CHEMICAL COMPOSITION OF FRUITS OF SOME WALNUT (*Juglans regia L.*) SELECTIONS

BAZI CEVİZ (*Juglans regia L.*) TİPLERİNİN KİMYASAL BİLEŞİMİ

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ABSTRACT: This study was conducted on 20 promising walnut types selected from Bahçesaray (Van) which has a large walnut seedling population. The paper presents chemical composition of these selections' kernels. Oil content, ranged from 62.08 to 70.16% and protein content varied between 12.87 and 18.97 %. Moisture and ash values were found as 2.13-3.59% and 0.84-2.12%, respectively. In addition, some important macro and micra nutrient concentrations were determined as follows: Potassium (K) 2960-6320 mg/kg; calcium (Ca) 640-1180 mg/kg; magnesium (Mg) 1020-1680 mg/kg; phosphorus (P) 2660-5390 mg/kg; copper (Cu) 10.00-27.20 mg/kg; manganese (Mn) 18.80-50.60 mg/kg; iron (Fe) 28.0-139.8 mg/kg and zinc (Zn) 19.60-43.60 mg/kg.

ÖZET: Bu çalışmada büyük bir ceviz populasyonuna sahip Van ile Bahçesaray İlçesi'nde yapılan seleksiyon çalışması ile ümitvar olarak seçilen 20 ceviz tipi üzerinde yürütülmüştür. Makalede, bu ceviz tiplerinin kimyasal bileşimleri sunulmşutur. Yağ oranı %62.08 ile 70.16 ve protein miktarı %12.87 ile 18.97 arasında değişmiştir. Nem ve kül miktarları ise sırası ile %2.13-3.59 ve %0.84-2.12 olarak belirlenmiştir. Bunlara ilaveten önemli bazı makro ve mikro elementleri miktarları ise: potasyum (K) 2960-6320 mg/kg; kalsiyum (Ca) 640-1189 mg/kg; magnesyum (Mg) 1020-1680 mg/kg; fosfor (P) 2660-5390 mg/kg; bakır (Cu) 10.00 - 27.20 mg/kg; manganez (Mn) 18.80-50-60 mg/kg; demir (Fe) 28.0 - 139.8 mg/kg ve çinko (Zn) 19.60 - 43.60 mg/kg olarak belirlenmiştir.

INTRODUCTION

Turkey is the mother land for walnut as many other fruit species because of the differences in its climatic conditions. The production of walnut in Anatolia which is the third in the world after China and United States is 115 000 MT (ANONYMOUS, 1977). As ŞEN (1988) has stated, Anatolia is a walnut garden This garden has 4.5 million walnut trees (ANONYMOUS, 1998). These walnut trees consist of almost completely of native seedlings (unbudded trees), that are grown without any irrigation and fertilization in the growing areas.

Walnut with a high nutritional value is very rich especially in protein, carbohydrate and oil contents. ŞEN (1986) mentions that we should regard walnut kernels as concentrated nutrients. However, they contain two of the most important three groups of nutrients vital for human nutrition.

It is known that mineral content mainly depends not only on biological properties of cultivars or selections, but also on many other factors as climate and soil factors, applied cultural practise, harvesting time, etc. That is why, when evaluating and comparing the components of walnut kernels, factors expressed above should be considered. Chemical composition of walnut nuts was studied by many authors. ŞEN (1980) found that the average oil content was 70.80% and protein 20.52% in the selections preselected from 550 walnut seedlings. Oil and protein contents of Yaloval, Şebin, Midland and Hartley varieties were determined by ÇEBELİOĞLU (1985) as 54.4 - 70.0% and 15.6 - 23.4%, respectively. On the other hand, KORAC et al (1988) reported that oil and protein contents ranged between 66.0-69.0% and 16.0 - 19.0% respectively.

The aim of this paper is to determine some chemical composition parameters (oil, protein, moisture, ash) and mineral constitution (K,Ca, Mg, P, Cu, Mn, Fe, Zn) of 20 walnut selections grown in Bahçesaray.

MATERIAL and METHODS

Material

This research was conducted on 20 walnut selection (BS-114, BS 22, BS-44, BS-139, BS-7, BS-191, BS-111, BS-51, BS-136, BS-54, BS-96, BS-137, BS-102, BS-113, BS-9, BS-133, BS-215, BS-127, BS-18, BS-334) preselected from Bahçesaray/Van (Eastern Turkey). All types were seedling trees of *juglans regia L.* In the study, some chemical composition (oil, protein, moisture and ash contents) and mineral elements (K, Ca, Mg, P, Cu, Mn, Fe and Zn) of these types were determined.

Methods

Oil analysis

Oil content was determined as percent by soxhalet apparatus using diethly ether solvent according to AOCS method (ANONYMOUS, 1964).

Protein analysis

For determination of protein, nitrogen was determined in dried samples using the micro-Kjeldahl method according to BREMLEY (1965). The protein content was calculated by using the factor of 6.25.

Moisture analysis

Moisture content was analysed and calculated according to the methods given by the Turkish Standard Institute (ANONYMOUS, 1991).

Ash analysis

1 g sample was weighted in porcelain cups and burned at 550±2°C until color turns white. The results obtained are given as percent (ANONYMOUS, 1988).

Macro and micro element analysis

Kernel samples of selections were ashed at 550°C and dissolved in 3.3 %HCl solution (ÇAKMAK et al, 1996). Potassium, Ca, Mg, Fe, Cu and Mn concentrations were determined by atomic absorption spectrophotometer. Phosphorus concentrations of the samples were determined according to Vanado molibdo phosphoric-yellow colour method using spectrophotometry. Nitrogen concentrations were measured by Kjeldahl procedure on Kjeltec system.

Statistical anlysis

The data were evaluated statistically using completely randomised blocks experimental design. Differences among means were compared by Duncan's multiple range test (P<0.05).

RESULTS AND DISCUSSIONS

Table 1 shows some average of the major components of walnut kernels (oil, protein, moisture and ash) and standard deviations, variation coefficients, and maximum and minimum values.

The average oil content was found as 65.50%. The highest level was recorded with BS-22 type (69.46%) and the lowest level with BS-113 type (63.02%). The differences among oil contents of walnut selections were statistically significant- Similar oil values were obtained in the studies carried out in different part of same region (Eastern Turkey). For example, YARILGAÇ (1997) found oil content as 56.29-69.40%. KOYUNCU and AŞKIN (1995) reported that this value ranged between 66.30% and 76.94%. Similarly, KORAC et al (1988) determined that the oil content varied between 66.0 and 69.0% in walnuts grown in Yugoslavia, as well.

The second main constituent of walnut kernels is protein. While the highest average protein content was found as 18.69 % in BS-215, the lowest value was 14.40% in BS-111 selection. The protein contents of the analysed types were statistically different from each other. Our results for protein are within the ranges of literature findings reported by YARILGAÇ (1997) and MITROVIC (1988).

Table 1. Chemical Composition of Selected Walnut Types.

Types	Oil (%)	Protein (%)	Moisture (%)	Ash (%)
BS-114	66.09 cde*	18.49 ab	2.45 e	1.51 abcde
BS-22	69.46 a	17.59 abcdef	3.12 abc	1.17 e
BS-44	65.57 cdef	17.93 abcde	3.45 a	1.71 abcde
BS-139	63.85 ef	18.16 abcd	3.42 ab	1.54 abcde
BS-7	65.27 cdef	17.69 abcdef	3.25 abc	1.86 abc
BS-191	67.0 bcde	16.95 bcdef	3.05 abc	1.74 abcde
BS-111	63.35 ef	14.40 g	3.21 abc	1.82 abc
BS-51	64.21 def	16.50 ef	3.15 abc	1.88 ab
BS-136	66.04 cde	16.68 def	3.34 ab	1.46 abcde
BS-54	63.41 ef	16.83 cdef	3.06 abc	1.71 abcde
BS-96	68.77 ab	17.78 abcdef	2.55 de	1.60 abcde
BS-137	65.57 cdef	17.94 abcde	3.15 abc	1.22 de
BS-102	64.02 def	17.80 abcdef	3.47 a	1.32 bcde
BS-113	63.02 f	16.24 ef	3.45 a	1.82 abc
BS-9	65.49 cdef	17.15 abcdef	3.00 bc	1.28 cde
BS-133	65.22 cdef	18.42 ab	3.06 abc	1.22 de
BS-215	64.38 def	18.69 a	3.22 abc	1.92 a
BS-127	64.38 abc	18.56 a	2.89 cd	179 abcde
BS-18	64.19 def	18.34 abc	3.39 ab	1.94 a
BS-334	67.73 abc	18.48 ab	2.37 e	1.64 abcde
Min.	**62.08**	**12.87**	**2.13**	**0.84**
Max.	**70.16**	**18.97**	**3.59**	**2.12**
Means	**65.50**	**17.53**	**3.10**	**1.61**
StDev.	**1.96**	**1.13**	**0.34**	**0.30**
Cv. (%)	**2.99**	**6.46**	**11.10**	**18.93**

*: Means followed by the same letters are not statistically significant (Duncan's multiple range test, P<0.05).

The analysed types had a moisture content varying between 2.37% (BS-334) and 3.47% (BS-102), and ash between 1.17% (BS-22) and 1.94% (BS-18). There were statistically significant differences among types in terms of moisture and ash contents. Our results for ash contents are little lower than those of KOYUNCU (1996) and SHARMA et al (1985), but agree with those reported by HADORN et al (1981).

The coefficient variation of oil values was found as 2.99% and protein values as 6.46%. These data indicate that there are small variations in main components of kernels (Table1).

According to the results in respect to nutrients, it was seen that there were statistically significant differences among the types except. Fe. Despite the fact that marked differences were observed in terms of average Fe concentrations, there were differences among some types. For example while the type BS-113 had 43.3 mg/kg Fe, BS-111 type contained 104.6 mg/kg Fe (Table 2). Also, the coefficient variation of Fe values showed large variation.

The ranges of the analysed elements were as average 2960 (BS-136) - 5830 (BS-51) mg/kg for k; 720 (BS-114)- 1065 (BS-102) mg/kg for Ca; 1020 (BS-136) - 1640 (BS-18) mg/kg for Mg; and 2660 (BS-136) 4970 (BS-133) mg/kg for P. The differences among these values were statistically significant (Table 2).

The minimum and maximum concnetrations of cupper, Mn, Fe and Zn of walnut kernels varied betwen 10.00 - 27.20 mg/kg and 18.80 - 50.60 mg/kg, 28.0-139.80 mg/kg, 19.60 - 43.60 mg/kg, respectively. While the differences among the selected types in respect to Cu, Mn and Zn concentrations were statistically significant, there were no differences in terms of Fe concentrations (Table 2).

Table 2. Macro and Micronutrient Contents of Selections

Types	K (mg/kg)	P (mg/kg)	Mg (mg/kg)	Ca (mg/kg)	Fe (mg/kg)	Mn (mg/kg)	Zn (mg/kg)	Cu (mg/kg)
BS-114	4130 fgh*	3150 gh	1230 g	720 e	55.2 ns	29.7 def	22.7 bc	16.6 abcde*
BS-22	4520 efg	3535 defg	1310 efg	780 cde	97.1	34.2 cde	31.1 abc	19.6 abc
BS-44	4300 efdh	3465 efg	1310 efg	780 cde	63.9	35.3 bcde	31.2 abc	20.8 ab
BS-139	4640 cdef	4620 ab	1560 abc	1030 ab	59.6	41.5 abc	35.6 a	16.5 abcde
BS-7	4820 bcdef	3955 bcdef	1490 abcde	840 cde	70.9	31.8 cde	30.4 abc	21.5 a
BS-191	4940 bcde	3605 defg	1320 defg	880 bcde	84.3	28.3 ef	35.0 a	13.6 cde
BS-111	5540 ab	4550 abc	1540 abc	940 abc	104.6	20.2 f	34.2 ab	16.8 abcde
BS-51	5830 a	3885 bcdefg	1460 abcdef	750 de	44.3	46.1 ab	22.6 bc	16.8 abcde
BS-136	2960 J	2660 h	1020 h	800 cde	59.6	29.8 def	29.6 abc	12.2 de
BS-54	5190 abcd	3710 defg	1580 ab	780 cde	68.0	36.8 abcde	22.3 bc	11.8 de
BS-96	4720 cdef	3255 fgh	1480 abcde	750 de	54.9	47.3 a	30.2 abc	16.0 abcde
BS-137	3650 hij	3850 cdefg	1350 cdefg	850 cde	69.2	37.4 abcd	31.3 abc	18.1 abcd
BS-102	3860 ghi	3360 fg	1280 efg	1065 a	49.6	41.4 abc	28.4 abc	13.8 bcde
BS-113	4070 fghi	3640 defg	1360 cdefg	780 cde	43.3	217.8 ef	26.1 abc	13.1 abcd
BS-9	4460 defg	4165 bcde	1370 bcdefg	820 cde	75.9	40.7 abcd	30.3 abc	20.0 abc
BS-133	5380 abc	4970 a	1580 ab	860 bcde	97.8	31.6cde	33.8 ab	18.4 abcd
BS-215	5300 abc	4270 bcd	1530 abcd	880 bcde	63.0	47.0 a	32.6 abc	21.1 a
BS-127	3380 ij	3710 defg	1260 fg	740 d	44.2	18.8 f	20.6 c	11.8 de
BS-18	5350 abc	4165 bcde	1640 a	920 abcd	61.6	37.6 abcde	27.2 abc	16.3 abcde
BS-334	4800 bcdef	3920 bcdef	1480 abcde	800 cde	48.8	27.0 ef	20.8 c	10.0 e
Min.	2960	2660	1020	640.0	28.0	18.80	19.6	10.0
Max.	6320	5390	1680	1180	139.8	50.60	43.60	27.20
Means	4592	3822	1406	838.25	65.79	34.52	28.30	16.24
StDev	780.08	579.15	161.65	106.17	23.45	8.73	6.24	3.97
Cv(%)	16.99	15.15	11.50	12.67	35.65	25.29	22.06	24.47

ns: Not significant

* : Means followed by the same letters are not statistically significant (Duncan's multiple range test. P<0.05).

In a study conducted by BULINKSKI (1974) the composition of walnut kernels wereas follows: K 4204-5300 mg/kg; Ca 756-987 mg/kg; Mg 785-1198 mg/kg; P 2494-4103 mg/kg; Cu 2.00-3,8 mg/kg; Mn 21-59 mg/kg and Fe 16-22 mg/kg. In another study, concentrations of Ca, K, Mg, Fe and P were 99 mg/100g, respectively (WOODROOF, 1979). WESTWOOD (1978), was reported as the values of K 450 mg/100 g, Ca 99 mg/100g, P 380 mg/100g and Fe 3.1 mg/100g.

In spite of the fact that there are some differences (for Fe) between the findings of BULINSKI (1974) and ours, majority of the values showed close similarities weth each other.

Consequently, these types selected for physical characteristics in former were evaluated in terms oil protein and some nutrient contents, as well. According to these findings showed Table 1 and 2 all investigated types were found as promising. We promise that these results with contribute to further breeding programs

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