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Evaluation of the total phenolic content, sugar, organic acid, volatile compounds and antioxidant capacities of fig (*Ficus carica* L.) genotypes selected from the Mediterranean region of Türkiye

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Abstract: Nowadays, the interest in research to determine the healthy compounds in fig fruits has increased, as many of them have been found to be beneficial to human health. This study aimed to determine the sugars, organic acids, total phenolic content, antioxidant capacity and volatile compounds in the fruits of 19 fig (*Ficus carica* L.) genotypes sampled from the Kahramanmaras province in Türkiye in 2018 and 2019. In the fruit of the fig genotypes, the total phenolic content was determined by the Folin-Ciocalteu method, the total antioxidant capacity was determined by the DPPH (2,2-diphenyl-1-picrylhidrazil) method, the sugars, organic acids and volatile aroma compounds were determined chromatographically (HPLC/RID detector), (HPLC/UV detector) and headspace gas chromatography-mass spectrophotometry (HS-GC/MS), respectively. The results showed that most of the biochemical contents and antioxidant capacities of the genotypes significantly differed from each other ($P < 0.05$). The total phenolic content and antioxidant properties of the fruits ranged from 50.29 to 580.59 mg gallic acid equivalent per 100 g fresh weight base (and 15.98 to 36.77% DPPH, respectively. Regarding the sugar content of the fig genotypes, the main sugar is fructose ranging from 3.35 to 7.37 g per 100 g. The highest fructose content of 7.37 g per 100 g was found in the genotype KMF12. A total of 58 volatile compounds were detected in the fruits of the 19 fig genotypes, including 18 aldehydes, 3 ketones, 6 esters, 2 terpenes, 17 alcohols, 1 acid and 11 other compounds. According to the obtained results, aldehydes, esters and ketones were found to be the major volatile compounds in the fig fruits. The genotypes with the highest values of the phytochemical and antioxidant properties among the genotypes were selected as candidates as a source of variation for breeders who want to develop new commercial varieties beneficial to human health.

Keywords: fig; sugars; organic acids; antioxidant activity; total phenolics; volatile compounds

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The fig is a Mediterranean fruit species, which has a wide distribution area due to its adaptability to different ecological conditions including the subtropical and warm temperate climate (Sandhu et al. 2023). It has been cultivated since the beginning of human settlement (Zidi et al. 2021). *Ficus carica* L. (fig) is a member of the Moraceae family, which includes more than 1400 species in about 40 genera and is one of the oldest cultivated fruit trees among horticultural plants (Mawa et al. 2013). It has a very old cultural history and wide distribution in the world. The plant has been reported to grow wild in Anatolia, the Mediterranean basin, South Caucasus, Georgia, Iran and the Arabian Peninsula, and among all these areas, the richest form of wild figs are found in Anatolia. The most important fig of this genus is *Ficus carica* L., which is known as the Anatolian fig (Simsek et al. 2020).

In the world, as of 2020, 1.3 million tonnes of figs were produced on 282 thousand ha area. Türkiye ranks first in fig production with 320 000 tonnes on 537 thousand ha, Egypt ranks second with 201 000 t and Morocco ranks third with 144 000 t. Approximately 70% of the figs produced in Türkiye are dried (Anonymous 2020a,b).

To prevent the loss of plant diversity in the world, it is necessary to identify, conserve and transfer genetic material for the future. It is well known that the genetic diversity of the world's horticultural crops is the main prerequisite for any breeding programme (Benjak et al. 2005; Dogan et al. 2014; Akan, 2022; Dalern, Cangi 2022; Delialioglu et al. 2022; Gelaw et al. 2023; Zhu et al. 2024).

Türkiye, especially Anatolia, is a country with many fig genetic resources. Therefore, studying and identifying the source of genetic variation among different fig genotypes and commercial varieties is always important and critical for initiating a breeding programme. Previously, a large number of studies on fig genetic resources and selection studies have been carried out in the world and in Türkiye (Messaoudi, Haddadi 2008; Mars et al. 2008; Saddoud et al. 2008; Simsek 2009; Cristo et al. 2010; Darzaji 2011; Gaaliche et al. 2012; Simsek et al. 2017; Uslu et al. 2018; Ugur et al. 2023).

Nowadays, fruits have gained more importance among consumers and producers because they contain compounds beneficial to human health (phenolic compounds, sugars, organic acids, volatile aroma compounds, etc.) and the interest in fruits is increasing (Celik et al. 2007; Gundesli et al. 2019; Maldonado-Celis et al. 2019; Gundesli et al. 2020; Urun et al. 2021). Among these beneficial compounds, sugars and organic acids are important compounds that affect the taste, smell, colour and appearance of fruits (Ikegaya et al. 2019). Sweetness is an important indicator of fruit quality and is highly correlated with ripeness in most fruits. In many fruits, sweetness is also an important indicator for assessing fruit quality, and many researchers have made various efforts to increase the sweetness during fruit development. Organic acids in fruits and vegetables are mostly present in a free form or combined as salts, esters or glycosides (Gundogdu, Yilmaz 2012). One of the properties of organic acids is that they contribute to the antioxidant effect. Although the organic acid content of fruits varies according to the genotypic structure of the plant and the ecological conditions in which it is grown, it plays a crucial role in the taste of the fruit by influencing the acid-sugar balance. The other effect of the organic acid-sugar ratio is also an important criterion used to characterise the fruit aroma and flavour. The organic acid content depends on the variety and climate. In short, the organic acid content is one of the main determinants of the fruit taste depending on the acid-sugar balance (Gundogdu, Bilge 2012).

The aroma composition is complex, with many volatile compounds unique to each aroma. Although different fruits often share many aromatic characteristics, the volatile mixtures of each fruit differ from the fruit aroma depending on the concentration of the individual volatiles and the threshold of perception. Flavour is one of the most important characteristics of fruits, and volatile flavour components, in particular, play an important role in determining the perception and acceptability of products by consumers (Gul,Tekeli 2019). The identification and characterisation of essential volatile compounds, which play a role in the formation of the most important properties of natural fruit, is very important in terms of providing the basic sensory identity and characteristic flavour of the fruit. At the same time, volatile aroma compounds are affected by the fruit growth and ripening stages, resulting in qualitative and quantitative changes (Chen et al. 2021; Zidi et al. 2021). Therefore, aroma can be used as a marker to distinguish between the fruit ripening stages and to identify different the fruit origins (genetic or geographical) (Khalil et al. 2017). Volatile aroma compounds in fruits can be influenced by many factors such as the variety, ecological conditions, cultural practices, ripeness, har-

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vest and post-harvest handling. Among these factors, ripeness is the most important criterion that changes the amount of volatile compounds (Gundesli et al. 2020, 2021; Kafkas et al. 2022).

Flavour is one of the most important quality attributes of figs and the most important quality parameter in both edible and processed products. The increasing demand for flavourful figs in recent years may be related not only to their potential health benefits, but also to their distinctive organoleptic characteristics (Gundesli et al. 2020; Urun et al. 2021). Fig volatile flavour compounds have been studied in the last decade and these studies are increasing day by day. Studies on fig volatile flavour compounds have been conducted in different fig producing countries of the world, but there is a need for more and comprehensive studies. This is because there is a great difference in which the flavour compounds are present in different varieties and what their concentration is. The main determinants of the fig fruit quality as perceived by consumers include a large number of compounds with varying degrees of volatility. Various techniques have been used to detect aroma compounds at very low concentrations. To date, more than 100 different volatile compounds have been identified in different tissues of different fig varieties. In different tissues of fig (*F. carica*), terpenes, alcohols, aldehydes, ketones, esters and other compounds are determined (Russo et al. 2017; Palassarou et al. 2017; Rodríguez-Solana et al. 2018; Gündesli et al. 2020).

Figs are one of the most important fruits for mankind due to their pleasant aroma, colour, good taste, flavour and health-promoting compounds (bioactive compounds). Many scientific studies have reported the presence of secondary metabolites such as vitamins, dietary fiber, polyphenols, sugars, volatile aroma compounds, organic acids, flavonoids, and anthocyanins. Figs have also been reported to have the highest antioxidant activity due to their high polyphenol content, especially flavonoids and anthocyanins (Ercisli et al. 2012; Mawa et al. 2013; Adiletta et al. 2019; Gundesli et al. 2020, 2021). Many epidemiological studies have shown that figs have scientifically validated medicinal and nutritional values that have been shown to have a positive effect on many diseases (gastrointestinal, respiratory, inflammatory, cancer and cardiovascular problems) (Mawa et al. 2013; Soltana et al. 2017; Walia et al. 2022). Figs are therefore an important part of the Mediterranean diet and are associated with longevity. Moreover, the bioactive compounds and functional properties of figs are closely related to the fruit quality and are often influenced by the genotype, fruit varieties, orchard management, climatic and environmental conditions, harvesting season and cultivation techniques (Veberic et al. 2008; Crisosto et al. 2010; Ercisli et al. 2012).

Studies on the organic acids, sugar, flavour and antioxidant content of fig fruits are scarce in literature. Therefore, the aim of this study was to determine the sugars, organic acids, volatile compounds, total phenolics and antioxidant capacity of 19 fig genotypes selected from the Eastern Mediterranean region of Türkiye and to develop new varieties that are beneficial to human health and to nominate them as a source of variation for breeders who want to develop new commercial varieties.

MATERIAL AND METHODS

Study area. Kahramanmaras is located at 37°43' North longitude and 37°28' East latitude and is 900 m above sea level. It has a continental climate with the highest average temperature in August (35.9 °C) and the lowest average temperature in January (1.2 °C). The region is an important fruit-growing area. Although the climate of Kahramanmaras province is transitional between the Mediterranean and Southeast Anatolian regions, it is located in the Mediterranean climate zone. It fits the exact definition of Mediterranean climate, the winters are mild and rainy, and the summers are hot and dry.

Preparation of plant materials and plant extracts. This study was carried out in 2018 and 2019 in Kahramanmaras province, located in the Eastern Mediterranean region of Türkiye, on 19 fig genotypes that stood out in the selection made by screening fig plantations from the "fig selection project" of TAGEM (General Directorate of Agricultural Research and Policies). Each fig tree was given a code number. These code numbers were preceded by the abbreviation of the province of Kahramanmaras (KM), the initials of the fig name (F), and finally, the tree number. Accordingly, each identified genotype was named from KMF07 to KMF19. Approximately 10 kg of ripe fresh fruit were randomly selected from each genotype at full maturity, packed on ice and immediately transported to Çukurova University, Faculty of Agriculture, Department of Horticulture Laboratory. Fresh fig pulp was obtained from

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each genotype by manually separating the peel from the flesh of the fruit. Three replicates of 500 g each were used at full maturity. Pulp tissue was obtained from fresh fruit and homogenised with equal proportions of deionised water at room temperature, and the diluted homogenate was stored at –20 °C until used for the volatile analysis. These triplicate homogenised samples were used for the analysis of the sugars, organic acids, volatile compounds, total phenolic and antioxidant capacity.

Total phenol content. The total phenolic content was determined using the Folin-Ciocalteu reagent in the modified method of Spanos and Wrolstad (1990). In short, a methanol substance was added to one gram of each sample. Water, Folin-Ciocalteu, and 20% sodium carbonate were added to the insoluble portion of the suspension and stored in darkness for 2 hours. The absorbance values for all the samples used in the study were analysed at 760 nm using a spectrophotometer (Thermo Scientific Multiskan GO microplate). Gallic acid (GA) standards prepared at determined concentrations in accordance with the study method were calculated by means of the daily calibration curve. The obtained results are expressed in milligram gallic acid equivalents (GAE) per 100 g fresh fig fruit sample (FW). Data are reported as the mean value for three measurements.

Total antioxidant capacity. The total antioxidant capacity was measured using the DPPH (2,2-diphenyl-1-picrylhydrazyl) method reported by Brand-Williams et al. (1995) with slight modifications. The alteration of the DPPH absorbance at 515 nm was recorded at 5-minute intervals using a Multiskan GO microplate spectrophotometer. The solvent was used as a control and computed as follows:

DPPH inhibition (%) = [(control absorbance – (sample absorbance – blank absorbance))/control absorbance] × 100

Analysis of the sugars. The HPLC analysis developed by Crisosto (1997) was performed to determine the specific sugars (glucose, fructose and sucrose) and total sugar in the samples taken from the homogeneously obtained fig fruit pulp. Before the analysis, the fruit pulp samples were thawed at 25 °C by adding 1 g to 4 mL of distilled water (Millipore Corp., Bedford, MA, USA). The reaction mixture was placed in an ultrasonic bath and sonicated for 15 min at 80 °C, then centrifuged at 5 500 rpm for 15 min and filtered (before being analysed in HPLC). The sugar contents were determined using three replicates, using HPLC (Shimadzu, Prominence LC-20A), RID (Refractive Index Detection), and a Coregel-87C column (7.8 × 300 mm). Separations were performed at 70 °C at a flow rate of 0.6 mL/min. Elution was performed in isocratic ultrapure water. The calibration curves obtained from the samples were evaluated according to the reference calibration values used and the contents were determined by this method.

Analysis of the organic acids. The organic acids in fig pulp extract were determined by the HPLC analysis developed by Bozan et al. (1997). The changes in the malic, citric, succinic, fumaric, L-ascorbic and oxalic acid levels in pulp samples were identified. For the extraction of organic acids, 1 g of the sample was mixed with 4 mL of 3% metaphosphoric acid. The mixture was placed in an ultrasound bath at 80 °C for 15 min and it was sonified and centrifuged at 5 500 rpm for 15 minutes. The mixture was filtered and the HPLC vials were removed. The extract organic acids were analysed using HPLC (Shimadzu LC 20A vp, Kyoto, Japan) equipped with a UV detector (Shimadzu SPD 20A vp) in which we used an 87 H column (5 µm, 300 × 7.8 mm, Transgenomic). Sulfuric acid (0.05 M) was used as solvent. The operating conditions were: column temperature, 40 °C; injection volume, 20 µL; detection wavelength, 210 nm; flow rate 0.8 mL/min. The identification of the organic acids and peak determination is based on the peak retention times and the comparison of the spectral data in accordance with the standards. The identified acids were assessed in accordance with the corresponding standardised calibration curves.

Analysis of the volatile compounds (HS-GC/MS). 1 g of homogenate fig pulp was weighed and 1 mL of $CaCl_2$ was added over 30 minutes at 40 °C incubation time. The SPME fibre 50/30 µm DVB/CAR/PDMS (Divinylbenzene/Carboxen/PDMS;grey) and were used for the extraction of volatiles. The adsorbed flavour compounds of the fig pulp were analysed using a Shimadzu GC-2010 Plus Gas chromatography mass spectrometer (GC/MS). An HP-Innowax Agilent column (30 m × 0.25 mm i.d., 0.25 µm thickness) was used with helium as the carrier gas. The GC oven temperature was kept at 40 °C and programmed to 260 °C at a rate of 5 °C/minutes, and then kept constant at 260 °C for 40 min. The injector temperature was at 250 °C. The MS was taken at 70 eV. The mass range was m/z 30–400. A library search was carried out using the commercial Wiley, Nist and Flavor GC–MS Libraries (Kafkas et al. 2022).

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RESULTS AND DISCUSSION

Nowadays, fruits containing phytochemicals and natural antioxidants are becoming very important in the human diet and are increasingly consumed by consumers. For this reason, this has attracted the attention of many researchers and many studies have been carried out on this subject (Abanoz, Okcu 2022; Dawadi et al. 2022). Different parts of the fig are known to contain many phytochemical compounds that are powerful antioxidants and may have protective effects against various diseases (Sandhu et al. 2023).

Total phenolic content (mg GAE per 100 g FW) and total antioxidant capacity (%DPPH inhibition). The results of the total phenolic content (TPC) and total antioxidant capacity (TAC) (DPPH) of 19 local fig genotypes are shown in Table 1. Statistically significant differences were found among the genotypes ($P < 0.05$) (Table 1). Wide variations in the TPC among the genotypes are evident. The TPC content of the genotypes ranged from 50.29 to 580.59 mg GAE per 100 g FW. The genotype KMF19 had the highest TPC content (580.59 mg GAE per 100 g FW), while KMF16 had the lowest (50.29 mg GAE per 100 g FW) (Table 1).

The TPC contents of most of the genotypes in our study were considerably higher than those reported in previous studies conducted in the main fig growing countries for different fig cultivars. For example, Solomon et al. (2006) reported between 56.0–74.9 mg GAE/100 g FW, Del Caro and Piga (2008) reported between 69.7–145.1 mg GAE/100 g FW, Pande and Akoh (2010) reported between 28.6–211.9 mg GAE/100 g FW, Nakilcioglu and Hisil (2013) reported between 198.8–307.64 mg GAE/100 g FW. Aljane et al. (2020), Gundesli et al. (2021), Kamiloglu and Capanoglu (2015) and Djuric et al. (2014) also reported between 51.50–100.23 mg GAE/100 g FW, 156.02 mg GAE/100 g FW, 193–417 mg GAE/100 g FW and 536.4 mg GAE/100 g FW, respectively, which indicated similarity with our results. However, Mujic et al. (2012) and Amessis-Ouchemoukh et al. (2017) found higher values than our study (536.4 and 500–756 mg GAE/100 g FW). The TAC content of the 19 fig genotypes ranged from 15.98 to 36.77% DPPH (Table 1). The genotype KMF7 had the highest TAC content (36.77% DPPH), while KMF7 had the lowest value (15.98%) (Table 1). The total antioxidant capacity (TAC) reported in our results was in agreement with Caliskan and Polat (2011); however, it was lower than the values reported by Solomon et al. (2006), Veberic et al. (2008) and Hoxha et al. (2015).

Table 1. Total phenol content and total antioxidant capacity of 19 fig genotypes

Genotype	Total phenols (mg GAE/100 g)	Antioxidant capacity (DPPH, %)
KMF07	120.32^{fgh}	15.98^{l}
KMF08	170.74^{e}	20.57^{jk}
KMF09	170.80^{e}	32.40^{bcd}
KMF10	210.93^{d}	20.00^{jk}
KMF11	340.68^{b}	21.14^{ij}
KMF12	140.30^{f}	22.46^{hi}
KMF13	110.17^{h}	23.25^{h}
KMF14	310.15^{c}	33.12^{bc}
KMF15	50.85^{ijk}	30.96^{def}
KMF16	50.29^{jk}	27.61^{g}
KMF17	30.60^{k}	26.58^{g}
KMF18	130.69^{fg}	31.58^{cde}
KMF19	580.59^{a}	36.77^{a}
KMF20	70.00^{ij}	29.73^{f}
KMF21	50.58^{ijk}	30.51^{ef}
KMF22	60.64^{ij}	29.67^{f}
KMF23	70.69^{i}	19.30^{k}
KMF24	60.12^{ij}	29.60^{f}
KMF25	110.58^{gh}	33.45^{b}
$LSD_{0.05}$	20.38^{**}	1.69^{**}

Different letters in the same column indicate statistically significant differences at $P < 0.05$

Individual sugars. In fruit varieties, sugars, which are one of the fruit quality parameters for both consumers and producers, is considered one of the flavour components. In this study, specific sugar values (sucrose, glucose, fructose, total sugars) and °Brix were determined in 19 promising fig genotypes. Data on the sugars, total sugars and °Brix are presented in Table 2. Statistically significant differences between the genotypes were found for all the specific sugars, total sugars and °Brix ($P < 0.05$). Fructose and glucose were the major sugars in the fruits of 19 fig genotypes with values ranging from 3.35 to 7.37 g/100 g and 2.88 to 8.00 g/100 g, respectively. The genotype KMF12 had the highest fructose content (7.37 g/100 g), while KMF16 had the lowest (3.35 g/100 g). The highest glucose content was 8.00 g/100 g for genotype KMF12, while KMF16 had the lowest value (2.88 g/100 g). For sucrose, values ranging from 0.014 to 0.074 g/100 g were obtained

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Table 2. Specific sugars (g/100 g FW), total sugar (g/100 g FW) and °Brix in fruits of 19 fig genotypes

Genotype	Sugars				Total sugar
	sucrose	glycose	fructose	°Brix	
KMF07	0.027^{efg}	5.32^{hı}	4.98^{hı}	17.06^{fgh}	10.36^{fg}
KMF08	0.014^{h}	5.89^{fg}	5.54^{g}	16.13^{hı}	11.46^{e}
KMF09	0.030^{e}	6.46^{de}	6.06^{ef}	14.53^{j}	12.55^{cd}
KMF10	0.036^{de}	4.73^{j}	4.51^{j}	15.86^{ı}	9.28^{h}
KMF11	0.018^{gh}	6.52^{de}	6.19^{e}	18.53^{bcd}	12.74^{c}
KMF12	0.071^{a}	8.00^{a}	7.37^{a}	17.06^{fgh}	15.45^{a}
KMF13	0.074^{a}	7.51^{ab}	7.29^{ab}	19.46^{b}	14.88^{ab}
KMF14	0.041^{cd}	6.28^{def}	6.12^{e}	16.80$^{f-ı}$	12.45^{cd}
KMF15	0.074^{a}	7.16^{bc}	6.81^{cd}	17.86^{def}	14.05^{b}
KMF16	0.043^{bcd}	2.88^{k}	3.35^{k}	13.46^{jk}	6.27^{ı}
KMF17	0.051^{b}	6.24^{ef}	6.38^{de}	16.40^{ghı}	12.68^{c}
KMF18	0.028^{efg}	6.10^{efg}	5.62^{fg}	19.06^{bc}	11.75^{de}
KMF19	0.020^{fgh}	5.08^{ıj}	4.73^{ıj}	17.33^{efg}	9.83^{gh}
KMF20	0.029^{ef}	4.97^{ıj}	4.81^{ıj}	18.40^{b-e}	9.81^{g}h
KMF21	0.042^{bcd}	4.66^{j}	4.41^{j}	12.93^{k}	9.11^{h}
KMF22	0.030^{e}	5.63^{gh}	5.41^{gh}	18.26^{cde}	11.08^{e}f
KMF23	0.046^{bc}	7.29^{bc}	6.88^{bc}	22.00^{a}	14.22^{b}
KMF24	0.015^{h}	5.65^{gh}	5.29^{gh}	17.06^{fgh}	10.96^{ef}
KMF25	0.015^{h}	6.82^{cd}	6.25^{e}	17.46^{d-g}	13.09^{c}
$LSD_{0.05}$	0.09**	0.52**	0.44**	1.17**	0.88**

Different letters in the same column indicate statistically significant differences at $P < 0.05$

in KMF8 and KMF15 with the lowest and highest sucrose content values, respectively (Table 2). The sugar contents in our study were considerably higher than those reported in previous studies for different fig cultivars; Aljane et al. (2007) reported glucose contents of 1.21–6.13 g 100/g FW, fructose contents of 1.91 to 4.65 g/100 g, Slatnar et al. (2011) reported glucose contents of 2.50 to 3.81 g/100 g FW, fructose contents of 2.34 to 3.40 g/100 g. On the other hand, Melgarejo et al. (2003) found glucose contents between 15.89 and 13.41 g/100 g FW, Caliskan and Polat (2012) reported the glucose content as 10.7 g/100 g FW and the fructose content as 7.8 g/100 g FW and Hssaini et al. (2021) found the glucose content as 29.4 g/100 g FW and the fructose content as 28.15 g/100 g FW indicating higher values than our study. Trad et al. (2014) found fructose contents between 4.40–6.10 g 100 g FW, glucose contents between 4.70–7.54 g/100 g FW, Pereira et al. (2017) reported fructose contents between 4.94–7.47 g/100 g FW, glucose contents between 5.40–7.70 g/100 g FW, sucrose contents between 1.90–2.60 g/100 g FW. The total sugar content (sucrose, glucose and fructose) varied between 6.27 (KMF16) and 15.45 (KMF12) g/100 g FW. The water soluble dry matter (°Brix) of 19 genotypes was analysed and four genotypes (KMF23, KMF13, KMF17 and KMF11) showed the highest value (22.00%, 19.46%, 19.06% and 18.53%, respectively), while KMF21 and KMF16 showed the lowest value (°Brix values were 12.93% and 13.46%, respectively) (Table 2). Ersoy et al. (2007) reported a total sugar content between 5.83% and 20.22% in different fig varieties. In another study, Petkova et al. (2019) found the total sugar content to be 12.9% in their study. According to Ersoy et al. (2007), the °Brix values (7.40–18.60%) in the fig varieties had values close to our study.

Organic acids. Studies have shown that organic acids influence the flavour formation and many physiological processes in fruit, depending on the variety. Especially in fruit varieties, the sugar-acid balance and content are very important for the flavour and aroma. In particular, the acid-sugar ratio is one of the most important criteria to characterise the fruit aroma (Urun et al. 2021; Shi et al. 2022; Sandhu et al. 2023). In our study, the oxalic acid, citric acid,

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Table 3. The content of organic acids in the fruit pulp of the 19 fig genotypes (%)

Genotype	Organic acid					Total organic acid
	oxalic acid	citric acid	malic acid	succinic acid	fumaric acid	
kMF07	0.0054^{cd}	0.267^{h}ı	0.095^{d-j}	0.266^{def}	0.0028^{c}	0.637^{fg}
KMF08	0.0098^{b}	0.317^{ef}	0.123^{ab}	0.327^{c}	0.0011^{def}	0.779^{c}
KMF09	0.0133^{a}	0.286^{gh}ı	0.131^{a}	0.212^{gh}ı	0.0027^{c}	0.647^{fg}
KMF10	0.0041^{ef}	0.234^{jk}	0.083ı^{j}	0.375^{b}	0.0014^{def}	0.698^{def}
KMF11	0.0023^{hıj}	0.295^{fgh}	0.103^{c-h}	0.269^{def}	0.0052^{a}	0.675^{ef}
KMF12	0.0038^{fg}	0.334^{de}	0.105^{c-f}	0.312^{cd}	0.0028^{c}	0.759^{cd}
KMF13	0.0030^{fgh}	0.299^{fgh}	0.114^{bc}	0.307^{cd}	0.0042^{b}	0.729^{cde}
KMF14	0.0061^{c}	0.451^{b}	0.088^{h}ı^{j}	0.177^{hıj}	0.0046^{ab}	0.728^{cde}
KMF15	0.0058^{cd}	0.477^{b}	0.104^{c-g}	0.177^{ıj}	0.0031^{c}	0.768^{c}
KMF16	0.0015^{jkl}	0.235^{jk}	0.080^{j}	0.163^{ıj}	0.0017^{d}	0.482^{j}
KMF17	0.0050^{de}	0.223^{k}	0.087^{h}ı^{j}	0.287^{cde}	0.0015^{de}	0.605^{gh}
KMF18	0.0011^{kl}	0.407^{c}	0.107^{b-e}	0.420^{ab}	0.0053^{a}	0.941^{a}
KMF19	0.0008^{l}	0.540^{a}	0.084ı^{j}	0.224^{fgh}	0.0009^{d-g}	0.851^{b}
KMF20	0.0014^{jkl}	0.233^{k}	0.092^{e-j}	0.223$^{f-ı}$	0.0008^{efg}	0.551^{hi}
KMF21	0.0030^{ghı}	0.208^{k}	0.083ı^{j}	0.180^{h}ı^{j}	0.0014^{def}	0.476^{j}
KMF22	0.0013^{jkl}	0.263ı^{j}	0.088^{g-j}	0.136^{j}	0.0009^{efg}	0.491^{ij}
KMF23	0.0017^{jkl}	0.177^{l}	0.097$^{d-ı}$	0.384^{b}	0.0030^{c}	0.663^{efg}
KMF24	0.0019^{jkl}	0.355^{d}	0.090^{f-j}	0.466^{a}	0.0006^{fg}	0.915^{ab}
KMF25	0.0040^{efg}	0.311^{efg}	0.110^{bcd}	0.248^{efg}	0.0002^{g}	0.674^{ef}
$LSD_{0.05}$	**0.00105****	**0.028****	**0.161****	**0.046****	**0.0007****	**0.066****

Different letters in the same column indicate statistically significant differences at $P < 0.05$

malic acid, succinic acid and fumaric acid contents were determined in the fruits of 19 fig genotypes and the results are shown in Table 3. Statistically significant differences were found among the genotypes in terms of the organic acid concentration ($P < 0.05$). According to the organic acid results, citric acid and succinic acid were the major and dominant organic acids in the fruits of all the fig genotypes, followed by oxalic acid, malic acid and fumaric acid.

The citric acid and succinic acid contents varied between 0.177% and 0.540%, and 0.136% and 0.466%, respectively. The highest citric acid content was obtained in KMF19 and the lowest was obtained in KMF23. The highest succinic acid content was obtained in KMF24 and the lowest was obtained in KMF22. Fumaric acid was also detected and was present in very small amounts (0.0002 to 0.0046%), so it can be concluded that it does not significantly affect the fruit flavour of figs. It is well known that the organic acid content can vary between species, cultivars and harvesting conditions (Zhang et al. 2020). Several studies have identified malic, citric, oxalic, quinic, ascorbic, shikimic and fumaric acids as the organic acids analysed in fig fruits or pieces (Oliveira et al. 2009; Pande et al. 2010; Sedaghat et al. 2018; Palmeira et al. 2019) and studies showed similar results to our present data and reported that citric acid is widely present in fig fruits as the main and predominant organic acid (Melgarejo et al. 2003; Veberic et al. 2008). Our results on the citric acid content were in full agreement with those obtained by Melgarejo et al. (2003) as 0.0212%, Trad et al. (2010) between 0.23 to 0.43% and Petkova et al. (2019) as 0.19 g/kg). In contrast, Slatnar et al. (2011) found a citric acid content between 1.36 and 1.83 g/kg FW and Hssaini et al. (2021) reported a citric acid content between 0.31 to 1.00 g/kg FW) indicating different values from our study.

Volatile compounds. In this study, a total of 58 volatile compounds were determined in the fruits of 19 fig genotypes using HS/SPME/GC-MS techniques and the results are shown in Tables 4–11. In our study, 18 aldehydes, 3 ketones, 6 esters, 2 terpenes, 17 alcohols, 1 acid and 11 other compounds were detected. Previous studies reported 24 to 59 volatile compounds in fig fruits (Oliveira et al. 2010; Gözlekci et al. 2011; Mujić et al. 2012; Russo et al.

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Table 4. Total aroma compositions (relative content, %) in the fruits of the fig genotypes

Genotype	Aroma compounds						
	ketones	alcohols	aldehydes	esters	terpenes	acids	other compounds
kMF07	14.24^{a}	5.96^{l}	70.19^{b}	3.41^{e}	0.44^{o}	0.00e	5.76^{b}
KMF08	3.82^{l}	7.39^{k}	19.79^{l}	1.26^{i}	0.00^{o}	0.00^{e}	6.77^{a}
KMF09	12.18^{c}	20.83^{g}	25.63^{k}	1.78^{h}	3.40^{m}	1.22^{d}	3.82^{d}
KMF10	6.38^{h}	4.82^{m}	24.27^{k}	1.69^{h}	11.48^{ij}	0.00^{e}	6.80^{a}
KMF11	14.00^{a}	21.67^{f}	38.75^{h}	7.25^{c}	15.50^{h}	0.00^{e}	0.52^{j}
KMF12	11.33^{d}	25.62^{c}	13.62^{m}	10.85^{b}	11.71^{i}	1.88^{c}	3.20^{f}
KMF13	2.75^{m}	7.64^{k}	43.82^{fg}	2.56^{f}	41.13^{a}	0.00^{e}	0.46^{j}
KMF14	4.96^{i}	22.61^{e}	42.80^{g}	2.65^{f}	26.06^{f}	0.00^{e}	0.00^{k}
KMF15	6.77^{g}	16.68^{i}	53.81^{c}	1.78^{h}	10.43^{k}	0.00^{e}	0.00^{k}
KMF16	10.28^{e}	37.36^{a}	24.37^{k}	11.57^{a}	15.64^{h}	0.00^{e}	0.77^{i}
KMF17	4.84^{ij}	17.50^{h}	42.77^{g}	2.59^{f}	31.20^{c}	0.00^{e}	0.00^{k}
KMF18	11.35^{d}	34.27^{b}	35.05^{i}	0.31^{k}	19.03^{g}	0.00^{e}	0.00^{k}
KMF19	13.12^{b}	37.38^{a}	38.58^{h}	2.17^{g}	5.95l	0.00^{e}	2.78^{g}
KMF20	2.86^{m}	17.25^{hi}	46.65^{e}	0.00^{l}	32.19^{b}	0.00^{e}	0.00^{k}
KMF21	4.58^{jk}	4.83^{m}	71.01^{b}	0.19^{k}	10.97^{jk}	0.00^{e}	5.63^{c}
KMF22	4.35^{k}	2.11^{n}	80.46^{a}	0.57^{j}	2.55^{n}	2.94^{b}	3.62^{e}
KMF23	5.00^{i}	13.57^{j}	51.44^{d}	2.24^{g}	27.44^{e}	0.00^{e}	0.00^{k}
KMF24	9.26^{f}	14.25^{j}	45.09^{f}	0.00^{l}	26.21^{f}	3.59^{a}	0.00^{k}
KMF25	4.80^{ij}	23.81^{d}	27.51^{j}	6.12^{d}	30.34^{d}	0.00^{e}	2.28^{h}
$LSD_{0.05}$	0.28**	0.66**	1.48**	0.14**	0.66**	0.04**	0.10**

Different letters in the same column indicate statistically significant differences at $P < 0.05$

2017; Gundesli et al. 2020). According to the results obtained, aldehydes, esters and ketones were found to be the main volatiles in fig fruits (Tables 4, 5, 6 and 7). As seen in Table 4, the percentage of volatile compounds ranged from 13.62% (KMF12) to 80.46% (KMF22) for aldehydes, from 2.11% (KMF22) to 37.38% (KMF19) for alcohols, from 2.75% (KMF13) to 14.00% (KMF7) for ketones, from 0.31% (KMF18) to 11.57% (KMF16) for esters, from 0.44% (KMF7) to 0.44% (KMF7) to 41.13% (KMF12) for terpenes, 1.22% (KMF9) to 3.59% (KMF24) for acids and 0.46% (KMF13) to 6.80% (KMF10) for other compounds (Table 5-11). The aromatic profiles of figs are influenced by various factors such as genetic traits, biotic and abiotic stress factors, cultural practices, fertilisation, irrigation, planting systems, ecological conditions and the soil type (Gundesli et al. 2020; Kafkas et al. 2022). There are very few studies on the volatile fractions of figs in different fig producing countries of the world and there is a great variability on the nature and concentration of flavour compounds isolated from different cultivars (Oliveira et al. 2010a; Gozlekci et al. 2011; Li et al. 2012; Ficsor et al. 2013; Mujić et al. 2014; Russo et al. 2017; Palassarou et al. 2017; Rodríguez-Solana et al. 2018; Gundesli et al. 2020). Gozlekci et al. (2011) and Mujić et al. (2014) previously reported similar results to the present study. Among the aldehydes, benzaldehyde (KMF8; 60.12%) was the main component and had the highest proportion. Our results showed a higher proportion of aldehydes compared to studies on different fig cultivars (Gozlekci et al. 2011; Mujić et al. 2014; Gundesli et al. 2020). In this study, aldehydes are the most abundant and have higher percentages as suggested by some researchers (Gozlekci et al. 2011; Mujić et al. 2014; Zidi et al. 2021). Gamma-decalactone, 3-hydroxy-2-butanone, 6-methyl-5-hepten-2-one were detected as the ketone compounds (Table 6). The ketone content in our study showed some differences from those reported in previous studies for different fig cultivars (Gozlekci et al. 2011; Russo et al. 2017; Gundesli et al. 2020). Acetic acid, ethyl ester, phenylmethyl ester, benzoic acid, 2-hydroxy, methyl ester, benzyl acetate, butanoic acid, 2-methyl, ethyl ester, and ethyl acetate were identified as the ester compounds. Ethyl acetate (KMF12; 10.35%)

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Table 5. Aldehyde compositions (relative content, %) of the fig (*Ficus carica* L.) genotypes

R.T.	Compound name	KMF07	KMF08	KMF09	KMF10	KMF11	KMF12	KMF13	KMF14	KMF15	KMF16	KMF17	KMF18	KMF19	KMF20	KMF21	KMF22	KMF23	KMF24	KMF25
	Aldehydes																			
15.984	2 octenal	1.08			0.97	0.43		0.82		1.57						1.94	3.20	0.67		
9.535	3-methyl- 2-butenal																			
21.653	2-decena,				0.32											0.54	1.78	0.53		
17.079	2-furancarboxaldehyde	2.04	0.27														0.68		1.70	
13.058	2-heptenal				1.09	0.42		1.28	0.47	1.56	0.37	0.49				2.68	3.28	1.21		0.76
10.108	2-hexenal	2.64	0.38	0.57	2.71	4.56	1.11	3.45	8.89	2.74		0.33			0.57	1.48	0.70	0.59	1.93	1.01
7.638	2-pentenal															1.06	1.20			0.64
1.809	acetaldehyde					13.42														
18.322	benzaldehyde	60.12	15.90	22.54	5.87	4.37	11.90	7.97	26.35	10.78	13.56	4.41	5.22	30.29	11.50	1.30	2.26	4.87	20.51	9.33
25.710	2,5-dimethyl- benzaldehyde,			0.31							1.50			1.84			0.67		0.52	0.87
1.642	2-methyl- butanal,											18.51	14.23		25.57				12.46	
3.300	3-methyl- butanal		1.23		1.46	3.60														
10.886	capronaldehyde		0.19	0.26							0.61		1.35		1.57		0.99	2.62	1.22	1.87
6.496	hexanal	4.31	0.99	1.61	9.89	9.22	0.61	26.38	6.71	32.51	8.33	18.62	13.19	4.12	4.81	54.73	55.84	35.37	5.65	7.30
9.138	*n*-heptanal				0.64	0.76		0.77	0.38	1.08						1,06	1.85	0.73	0.40	0.82
14.970	nonanal		0.23	0.34	0.34	1.61				0.68		0.41	0.42			0,84	2.16	1.00	0.70	1.86
12.070	octanal					0.36		0.34					0.63			1,08	2.52	0.80		0.82
4.272	pentanal		0.60		0.98			2.81		2.89				2.33	2.63	4,3	3.33	3.05		2.23
	Total aldehydes	70.19	19.79	25.63	24.27	38.75	13.62	43.82	42.80	53.81	24.37	42.77	35.04	38.58	46.65	71.01	80.46	51.44	45.09	27.51

RT – retention time (min)

Table 6. Ketone compositions (relative content, %) of the fig (*Ficus carica* L.) genotypes

R.T.	Compound name	KMF07	KMF08	KMF09	KMF10	KMF11	KMF12	KMF13	KMF14	KMF15	KMF16	KMF17	KMF18	KMF19	KMF20	KMF21	KMF22	KMF23	KMF24	KMF25
	Ketons																			
32.692	gamma decalactone	12.89	3.09	9.63	5,85	7.47	8.70	0.94	2.56	6.15	2.56	2.04	1.45	11.60	2.45	3.88	3.09	3.94	6.24	2.67
11.932	3-hydroxy- 2-butanone	0.46	0.53	2.24		5.88	2.63	1.04	1.45		6.97	2.80	9.90					0.75		0.90
13.499	6-methyl-5-hepten-2-one	0.89	0.20	0.31	0,53	0.65		0.77	0.95	0.62	0.75			1.52	0.41	0.70	1.26	0.31	3.02	1.23
	Total ketones	14.24	3.82	12.18	6.38	14.00	11.33	2.75	4.96	6.77	10.28	4.84	11.35	13.12	2.86	4.58	4.35	5.00	9.26	4.80

RT – retention time (min)

Table 7. Esters compositions (relative content, %) of the fig (*Ficus carica* L.) genotypes

R.T.	Compounds name	KMF07	KMF08	KMF09	KMF10	KMF11	KMF12	KMF13	KMF14	KMF15	KMF16	KMF17	KMF18	KMF19	KMF20	KMF21	KMF22	KMF23	KMF24	KMF25
	Ester																			
2.968	Acetic acid, ethyl ester		0.58						2.23		11.00	2.16						1.12		2.99
23.788	Acetic acid, phenylmethyl ester			0.15	0.44		0.50					0.43								
24.912	Benzoic acid, 2-hydroxy-, methyl ester	2.94	0.43	0.27				0.28						1.13						
23.790	Benzyl acetate								0.42		0.57		0.31			0.19	0.57			0.59
5.729	Butanoic acid, 2-methyl-, ethyl ester																			2.54
2.973	Ethyl Acetate	0.47	0.25	1.36	1.25	7.25	10.35	2.28		1.78				1.04				1.12		
	Total esters	3.41	1.26	1.78	1.69	7.25	10.85	2.56	2.65	1.78	11.57	2.59	0.31	2.17	0.00	0.19	0.57	2.24	0.00	6.12

RT – retention time (min)

Table 8. Terpene compositions (relative content, %) of the fig (*Ficus carica* L.) genotypes

R.T.	Compounds name	KMF07	KMF08	KMF09	KMF10	KMF11	KMF12	KMF13	KMF14	KMF15	KMF16	KMF17	KMF18	KMF19	KMF20	KMF21	KMF22	KMF23	KMF24	KMF25
	Terpen																			
23.660	1,2-dimethoxy- benzene	0.44		1.04		3.15	0.66	0.84	7.82	2.48	2.11	6.19	5.87		1.17			0.69		
5.477	methyl- benzene,			2.36	11.48	12.35	11.05	40.29	18.24	7.95	13.53	25.01	13.16	5.95	31.02	10.97	2.55	26.75	26.21	30.34
	Total Terpenes	0.44	0.00	3.40	11.48	15.50	11.71	41.13	26.06	10.43	15.64	31.20	19.03	5.95	32.19	10.97	2.55	27.44	26.21	30.34

RT – retention time (min)

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Table 9. Alcohol compositions (relative content, %) of the fig (*Ficus carica* L.) genotypes)

R.T.	Compounds name	KMF07	KMF08	KMF09	KMF10	KMF11	KMF12	KMF13	KMF14	KMF15	KMF16	KMF17	KMF18	KMF19	KMF20	KMF21	KMF22	KMF23	KMF24	KMF25
	Alcohols																			
9.669	3-methyl- 1-butanol,	1.51		1.13	0.91	7.16	6.00		3.55	1.37		4.65	6.41	3.75					5.73	4.36
16.602	1-heptanol											0.33	0.33		0.38	0.40	0.33	0.57		
13.771	1-hexanol				0.19				0.66	0.56	1.25	0.86	0.56		0.52	0.32		1.41		
17.560	2-ethyl- 1-hexanol	0.47	0.15		0.14	0.39	0.37	0.23	0.63		0.64	0.91	0.39		1.03	0.22	0.35	0.89	1.36	0.71
16.480	1-octen-3-ol		0.10		0.44	0.37	0.34	0.57	0.37	0.92	0.42	0.52	0.34		0.40	0.86	1.06	0.81		0.64
10.875	1-pentanol				0.49	0.56		0.79	0.63	1.04		0.97		2.10	2.21	0.70		1.52		
8.477	1-penten-3-ol		0.48		0.91	1.72		1.23	1.35					1.90	0.37	1.03	0.37		0.74	1.70
6.698	2-methyl-1-propanol					1.11	0.67			1.18	2.84	1.59	1.08							
19.752	2,3-butanediol			3.70		2.35					10.62	5.05	20.58							
12.824	2-heptanol		0.12	0.36	0.34	0.44	0.74	0.37	0.71					6.19	2.96				0.65	9.35
27.102	benzene methanol		0.17	0.39	0.70	0.53	1.04	0.30	2.22	7.12	2.58	1.93	1.39	2.23	2.43	0.45		2.10	1.04	1.09
23.812	epoxylinalol		1.04			2.64	6.79	0.52					0.66							
15.138	2-butoxy- ethanol											0.30	0.29			0.22		0.46		1.64
12.890	hex-2(e)-enol			0.19	0.38				0.70	0.81				0.89	0.38					
9.699	iso amyl alcohol		0.57				6.64	2.10	0.79	1.26	16.05				0.45	0.63		4.31	1.95	
4.308	isobutyl alcohol										2.65		2.24							
19.115	linalool	3.98	4.76	15.06	0.32	4.40	3.03	1.53	11.00	2.42	0.31	0.39		20.32	6.12			1.50	2.78	4.32
	Total alcohols	5.96	7.39	20.83	4.82	21.67	25.62	7.64	22.61	16.68	37.36	17.50	34.27	37.38	17.25	4.83	2.11	13.57	14.25	23.81

RT – retention time (min)

Table 10. Acid compositions (relative content, %) of the fig (*Ficus carica* L.) genotypes

R.T.	Compounds name	KMF07	KMF08	KMF09	KMF10	KMF11	KMF12	KMF13	KMF14	KMF15	KMF16	KMF17	KMF18	KMF19	KMF20	KMF21	KMF22	KMF23	KMF24	KMF25
	acids																			
26.44	hexanoic acid			1.22			1.88										2.94		3.59	
	Total acids	0.00	0.00	1.22	0.00	0.00	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.94	0.00	3.59	0.00
	other compounds																			

RT – retention time (min)

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Table 11. The other compounds (relative content, %) of the fig (*Ficus carica* L.) genotypes

R.T.	Compounds name	KMF07	KMF08	KMF09	KMF10	KMF11	KMF12	KMF13	KMF14	KMF15	KMF16	KMF17	KMF18	KMF19	KMF20	KMF21	KMF22	KMF23	KMF24	KMF25
	Other compounds																			
1.602	2-d-2-pentadecyl-1,3-dioxolane			3.20			2.41													
37.688	4-octylbutan-4-olide	2.06		0.62			0.40	0.46									0.29			
18.820	cineole <1,4->																			1.59
17.743	furan <2-amyl->																			0.69
1.601	heptane		6.77		4.85															
7.947	1-chloro- heptane															0.34	0.43			
3.359	isocyano- methane																			
3.631	1-chloro- pentane				1.00									2.01		5.29	2.90			
21.655	phenethylamine				0.47						0.42									
29.887	phenol				0.48		0.39				0.35			0.77						
33.196	2-methoxy-4-(2-propenyl)-phenol	3.7				0.52														
	Total other compounds	5.76	6.77	3.82	6,80	0.52	3.20	0.46	0.00	0.00	0.77	0.00	0.00	2.78	0.00	5.63	3.62	0.00	0.00	2.28

RT – retention time (min)

had the highest percentage among the esters. Esters play an important role in determining the harvest time and fruit flavour. Many researchers have found that fig fruits contain esters, methyl butanoate, methyl salicylate, methyl hexanoate, hexyl acetate, ethyl butyrate, methyl acetate, methyl salicylate, and diethyl succinate (Gozlekci et al. 2011; Russo et al. 2013; Mujić et al. 2014; Barolo et al. 2014; Rodríguez-Solana et al. 2018; Gundesli et al. 2020). In another study, Kafkas et al. (2006) reported that the ester composition determined in red (37.22%) and blue (28.09%) blackberries was similar to our results. The alcohols ranged from 2.11% (KMF22) to 37.36% (KMF16) of the volatile matter. The alcohols detected included 3-methyl-1-butanol, 1-heptanol, 1-hexanol, 2-ethyl-1-hexanol, 1-octen-3-ol, 1-pentanol, 1-penten-3-ol, 2-methyl-1-propanol, 2,3-butanediol, 2-heptanol, benzenemethanol, epoxylinalol, 2-butoxy-ethanol, hex-2(E)-enol, isobutyl alcohol and linalool (Table 6). Among the alcohols, 2,3-butanediol (KMF13; 20.58%) was the most abundant. It is known that alcohols contribute to the flavour in studies on different fruits (Mujić et al. 2014). Studies have shown that alcohols are the most important contributors to the fig flavour. Some of these alcohols, particularly 1-hexanol, 1-heptanol and 1-nonanol, have been reported to contribute positively, while methyl alcohol, ethyl alcohol and isobutyl alcohol have been reported to contribute negatively (Oliveira et al. 2010a; Mawa et al. 2013; Russo et al. 2017; Rodríguez-Solana et al. 2018; Gundesli et al. 2020; Kafkas et al. 2022). Among the terpenes, methylbenzene (KMF13) (Table 8) and hexanoic acid were dominant and were found in the highest proportions (Table 10). Other compounds such as 2-D-2-pentadecyl-1,3-dioxolane (KMF9) and 1-chloropentane (KMF21) had high ratios (Table 10). Previous studies have shown that caryophyllene and limonene are the major volatile compounds for different fig cultivars (Oliveira et al. 2010a; Gozlekci et al. 2011). Furthermore, it has been previously reported that low levels of these volatiles occur naturally in many foods such as fruits (Russo et al. 2017). According to our results, similarities and some differences were observed when comparing the volatile aroma compounds in figs, which were found to be due to ecological factors, different cultivars and methods (Gozlekci et al. 2011; Mawa et al. 2013; Mujić et al. 2014; Trad et al. 2014; Russo et al. 2017; Rodriguez-Solana et al. 2018; Gundesli et al. 2020).

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CONCLUSIONS

This is the first study to compare the profile of different phytochemical and volatile compounds in fruits of 19 fig genotypes selected from the Eastern Mediterranean region of Türkiye. In the present study, the genetic differences between the genotypes are considered to be effective in determining the biochemical content of the fruits. The main volatile compounds in the fig genotypes were found to be esters and aldehydes. These compounds can be used to differentiate the fig cultivars based on aromatic criteria and to support current and future uses of these aroma compounds in clinical trials and as a modern therapy for human health and nutrition. In addition, these genotypes will be used as a source of variation in special breeding programmes for future researchers. The genotypes with the highest values of phytochemical and antioxidant properties were KMF-19 for the TPC, KMF-7 and KMF-23 for the TAC. For the aroma compounds, the most important genotypes were KMF-22 and KMF-7 and they are selected as candidates as a source of variation for breeders who want to develop new commercial varieties beneficial to more aromatic fig fruits.

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