37 % (A-15) for Ca, 2.95 % (A-8) - 4.48 % (A-19) for Mg, 53.4 ppm (A-15) - 335.6 ppm (Kerman) for Fe, 9.2 ppm (A-19) - 52.6 ppm (A-3) for Mn, 13.5 ppm (Kerman) - 22.8 ppm (A-13) for Zn and 10.94 ppm (P-65) - 87.22 ppm (A-3) for Cu (Table-2). It has been recorded that leaves of pistachio varieties contain 1.80-2.20 % N, 0.06-0.13 % P, 0.8-1.2 %

TABLE-2
LEAF MINERAL CONTENTS (AS % AND ppm) IN 17 PISTACHIO VARIETIES AND SELECTIONS

Pistachios	N (%)	P (ppm)	K (%)	Ca (%)	Mg (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
P-65	1.66	457	1.340	4.23	3.67	145.6	26.5	19.4	10.94
Siirt	1.71	556	1.674	4.32	3.58	159.7	47.8	18.3	18.53
Kirmizi	1.83	750	0.785	4.94	3.11	121.9	12.5	17.4	18.70
Uzun	1.66	756	0.306	5.79	3.63	215.3	14.5	16.9	21.50
Sultani	1.68	635	0.637	3.98	3.16	125.9	17.0	15.9	27.32
Ketengömlek	1.57	980	0.692	3.89	3.28	89.9	13.3	18.7	29.55
A-3	1.90	1443	0.642	4.86	3.51	86.2	52.6	18.7	87.22
A-8	1.88	519	0.115	4.38	2.95	73.5	19.1	22.6	25.29
A-13	1.54	635	0.334	4.32	3.35	224.2	23.2	22.8	26.30
A-15	1.62	808	1.633	8.37	3.08	53.4	11.8	21.2	35.70
A-19	1.90	692	0.562	6.62	4.48	291.7	9.2	18.4	86.41
Halebi	1.88	461	0.283	3.83	3.57	133.4	20.3	20.2	23.98
Ohadi	1.40	462	0.441	4.40	3.14	81.9	18.4	21.3	28.89
Kerman	2.18	346	0.448	3.98	3.50	335.6	19.5	13.5	24.86
Kaleh Ghochi	1.54	1096	0.309	5.25	3.22	99.3	11.2	18.4	22.22
Ahmetaga	2.18	750	0.628	4.22	3.15	106.4	18.4	17.5	19.52
Ekberi	1.96	635	0.884	4.24	3.24	151.2	18.6	20.1	27.26

K, 2.2-3.7 % Ca, 43-170 ppm Fe, 20-50 ppm Mn, 10-25 ppm Zn and 3-4 ppm Cu[12]. Determining leaf nutrients of pistachio varieties grown in Iran, Malakouti[11] reported that pistachio leaves contain 2 % N, 0.12 % P, 1.6 % K, 2.5 % Ca, 0.5 % Mg, 110 mg/kg Fe, 50 mg/kg Mn, 40 mg/kg Zn and 12 mg/kg Cu. Seferoglu *et al.*[7] recorded 1.12-2.46 % N, 0.085-0.150 % P, 0.81-2.02 % K, 1.30-3.70 % Ca and 0.40-0.92 % Mg in pistachio leaves.

With respect to nut traits, the range in pistachio varieties was found as 0.84 (Ohadi)-1.53 (Kerman) g in nut weight, 0.50 (A-3)-0.82 (A-15) g in kernel weight, 42 (P-65)-70 (Ohadi) % in kernel percentage and 3.72 (Halebi)-6.50 (Uzun) cm in leaf stalk length (Table-3). Regarding pomological characteristics, similar results were reported[5,8,13,14].

According to nutrient data, N and P contents of nuts were usually found higher than those leaves. Whereas, Ca, Mg, Mn and Cu contents on leaves had higher than those nuts. Deficients of P, N, Fe and Zn have been reported for pistachios grown in Turkey[15]. The nutrient uptake of pistachios is affected by on-off year. It has been suggested that pistachio leaves on year uptake more N, P and Zn from the soil than off year[2]. Also, K application has positive effect on pistachio yield and quality[16]. To conclude, leaf and fruit nutrient data suggested that they can be influenced by different ecological conditions, soil structure and technical and cultural practices.

TABLE 3
SOME NUT CHARACTERISTICS OF PISTACHIO VARIETIES AND PROMISING SELECTIONS

Pistachios	Nut weight (%)	Kernel weight (g)	Kernel percentage (%)	Leaf stalk length (cm)	Fruit tip shape	Splitting percentage (%)	Split opening	Shell separation
P-65	1.42	0.59	42	4.97	O	M	M	M
Siirt	1.17	0.56	48	5.42	O	H	M	D
Kirmizi	1.22	0.68	55	6.30	O	M	M	E
Uzun	1.07	0.58	54	6.50	O	M	M	M
Sultani	1.06	0.57	53	5.80	O	L	W	E
Ketengömlek	1.12	0.62	55	4.44	O	H	W	M
A-3	1.06	0.55	51	5.36	O	M	N	D
A-8	1.23	0.65	52	5.72	O	M	M	M
A-13	1.29	0.73	56	4.91	O	M	M	M
A-15	1.39	0.82	58	6.05	O	H	M	M
A-19	1.20	0.60	50	6.01	O	M	M	M
Halebi	1.04	0.58	55	3.72	O	H	W	D
Ohadi	0.84	0.59	70	4.79	O	M	W	D
Kerman	1.53	0.65	42	5.25	O	L	W	M
KalehGhochi	1.38	0.70	50	5.98	O	H	W	E
Ahmetaga	1.40	0.80	57	6.20	O	H	W	E
Ekberi	1.33	0.76	57	5.90	O	H	W	E

O: Oval, M: Middle, H: High, L: Low, W: Wide, N: Narrow, E: Easy, D: Difficult.

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