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ResearchArticle

Characterization of Pomological and Physicochemical Properties of Zivzik and Pervari Pomegranate Genotypes Grown in Siirt Province

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Abstract

Commercial pomegranate cultivation in Siirt province is concentrated in Şirvan and Pervari districts. Although Zivzik pomegranate variety is a registered pomegranate variety, it is not well known outside the region where it is grown (Zivzik, Sarıdana, Kapılı and Pirinçli villages). Pervari pomegranate is grown in the regions between Bitlis stream, Hizan and Pervari. In this study, pomological and physicochemical characteristics of different sized fruits of Zivzik (*n=8*) and Pervari (*n=10*) pomegranate genotypes collected from different locations in Siirt province were investigated. The pomological characteristics examined were fruit weight, aril yield, 100 aril weight, fruit width-length, aril width-length, rind (peel) skin and aril colour, juice yield, juice density and colour. The physicochemical properties analysed were total soluble solids, total acid, pH, ascorbic acid, total sugar, reducing sugar, total phenolic substance, anthocyanin, antioxidant capacity (DPPH), moisture and ash content. It was found that the most abundant organic acid in Zivzik and Pervari pomegranates was citric acid (3.34-4.67 g/L) and malic acid was found more in Zivzik pomegranate (1.76 g/L). Zivzik pomegranate was found to be richer in terms of the amount of phenolic compounds. Quercetin and caffeic acid are the most abundant phenolic compounds in the fruit of both varieties.

Keywords: phenolic compounds, antioxidant capacity, organic acids, local pomegranate genotypes

Siirt İlinde Yetiştirilen Zivzik ve Pervari Nar Genotiplerinin Pomolojik ve Fizikokimyasal Özellliklerinin Karakterizasyonu

Öz

Siirt ilinde ticari olarak nar yetiştiriciliği Şirvan ve Pervari ilçelerinde yoğunlaşmıştır. Zivzik nar çeşidi tescil edilmiş bir nar çeşidi olmakla birlikte yetiştirildiği bölge (Zivzik, Sarıdana, Kapılı ve Pirinçli köyleri) dışında pek tanınmamaktadır. Pervari narı ise Bitlis deresi, Hizan ile Pervari arasında kalan bölgelerde yetiştirilmektedir. Bu çalışmada, Siirt ilinde farklı lokasyonlardan toplanan Zivzik (*n=8*) ve Pervari (*n=10*) nar genotiplerine ait farklı boyutlardaki meyvelerin pomolojik ve fizikokimyasal özellikleri incelenmiştir. İncelenen pomolojik özellikler; meyve ağırlığı, dane randımanı, 100 dane ağırlığı, meyve eni-boyu, tane eni-boyu, kabuk ve dane rengi, meyve suyu randımanı, meyve suyu yoğunluğu ve rengidir. İncelenen fizikokimyasal özellikler; SÇKM, toplam asit, pH, askorbik asit, toplam şeker, indirgen şeker, toplam fenolik madde, antosiyanin, antioksidan kapasite (DPPH), nem ve kül miktarıdır. Zivzik ve Pervari narlarında en fazla bulunan organik asidin sitrik asit olduğu (3.34-4.67g/L) ayrıca malik asidin Zivzik narında daha fazla (1.76 g/L) bulunduğu tespit edilmiştir. Fenolik bileşiklerin miktarı bakımından Zivzik narının daha zengin olduğu saptanmıştır. İki çeşidin meyvesinde de kuersetin ve kafeik asit en yoğun bulunan fenolik bileşiklerdir.

Anahtar Kelimeler: fenolik bileşikler, antioksidan kapasite, organic asitler, yerel nar genotipleri

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1. Introduction

Pomegranate (*Punica granatum L.*) is a tropical and subtropical climate fruit and the fruits of cultivated varieties weigh 150-500 g, 5-15 cm in diameter and spherical in shape. The fruits are covered with a coriaceous skin of bright red, yellowish green or whitish colour, depending on the variety. The colour of the juice ranges over a wide spectrum from white to pink and blood red [1, 2].

In many parts of the world, pomegranate fruit is utilised in the production of jelly, fruit juice, salad dressing, pomegranate syrup, liqueur, wine and similar products [3-5]. In Mediterranean countries, pomegranate is usually consumed fresh [6]. The edible part of the pomegranate, i.e. the seeds, accounts for 52 per cent of the fruit. On the other hand, 78% of the arils consist of fruit flesh and 22% of the seeds. [7]. Akbulut et al. [8] reported that 100 g of pomegranate seeds contained approximately 78% water, 19% carbohydrate, 1.7% protein, 1.2% oil and 83 kcal/100 g energy.

Pomegranate contains significant levels of phenolic substances. An important part of these phenolics is located in the rind (peel). Guo et al. [9] reported that pomegranate peels have 10 times more total phenolic substance content than pulp. It has been reported that pomegranate juice contains a similar amount of phenolic substances as red wine and about 2 times more than green tea [4]. Pomegranate peels are extremely rich in hydrolyzable phenolics and contain mainly ellagitanene and its isomers and to a lesser extent punicalin (4,6-galla-gylglucose), gallic acid, ellagic acid and ellagic acid glycosides. In addition, pomegranate is a fruit rich in anthocyanins and its characteristic red-violet colour depends on the chemical structure of anthocyanins on the one hand and the concentration of anthocyanins on the other. The chemical composition of pomegranates may vary depending on genotypic characteristics, the ecology in which they are grown, fruit maturity, cultural practices in the orchards and post-harvest storage conditions [10].

As a result of the studies on functional foods and functional components of these foods due to the increasing awareness of healthy nutrition in the world, it has been observed that pomegranate is a fruit that can be used in the production of functional foods [11, 12]. Pomegranate is very rich in potassium, magnesium, sodium and vitamin C [8, 13]. It has been reported that consumption of pomegranate as table or pomegranate juice may improve the course of obesity, diabetes, cardiovascular diseases, some inflammatory diseases and various types of cancer [14]. The discovery of these properties of pomegranate has led to a great increase in the production and consumption of pomegranate. Pomegranate seeds are used abroad as raw material for pharmaceuticals [15]. However, pomegranate fruits are also used in the production of pharmaceuticals, dyes, inks, oils, animal feed, tannins and vinegar. [16-17]. The peel of the pomegranate fruit is also used in leather processing due to its high tannin content (28-30%) [18]. In addition, in a study on the use of the compounds in the bark in the tannin industry, it was found that the amount of tannin was high, a very good quality product was obtained, and the extract could be used either in combination with synthetic agents or directly in leather tanning [19].

Turkey has a wide range of pomegranate varieties and species, both because it is located on one of the regions where pomegranate is naturally distributed and because Anatolia is a region where pomegranate cultivation has been practised since ancient times [20-22]. Today, Turkey is an important pomegranate producer in the world [23]. According to the data of the Turkish Statistical Institute, 681.460 tonnes of pomegranate was produced annually on a total area of 290.697 decares in Turkey in 2022 [24]. However, pomegranate production in Turkey is concentrated along the coastline of the Aegean and Mediterranean regions and in the Southeastern Anatolia region [25]. The Southeastern Anatolia Region is a region where pomegranate has been widely cultivated for many years thanks to its suitable ecological conditions for pomegranate cultivation [22]. Parallel to the significant increase in pomegranate production in Turkey, pomegranate plantations and production in the Southeastern Anatolia Region have also increased significantly over the years. As of 2022, 97.865 tonnes of pomegranate were produced annually in 73.262 decares of land in the Southeastern Anatolia Region. [24]. Especially in Şanlıurfa, Adıyaman, Diyarbakır, Diyarbakır and Siirt, pomegranate plantation and production has increased considerably with the effect of government support in recent years.

In Siirt province, 6.143 tonnes of pomegranate are produced annually on a total area of 10.054 decares. [24]. Zivzik and Pervari pomegranates have an important place in this production thanks to their unique taste, aroma and abundant juiciness. Zivzik pomegranate is generally consumed for table use in Turkey by consumers who are familiar with this variety. Pomegranate cultivation in Pervari district is carried out in the settlements on the sides of Botan valley. Pomegranate cultivation is an important source of livelihood in these settlements [26]. In order to ensure the visibility of Zivzik and Pervari pomegranates grown especially in Şirvan and Pervari districts in national and international markets, to promote them against pomegranates grown in other regions and countries and to ensure their competitiveness, it is of great importance to determine their fruit composition and quality characteristics.

2. Material and Methods

2.1. Material

This study was carried out in 2019 using fruits collected from Zivzik and Pervari pomegranates grown in different locations in Şirvan (Zivzik, Sarıdana, Kapılı and Pirinçli villages) and Pervari districts of Siirt province. Fruit samples were taken from 8 different orchards for Zivzik pomegranate and 10 different orchards for Pervari pomegranate (Figure 1). Samples of the pomegranate genotypes examined were collected at the ripening time (in October), in different sizes to represent the garden in which they were grown and 15 kg from each orchard. Then the collected fruit samples were transported to Harran University Food Engineering Laboratories where measurements and analyses were carried out to determine their pomological and physicochemical properties.

Figure 1. Collection of fruits of Zivzik and Pervari pomegranate genotypes

2.2. Metods

After the samples of Zivzik (*n=8*) and Pervari (*n=10*) pomegranates collected from different gardens were transported to the laboratory, the samples taken from each garden were divided into 3 groups according to their sizes. Samples with fruit width*length less than 40 cm^2 were defined as "small", samples between 40 cm^2 and 60 cm^2 were defined as "medium", samples larger than 60 cm^2 were defined as "large" and the following measurements and analyses were made according to this grouping. In order to determine the pomological differences between the studied pomegranate genotypes and between fruit samples of different sizes of a genotype; fruit weight, aril yield, 100 aril weight, fruit width and length, aril width and length, rind (peel) top ground colour, aril colour, fruit juice yield, fruit juice density, fruit juice colour (L, a, b), colour intensity of fruit juice were examined. In order to determine the physicochemical properties of pomegranate samples; total soluble solids (TSS), total acid, pH, L-ascorbic acid (vitamin C), total sugar, reducing sugar, total phenolic substance, anthocyanin, antioxidant capacity (DPPH), moisture and ash (rind, aril and pomegranate juice) analyses were performed. (Figure 2) [27-33].

Figure 2. Juices of pomegranate genotypes and some physicochemical analyses

The results of the analyses reported in the studies in the literature about the composition of pomegranate and its juice are given in Table 1. The measurements and analyses in this study were based on the reference analysis methods presented in these studies.

Table 1. Upper and lower limit values in the literature related to the composition of pomegranate and its juice

Characteristics	Lower-Upper Limits	References
Aril yield (%)	(72-85)(60-73)(52)	[6],[13], [34]
100 aril weight (g)	(14.7-25.2)(9.1-20.9)(18.06-42.48)	[34], [35], [36]
Juice yield (%)	(35-55)(62.5-80.8)(33.34-50.04)(27.6-78.1) (34-70)(40.56)	[6],[13], [34], [35], [36],[37], [38]
Relative density (20/20°C)	(min.1.038)(1.056-1.074)(1.0543-1.0664) (1.054-1.079)	[34], [38],[39],[40],[41]
pH	(2.9-3.3)(2.9-3.1)(2.75-4.1)(2.4-4.41)	[34], [38],[40],[41]
Total acid (citric acid,%)	(0.5-3)(0.22-3.45)(0.12-1.77)(0.37-2.77) (0.19-2.05)(0.2-5.52)	[36],[37],[39],[40],[41]
TSS (%Bx)	(13.3-17.7)(11.3-16.8)(12.6-18)(12.4-15.6)	[34], [36],[37],[40]
Ash (g/L)	(0.246%)(2.37-6.11)	[34], [37],[41]
Reducing sugar (%)	(5.7-10.2)(10.82-15.8)(10.5)(11.59-15.66)	[13], [34], [37],[40]
Total sugar (g/L)	(10-15)(6.2-10.6)(4.4-21)(4.3-10.7)(10.6)	[2], [13], [38],[39],
Vitamin C (mg/100mL)	(7)(3.4-11.6)(3.7-10)(4.29-8.92)(0.49-14)	[2], [6],[39]

3. Results and Disscussion

3.1. Pomological Analyses

The pomological characteristics of Zivzik pomegranate, one of the pomegranate genotypes examined in this study, are presented in Table 2. According to the findings obtained; the edible part of Zivzik pomegranate, the arils, constitutes approximately 54.73% of the fruit. In parallel with the increase in fruit size, fruit weight, 100 aril weight and aril size increased, but there was no significant difference in aril yield. Although an increase in aril characteristics was found in parallel with the increase in fruit weight in Zivzik pomegranate genotypes, it was determined that this increase in fruit weight principally caused an increase in the inedible part, fruit peel.

It was observed that Zivzik pomegranate fruits were not completely round in shape, and slightly flattened on the axis of the stem and corolla, i.e. the aspect ratio was above 1. In all samples of this variety, fruit peel colour was observed to be red and pink tones on a yellow main background. It was observed that the aril colour of the fruits of this variety was light red.

It was determined that the juice yield for Zivzik pomegranate did not vary significantly according to fruit size and the average juice yield was 36.31%. However, the density and colour of the juice did not differ significantly according to fruit size. The colour intensity of the fruit juice decreased with increasing fruit size.

Table 2. Pomological characteristics of Zivzik pomegranates of different sizes (*n=8*)

Characteristics		Size			Average
		Small	***Medium***	***Large***	
Fruit weight (g)		156.32	255.71	362.14	258.05
Aril yield (%)		54.14	54.21	55.85	54.73
100 aril weight (g)		38.05	40.73	42.94	40.57
Fruit width (mm)		643.15	777.81	865.72	762.22
Fruit length (mm)		588.28	716.49	796.46	700.41
Aril width (mm)		78.24	78.61	79.47	78.77
Aril length (mm)		123.12	135.42	134.25	130.93
Rind (peel) colour		Light red-Yellow	Light red-Yellow	Light red-Yellow	Light red-Yellow
Aril colour		Red	Light red-Pink	Light red-Pink	Light red
Juice yield (%)		35.98	36.42	36.55	36.31
Juice density (g/mL)		1.071	1.074	1.072	1.072
Juice colour	*L*	23.72	23.79	23.41	23.64
	a	5.58	5.49	5.83	5.63
	b	1.34	1.65	1.41	1.46
Juice colour intensity (Abs)		4.921	4.739	4.498	4.719

The pomological characteristics of Pervari pomegranate, another pomegranate genotype examined in this study, are presented in Table 3. Parallel to the increase in the size of the fruits of Pervari pomegranate genotype, the weight and aril yield increased. On the other hand, there was a limited increase in aril size and weight. As in Zivzik pomegranate, the increase in fruit size of Pervari pomegranate largely affected the weight of the fruit peel. However, unlike Zivzik pomegranate, the increase in fruit size caused an increase in the number of arils in the fruit rather than aril size.

In the fruit samples examined, it was observed that the peel colour of Pervari pomegranate was light red on a yellow background and the aril colour was light red. In addition, it was determined that the fruits of this genotype had an aspect ratio above 1 and had a very similar shape to Zivzik pomegranate in this respect.

The average juice yield of Pervari pomegranate fruits from different gardens was 34.74% and the average juice density was 1.074 g/mL. The colour and density of the juice of the fruits of this genotype are similar to those of the Zivzik pomegranate, with some differences in fruit size.

Although the fruit juice yield values of Pervari pomegranate genotypes were lower than those of Gündoğdu et al. [42] in 5 different Pervari pomegranate genotypes, the results of aril yield, peel colour, aril colour and fruit size were very similar. The difference in juice yield may have been caused by many environmental factors, especially rainfall amount and regime.

Table 3. Pomological characteristics of Pervari pomegranates of different sizes (*n=10*)

Characteristics		Size			Average
		Small	***Medium***	***Large***	
Fruit weight (g)		159.36	268.15	351.28	259.59
Aril yield (%)		51.34	53.91	53.83	53.02
100 aril weight (g)		40.51	41.27	41.49	41.09
Fruit width (mm)		638.54	771.53	829.71	746.59
Fruit length (mm)		572.64	705.94	781.37	686.65
Aril width (mm)		77.34	77.79	78.34	77.82
Aril length (mm)		131.03	134.64	133.82	133.16
Rind (peel) colour		Red-Yellow	Light red-Yellow	Light red-Yellow	Light red-Yellow
Aril colour		Light red	Pink	Light red-Pink	Light red
Juice yield (%)		33.15	35.61	35.47	34.74
Juice density (g/mL)		1.076	1.070	1.078	1.074
Juice colour	*L*	23.38	22.86	22.27	22.83
	a	6.21	5.76	5.91	5.96
	b	1.04	1.27	1.39	1.23
Juice colour intensity (Abs)		4.687	5.235	4.811	4.911

3.2. Physicochemical Analyses

As shown in Table 3, total soluble solid (TSS) content of Zivzik pomegranate did not show a significant change depending on fruit size. As in all fruits, TSS in pomegranate depends on the variety and maturity and even on the climatic conditions at the stage of fruit development. In studies on the composition of pomegranate juice, Cemeroğlu et al.[40] reported that the TSS varied between 12.6-18.0% and Velioğlu et al.[43] reported that it varied between 13.2-18.7%. The fact that the TSS value of Zivzik pomegranate was higher than the values obtained in other studies in the literature showed that the sugar accumulation in the arils of this variety was higher and therefore it was a highly attractive pomegranate variety. A similar situation in terms of TSS is also valid for the fruits of Pervari pomegranate genotypes that we examined within the scope of the study. As a matter of fact, the samples of this genotype had an average of 15.90% °Bx and 16.10% °Bx TSS in the samples of Zivzik pomegranate (Table 4, Table 5).

In terms of total acidity, the lowest value (0.957 g/100mL) was found in large-sized fruits and the highest value (1.027 g/100mL) was found in small-sized fruits. Similarly, total acidity in Pervari pomegranates decreased in parallel with the increase in fruit size. Since the average acidity of the fruits of both genotypes examined in the study was around 1g/100mL, they can be defined as sweet-sour pomegranate genotypes. In contrast to acidity, pH values increased with increase in size in fruit samples of both genotypes.

Velioğlu et al.[43] reported that total acidity varied between 0.2-5.52 g/100mL in their study on 120 pomegranate varieties. According to Gözlekçi [44], the most important difference in the composition of pomegranate fruits with ripening is observed in total acidity and there is always a decrease in acidity and an increase in pH in the following weeks during the ripening period.

Although all of the fruits of different sizes belonging to the pomegranate genotypes examined in our study were ripe, the findings obtained showed that there was a negative correlation between fruit size and total acidity and a positive correlation with pH.

The ratio of TSS/total acid, which is expressed as flavour value in fruits and juices, is an important criterion in the evaluation of fruit. The decreasing order in terms of TSS/total acid values are Zivzik (16.1/0.996=16.15) and Pervari (15.90/1.11=14.32). This finding indicates that, apart from colour and general appearance, Zivzik pomegranates will be the most preferred among the varieties in terms of taste in consumer appeal and evaluation, followed by Pervari pomegranates.

Spectral curves of the pomegranate juice samples analysed in the studies were obtained. From these spectral curves, it was determined that the maximum absorbance value of the samples was between 512-521nm. The anthocyanin that gives maximum absorbance values in this wavelength range is cyanidin 3-glucoside (Asterin). The molecular weight of this anthocyanin is 445.2 and the molar absorbance value is 29600 [28]. Du et al.[27] stated that the most abundant anthocyanin in pomegranate juice is cyanidin 3-glucoside.

Pomegranate juice contains very little or a lot of anthocyanins, depending on the fruit from which it is obtained, and thus shows a colour ranging from light pink to purple red. Depending on the nature of the solvent medium, the wavelength value showing maximum absorbance in the spectral curve generally varies between 510 - 540 nm for anthocyanins [37]. Since colour is one of the most important criteria in this type of fruit juices, samples with high anthocyanin and colour intensity in terms of fruit juice production technology have potential for fruit juice production. The anthocyanin content in the fruit juices of Zivzik and Pervari pomegranate genotypes examined in this study was distributed between 154.22-164.32 mg Cy.3 Gl/L. On the other hand, anthocyanin content in fruit juice decreased as fruit size increased in both genotypes.

Table 4. Chemical properties of Zivzik pomegranates of different sizes (n=8)

Properties	**Size**			**Average**
	Small	***Medium***	***Large***	
TSS (%Bx)	16.1	16.0	16.2	16.1
Total acid (g/100mL)	1.027	1.005	0.957	0.996
pH	3.55	3.67	3.72	3.64
L- ascorbic acid (C vit.) (mg/100mL)	15.58	15.43	14.91	15.30
Total Sugar (%)	13.04	12.82	13.13	12.99
Reducing Sugar (%)	12.81	12.79	12.94	12.84
T. Phenolic Subs. (mg Gallik A/L fruit juice)	1019.14	939.16	935.28	964.52
Anthocyanin (mg Cy.3 Gl/L nar suyu)	194.28	172.67	164.32	177.09
Antioxidant Activity (DPPH% fruit juice)	90.01	88.31	87.97	88.76
Aril moisture (%)	80.24	79.61	78.82	79.55
Rind (peel) moisture (%)	65.64	64.91	64.14	64.89
Fruit juice ash (%)	0.71	0.73	0.72	0.72
Aril ash (%)	0.96	1.01	1.02	0.99
Rind (peel) ash (%)	1.41	1.49	1.43	1.44

Table 5. Chemical properties of Pervari pomegranates of different sizes (n=10)

Properties	Size			Average
	Small	***Medium***	***Large***	
TSS (%Bx)	16.0	15.85	15.80	15.90
Total acid (g/100mL)	1.128	1.109	1.086	1.11
pH	3.51	3.56	3.60	3.55
L- ascorbic acid (C vit.) (mg/100mL)	15.03	14.92	14.84	14.93
Total Sugar (%)	13.45	13.62	13.88	13.65
Reducing Sugar (%)	13.06	13.12	13.49	13.22
T. Phenolic Subs. (mg Gallik A/L fruit juice)	979.82	928.34	856.42	921.52
Anthocyanin (mg Cy.3 Gl/L nar suyu)	176.51	159.38	154.22	163.37
Antioxidant Activity (DPPH% fruit juice)	86.54	86.29	85.16	85.99
Aril moisture (%)	81.34	80.64	79.67	80.55
Rind (peel) moisture (%)	66.57	65.96	65.45	65.99
Fruit juice ash (%)	0.62	0.69	0.70	0.67
Aril ash (%)	0.91	0.93	0.92	0.92
Rind (peel) ash (%)	1.37	1.42	1.39	1.39

During the processing of pomegranate, in addition to the phenolic substances naturally present in the aril, phenolic substances in the outer peel, carpel and placental membrane pass into the fruit juice in small or large amounts depending on the processing method. Total phenolic substance of Zivzik pomegranates varied between 935.28-1019.14 mg/L, and total phenolic substance of Pervari pomegranates varied between 856.42-979.82 mg/L. It is not possible to say that the total amount of phenolic substances in pomegranate develops in a certain direction with maturity. In all of the samples used in this study, it was found that the amount of phenolic substances in pomegranate juices decreased as the fruit size increased.

In the analyses, it was determined that L-ascorbic acid (vitamin C) content varied between 14.84-15.58 mg/100mL in the samples examined. Vitamin C content decreased as the fruit size increased in the varieties examined. It has been reported that pomegranate is a good source of vitamin C. However, it is a poor fruit in terms of content compared to rosehip, strawberry and lemon, but a rich fruit compared to apple, pear and plum [2, 23]. In studies on the composition of pomegranate juice, the amount of vitamin C was reported to vary between 11.38-94.02 mg/L by Gündoğdu and Yılmaz [23], 4.0-24.6 mg/100mL by Cemeroğlu et al. [45] reported that it varied between 5.21-30.84 mg/L and depending on the genotype studied. Our findings are in parallel with the literature in this respect.

3.3. Organic Acids and Phenolic Compounds

Pomegranate fruit contains significant amounts of organic acids and phenolic compounds, depending on the variety [45-47]. It has been previously reported by different researchers that pomegranate juice is an important source of antioxidants and this feature is due to the phenolic compounds it contains [48]. However, the antioxidant effects of phenolic compounds in pomegranate fruits can be explained by binding free radicals, forming chelates with metals and inactivating some enzymes.

The most abundant organic acid in the fruit juices of Zivzik and Pervari pomegranate genotypes analysed in this study was citric acid (Table 6.). This organic acid was followed by L-malic acid and tartaric acid. Total organic acid content was determined as 4.91 g/L in Zivzik pomegranate genotype samples and 5.04 g/L in Pervari pomegranate genotype samples. The findings of total organic acid content, total acidity and pH in fruit juices support each other. As a matter of fact, total acidity in Pervari pomegranate genotype samples was higher and pH was lower than Zivzik pomegranate genotype samples. However, our findings are similar to those of Saxena et al. [2] who reported that citric acid was the most abundant organic acid in pomegranate juices followed by malic, oxalic, succinic and tartaric acid and Turgut and Seydim [49] who reported the same order except succinic acid. In addition, a similar ranking with our findings was obtained in Ghaderi-Ghahfarokhi et al. [50], who examined Iranian origin pomegranate cultivars, and Poyrazoğlu et al. [51] and Gundogdu and Yilmaz [52], who examined Turkish origin pomegranate cultivars.

Caffeic acid, quercetin and catechin were found to be the most abundant phenolic compounds in the fruit juices of the samples belonging to Zivzik and Pervari genotypes, respectively (Table 6.). It was determined that all three phenolic compounds were found more in the samples of Zivzik genotype compared to the samples of Pervari genotype. This finding coincides with the findings of total phenolic substance of fruit juices (Zivzik > Pervari).

Table 6. Organic acids and phenolic compounds in Zivzik and Pervari pomegranates

Organic Acids	**Zivzik**	**Pervari**
Citric acid (g/L)	3.28	3.54
L-malic acid (g/L)	1.52	1.06
Tartaric acid (g/L)	0.11	0.44
Total	4.91	5.04
Phenolic Compounds	**Zivzik**	**Pervari**
Quercetin (mg/L)	52.9	34.1
Catechin (mg/L)	10.1	9.3
Caffeic Acid (mg/L)	55.2	50.7
Total	118.2	94.1

4. Conclusion

In recent years, a huge demand for pomegranate consumption has emerged with the increasing scientific research on pomegranate and the importance of pomegranate juice in terms of healthy nutrition awareness thanks to the support of the media. At the same time, with the elimination of pomegranate granulation, which is a fundamental problem in pomegranate juice production, large quantities of pomegranate can be processed into fruit juice with industrial-scale machines. With this study, in addition to the provinces in Turkey where pomegranate is produced intensively in terms of variety and quantity, the province of Siirt has a certain potential and determining that these pomegranates can be evaluated for table and/or industrial use will make great contributions to the pomegranate cultivation in Siirt province.

It is known that apple and grape juices are not very popular in Turkey and are therefore hardly consumed at all. It is possible to increase pomegranate consumption by adding pomegranate juice produced from pomegranates grown in Siirt province to other fruit juices at certain rates. The two local pomegranate genotypes we examined can also be evaluated for this purpose and their production can be expanded in this way.

Ethics in Publishing

There are no ethical issues regarding the publication of this study.

Author Contributions

Ebru SAKAR: Investigation, Material Supply, Original Draft Writing, Review and Editing,

Hasan VARDİN: Investigation, Experimental Analyses, Original Draft Writing,

Mehmet KARAASLAN: Investigation, Experimental Analyses, Original Draft Writing,

Mehmet İlhan ODABAŞIOĞLU: Investigation, Material Supply, Original Draft Writing

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