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Some chemical contents of selected almond (*Prunus amygdalus* Batsch) types

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SUMMARY – This study was undertaken to determine some chemical contents of selected almond types naturally grown in Kemaliye district of Erzincan. Significant differences were reported for some chemical contents, macro and micro nutrients of almond types. Moisture content, fat, crude protein, total sugar, and ash in dry almond weight ranged between 3.60-4.39%, 47.48-56.70%, 19.04-24.51%, 2.56-4.17% and 3.03-4.66% respectively. Mineral contents were determined as 98.5-187.0 mg/100 g for Ca, 360.8-513.4 mg/100 g for Mg, 403.9-800.0 mg/100 g for P, 1677.3-2051.1 mg/100 g for K, 39.77-146.35 ppm for Fe, 77.86-88.44 ppm for Zn, 29.00-33.95 ppm for Mn, 16.0-23.0 ppm for Cu, 56.66-103.88 ppm for Na.

Key words: Almond, *Prunus amygdalus*, chemical contents, macro and micro elements.

RESUME – *"Les contenus chimiques de quelques types d'amandiers (*Prunus amygdalus *Batsch)". On a fait ce travail pour déterminer quelques composés chimiques chez les types d'amandes sélectionnées autour de la sous-préfecture de Kemaliye, l'un des arrondissements d'Erzincan. On a remarqué beaucoup de différences entre les quelques composés chimiques des amandes et les composés macro et micro-éléments alimentaires. Du reste, on est arrivé aux résultats ci-dessous : la quantité d'humidité dans l'amandon sec 3,60-4,39%, quantité d'huile 47,48-56,70%, quantité de protéine brute 19,04-24,51%, quantité de sucre total 2,56-4,17% et la quantité de cendre 3,03-4,66%. Et on a bien déterminé que les quantités des éléments minéraux peuvent varier entre les chiffres indiqués : quantité de Ca 98,5-187,0 mg/100 g, Mg 360,8-513,4 mg/100 g, P 403,9-800,0 mg/100 g, K 1677,3-2051,1 mg/100 g, Fe 39,77-146,35 ppm, Zn 77,86-88,44 ppm, Mn 29,00-33,95 ppm, Cu 16,0-23,0 ppm et Na 56,66-103,88 ppm.*

Mots-clés : *Amandier,* Prunus amygdalus, *composés chimiques, macro et micro-éléments.*

Introduction

Almond is an important food crop, varying in use from local consumption as an edible nut in its natural state to inclusion as a major ingredient in manufactured food products. The edible kernel is eaten raw or cooked, either blanched or unblanched. Kernel may be roasted dry but are usually cooked in oil followed by salting with various kinds of seasoning. Kernels are combined with chocolate in confectionery. Almond kernels can be sliced and diced into various shapes to be used in pastry, ice cream mixes and combinations with vegetable. The kernels may be ground and made into a paste which is used in making various bakery products (Dokuzo_uz and Gülcan, 1979; Kester and Asay, 1979).

Almond kernels area concentrated sours of energy, supplying significant amounts of fats, protein and fiber. The fat is primarily unsaturated, mostly oleic and linoleic fatty acids. On the other hand, unsaturated fatty acids are important in maintaining lowered blood cholesterol levels (Saura Calixto *et al*., 1981; Kester *et al*., 1990). Almond also include considerably macro and micro nutrients.

Saura Calixto *et al*. (1981) observed that average kernel contents consisted of 93% water, 3.05% ash, 53.37% oil, 20.51% protein, 5.52% total sugar, 766 mg/100 g K, 364 mg/100 g P, 227 mg/100 g Mg and 185 mg/100 g Ca.

Barbera *et al*. (1994) reported that kernel contents ranged from 5.93 to 7.27% for water, 8.03-8.13% for ash, 53.67-54.26% for oil, 23.03-23.98% for protein, 4.15-5.29% for total sugar, 1546-1685 mg/100 g for K, 253-259 mg/100 g for P, 640-678 mg/100 g for Ca, 447-494 mg/100 g for Mg, 24.30-25.80 ppm for Cu, 76.33-80.50 ppm for Zn, 54.83-65.33 ppm for Fe and 37.67-37.83 ppm for Mn.

Schirra *et al*. (1994) determined that average kernel contents included 3.0% ash, 1050 mg/100 g

K, 300 mg/100 g P, 467 mg/100 g Ca, 30 mg/100 g Mg, 5 ppm Cu, 34 ppm Zn and 70 ppm Fe.

Cultivar, ecological conditions and different ripening harvest generally effect on the chemical contents of almond kernel (Soler *et al*., 1988).

Aim of this study was to determine some chemical contents of selected almond types naturally grown in Kemaliye district of Erzincan.

Materials and methods

This study was conducted to determine some chemical contents of thirteen selected sweet almond types.

Samples were dried at 105°C for determining moisture contents (Anonymous, 1986).

The oil was extracted with petroleum ether (40-60°C) by using a soxhlet extractor over 6 h (Anonymous, 1986; Soler *et al*., 1989).

Nitrogen content was determined by the micro Kjeldahl method (Anonymous, 1986). Nitrogen was converted to crude protein using the factor 5.18 as recommended for this product by FAO (Anonymous, 1970) and other authors (Lee, 1975; Esteban *et al*., 1985).

Total sugar content was determined by the Anthrone method (Kaplankıran, 1984).

Ash quantity of kernel was determined after the samples were burnt at 500 ± 50°C in ash oven for 8-10 hours.

Phosphorus was determined by using Spectrophotometric method (Kacar, 1972) and K, Ca, Mg, Fe, Zn, Mn, Cu and Na were determined by using Atomic Absorption Spectrophotometer (Kacar, 1962).

Data were subjected to ANOVA and Duncan Multiple Range Test.

Results and discussion

Average of results of chemical contents of kernel in the selected almond types was given in Table 1. Significant differences for chemical contents of kernel were observed depending on the types.

As a matter of fact, while the highest moisture content was 4.39% in 24-Ke-150 type, 24-Ke-192 had the lowest value (3.60%).

Based on the selected almond types, oil contents ranged between 47.48% (24-Ke-29) and 56.70% (24-Ke-191), crude protein contents was determined as 19.04% (24-Ke-191) and 24.51% (24-Ke-40).

Total sugar contents significantly differed depending on the types, and it was determined as between 4.17% (24-Ke-138) and 2.56% (24-Ke-159).

Ash contents was recorded between 3.03% (24-Ke-159) and 4.66% (24-Ke-192).

Macro and micro nutrient contents of the almond types were rather determined high. 98.5 and 187.0 mg/100 g Ca, 360.8 and 513.4 mg/100 g Mg, 403.9 and 800.0 mg/100 g P, 1677.3 and 2051.1 mg/100 g K contents were determined in the almond types. Micro nutrients contents ranged 39.77 and 146.35 ppm Fe, 77.86 and 88.44 ppm Zn, 29.00 and 33.95 ppm Mn, 16.0 and 23.0 ppm Cu and 56.66 and 103.88 ppm Na.

Significant correlation were obtained between fat and protein (r = –0.72*), moisture content and Cu (r = –0.72*), ash and Ca (r = –0.66*); total sugar and P (r = 0.65*); and P and K (r = 0.70*).

Table 1. Moisture, fat, crude protein, total sugar, ash and mineral nutrient contents in different types of almond (% of dry material)

Type no.	Moisture (%)	Fat (%)	Crude protein (%)	Total sugar (%)	Ash (%)	Ca (mg/100 g)	Mg (mg/100 g)	P (mg/100 g)	K (mg/100 g)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Na (ppm)
24-Ke-29	4.00 b	47.48 g	22.29 d	3.92 b	4.52 a	108.2	466.2	708.2	2041.0	110.47	80.75	32.18	18.0	94.44
24-Ke-40	3.82 b	48.85 f	24.51 a	3.15 d	4.07 b	98.5	360.8	519.1	2000.0	39.77	82.68	31.48	20.0	56.66
24-Ke-45	3.71 b	52.92 d	20.52 f	3.29 cd	4.58 a	118.1	377.4	532.4	1970.3	83.95	77.86	30.42	20.0	103.88
24-Ke-80	3.91 b	51.50 e	24.17 b	3.42 c	3.48 d	148.7	510.6	660.9	1929.8	70.70	81.72	33.95	18.0	80.00
24-Ke-84	4.01 b	51.08 e	22.09 d	3.05 d	3.18 e	147.6	435.7	563.9	1940.0	75.11	85.56	29.71	16.0	66.11
24-Ke-125	3.75 b	51.77 e	20.77 f	3.12 d	3.11 e	164.2	413.5	548.2	1838.9	129.24	83.64	33.60	22.0	56.67
24-Ke-138	3.66 b	53.53 c	19.82 g	4.17 a	3.23 e	177.2	488.4	800.0	2051.1	54.13	79.80	31.83	22.0	85.00
24-Ke-150	4.39 a	50.31 e	21.42 e	4.14 a	3.83 bc	177.0	452.3	655.7	1909.7	61.88	78.83	29.00	17.0	80.27
24-Ke-151	4.01 b	50.54 e	20.06 g	3.20 cd	4.45 a	137.8	438.5	650.5	1899.6	68.49	79.00	29.17	22.0	56.66
24-Ke-158	3.76 b	48.88 f	23.08 c	3.09 d	3.68 c	167.3	410.7	626.8	2010.7	99.41	88.44	32.00	21.0	84.96
24-Ke-159	3.79 b	54.84 b	19.79 g	2.56 e	3.03 e	187.0	485.6	403.9	1677.3	146.35	81.71	29.36	20.0	84.99
24-Ke-191	3.72 b	56.70 a	19.04 h	4.13 a	3.89 bc	118.2	449.6	679.4	1950.1	106.04	79.80	29.00	23.0	61.39
24-Ke-192	3.60 b	52.13 e	20.94 f	2.88 d	4.66 a	147.6	513.4	747.6	1980.4	115.98	82.68	32.72	23.0	70.83
LSD	*0.78*	*0.61*	*0.417*	*0.1*	*0.19*									

[a,b,c,d,e,f,g,h]Significantly different at Duncan's Multiple Range Test (95%).

Significant differences for chemical contents of kernel were reported by several researchers (Saura Calixto *et al*., 1981; Soler *et al*., 1989; Barbera *et al*., 1994; Nieddu *et al*., 1994; Schirra *et al*., 1994). It was considered that biochemical differences of the types consisted of genetic variation, ecological conditions and different repining harvest time.

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