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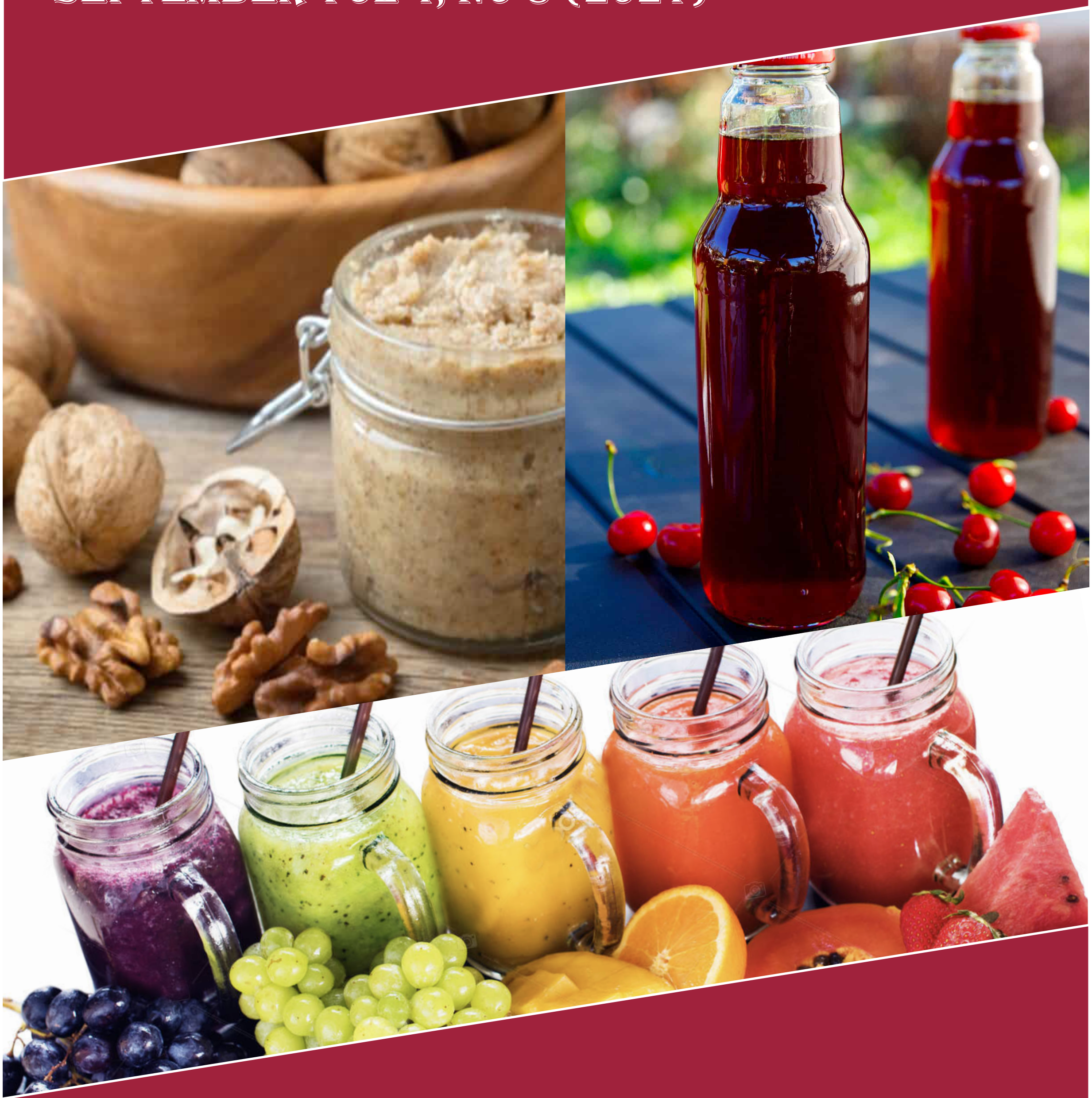

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Antioxidant Activity and Volatile Aroma Compounds of Sour Cherry (Prunus cerasus L.,) Vinegar in the Fermentation Process

Nilgün H. Budak [1]

Abstract

In the present study, sour cherry vinegar was produced from sour cherry juice produced from fresh sour cherries and sour cherry concentrate with rich bioactive component contents, strong antioxidant, antidiabetic, antiobesity, antimutagen, and anticarcinogen properties. In the vinegar production process, changes in total acidity, total soluble dry matter, antioxidant activity, and organic acid composition were examined. The present study mainly aimed to determine the effects of using fresh cherry juice or concentrated cherry juice in vinegar production. Tartaric, malic, and acetic acid organic acids were detected during the production stages of sour cherry vinegar.

In the antioxidant activity analysis by the DPPH method, it was determined that the percentile inhibition level of sour cherry vinegar was higher than those of sour cherry juice and cherry wine. No differences were observed in the component level in the analyses of fresh cherry juice and sour cherry vinegar samples produced from concentrated sour cherry. Therefore, considering that the harvest time of sour cherry is very short, it was concluded that sour cherry vinegar can be efficiently produced from concentrated sour cherry juice regardless of the harvest season.

Keywords: Cherry vinegar, antioxidant, DPPH, organic acid components, acetic acid

TÜBİTAK ULAKBİM

1 Department of Food Processing, Egirdir Vocational School, Isparta University of Applied Sciences
*Corresponding author
Nilgün H. Budak Department of Food Processing, Eğirdir Vocational School, Isparta University of Applied Sciences, 32500, Eğirdir, Isparta, Turkey.
Phone: +90 (246) 3116394 Fax: +90 (246)3116661 E-mail: nilgunbudak@isparta.edu.tr

INTRODUCTION

Sour cherry (*Prunus cerasus* L.) is a fruit belonging to the *Rosaceae* family. With its distinctive sour taste, dark red color, and flavor, it is usually consumed as fruit juice (Kirakosyan et al., 2009). The preventive effects of sour cherry, which is rich in bioactive components, on overall health, diabetes, obesity, cardiovascular and inflammatory diseases have been reported (Lara et al., 2016). Sour cherry is consumed as sour cherry juice, sour cherry juice concentrate, sour cherry jam, sour cherry marmalade, dried sour cherry, sour cherry wine. Also, sour cherry vinegar can be produced from sour cherry. Two methods are used in vinegar production as traditional (surface culture method) and industrial (deep culture method). There are two stages in the traditional method of vinegar production. The first stage is alcohol fermentation, in which the sugar content in fruits or vegetables is converted to ethanol by wine yeast (*Saccharomyces* sp.) (Garcia-Garcia et al., 2006). The second stage in which the alcohol in the environment is converted into acetic acid by the acetic acid bacteria is known as acetic acid fermentation. (Plessi, 2003; Ozturk et al., 2015). The positive effects of vinegar on health are related to the raw materials used and the fermentation conditions (Ubeda et al. 2011). Studies have shown that vinegar has anticarcinogen, antioxidant, antibacterial effects, and some other effects that positively affect cholesterol levels and strengthen the immune system. (Budak et al., 2014).

The present study aimed to produce vinegar by surface culture method using fresh sour cherry and concentrated sour cherry juice as raw materials. The changes in the chemical, antioxidant and organic acid components that make up the functional and organoleptic properties of vinegar during the fermentation process were examined.

MATERIAL AND METHODS

2.1 Materials, chemicals, and reagents

The chemicals and reagents used were obtained from Sigma-Aldrich. Rehydrated wine yeast (*Saccharomyces cerevisiae* strain, ConFermUni V yeast) was obtained from Eaton's

Begerow® Product Line Co. (Nettersheim, Germany). Cherry fruits were produced from local markets in Isparta province Eğirdir district while sour cherry concentrate was provided from Asya Meyve Suyu ve Gıda San. A. Ş.

2.2. Production of cherry juice from cherry fruit

Firstly, the stems were separated from the sour cherry fruits. The fruits were then washed and the seeds were removed. After the necessary conditions were met, the sour cherries were crushed to extract their juice and sour cherry juice (FCJ) was obtained by filtering through a multi-layered filter cloth.

2.3. Production of sour cherry juice from sour cherry concentrate

The sour cherry concentrate obtained from sour cherry fruits collected from the same region was provided. The sour cherry concentrate was diluted with distilled water (dH_2O) and was adjusted to 14 (%) DM. This sour cherry juice was coded as CJJ.

2.5. Preparation of the Inoculum

Inoculation procedure was prepared according to Özen et al. 2020.

2.6. Production of sour cherry vinegar

Production of sour cherry vinegar (FCV and CCV) was carried out according to the traditional vinegar production method reported by Özen et al. (2020). Vinegar production flow charts are given in Figure 1 and Figure 2. The samples were taken on days 0, 15, 30, 45, and 60

Proximate analyses

Total titratable acidity was measured according to AOAC (1992). Total soluble solids (TSS; °Brix) contents of the samples were determined using Abbe refractometer (Bellingham Stanley Limit 60/70 Refractometer, England).

2.8. Antioxidant activity analyses

The antioxidant activity values of the samples were determined spectrophotometrically using the stable radical 2,2-diphenyl-1-picrylhydrazil (DPPH). The free radical scavenging activity of a sample is given as the percentage of DPPH reduced by the determined amount of active ingredient. Accordingly, 3.9 mL of 80 μM DPPH (0.0032 g DPPH is completed with 100 mL methanol) solution to be completed to 4 ml by taking 10 μL from the samples completely dissolved (using ethanol, water, etc. suitable solvent) in a single concentration was taken and treated with 0.1 mL of sample. Only the final solution and the DPPH solution were kept in the dark for 30 minutes and the absorbance values were read against methanol at 517 nm. Total activity values are given as inhibition % (Bunea et al., 2011).

2.9. Organic acid analyses

Organic acids and their values in the samples were determined by HPLC (Shimadzu SCL-10A, Scientific Instruments, Inc., Tokyo, Japan). HPLC device consisted of a DAD detector (SPD-M20A), a system control unit (LC 20ADvp), a pump (LC 10ADvp), a gas separator (DGU 20A3), and a column furnace (CTO-10ASvp). Inertsil ODS-3V C18 (GL Sciences Inc.) column was used for organic acid determination (250x4.60 mm, 5 μm). The mobile phase used was the 5 mM H_2SO_4 solution. The pH of the mobile phase was adjusted to 3.0±0.05 using 4 N NaOH. The column furnace temperature was set at 30°C and the flow rate of the mobile phase was 1.0 mL/min. The samples were directly passed through a 0.45 μm polytetrafluoroethylene (PTFE) filter (Membrane Solutions) and 20 μL was injected into the system. Organic acid determination was carried out using a DAD detector at 210 nm wavelength. The results are given by calculating the graph equations obtained from the standards given at different concentrations. The sample mixture chromatogram of the standards used in the determination of organic acid is given in Figure 3.

2.10. Statistical analysis

Both vinegar productions were carried out in two parallels with three replicates. All analyses were repeated thrice. Analysis results are expressed as mean±standard deviation. Data were subjected to a one-way analysis of variance (ANOVA) using SPSS 18.0 (SPSS Inc., Chicago, IL, USA). The Duncan's test was utilized to evaluate significant differences ($P< 0.05$) between fermentation times while the Student t-test was used to evaluate significant differences ($P< 0.05$) between the samples.

RESULTS AND DISCUSSIONS

3.1 Proximate composition

In the present study, sour cherry vinegar (FCV and CCV) was produced from fresh cherry juices (FCJ) and concentrated fruit juices (CCJ). During the fermentation, titration acidity and % water-soluble dry matter values were determined. These values are given in Figures 4 and 5.

While the total acidity values were statistically different from each other at the beginning of the fermentation ($P< 0.05$) among the samples, the values on day 30 were found to be close to each other ($p>0.05$). In the acid fermentation process of the second stage of fermentation, the total acidity values of both samples increased significantly (P< 0.05). At the end of the acetic acid fermentation, no differences were observed between the total acidity values of the vinegar. The values 4.52% in the FCV sample and 4.74% in the CCV sample met the minimum 4% acidity criterion specified in TSE. The values obtained in the present study were similar to those obtained by Budak et al (2017) and Aykin et al. (2015) in apple and pomegranate vinegar.

Total soluble dry matter values of the samples decreased significantly in the first 15 days of fermentation (P< 0.05). No differences were observed between days 30, 60, and 90. The sugar content in the cherry juice decreased on day 15 due to the activity of the yeasts.

3.2. Antioxidant analysis by the stable radical 2,2-diphenyl-1-picrylhydrazil (DPPH) method

Antioxidant activity determination according to the DPPH method was determined in terms of inhibition %. In the antioxidant analysis carried out according to the days, the production from the cherry yielded the inhibition values 31.89, 35.95, 37.32, 82.36, and 80.85 %, respectively while the inhibition values in production using concentrated sour cherries were; 52.08, 46.75, 47.29, 83.83, 80.51 %, respectively. In the samples on days 45 and 60, DPPH analysis results were significantly higher than those of the other days (p<0.05). The DPPH results are given in Figure 6. Casedas et al. (2016) determined that the DPPH % inhibition value in cherry juice was 54. In the present study, the inhibition % value of sour cherry juice was determined in the range of 31.89-52.08.

3.3. Organic acid analyses

Tartaric acid, malic acid, and acetic acid were prominent in the samples at the production stages of sour cherry vinegar from sour cherry juice and concentrated sour cherry juice. Table 1 shows the data related to the organic acid contents in the samples determined by days.

The malic acid in sour cherry juice was determined to be 12361.04 and 13481.9 mg/L in the FCJ-0 day and CCJ-0 day samples, respectively. In the FCJ-15 day and CCJ-15 day samples, the malic acid value was found to be the highest in all fermentation stages with 15776.48 and 13710.71 mg/L, respectively. Malic acid values in the FCV-60 day and CCV-60 day samples were determined to be 2648.99 and 1089.92 mg/L, respectively. The malic acid levels on days 45 and 60 were significantly different from those of the other samples. The dominant organic acid in sour cherry juice was malic acid, while the dominant organic acid in vinegar was acetic acid. Acetic acid values in FCV-60 day and CCV-60 day vinegar samples were determined to be 2663.09 and 2978.71 mg/L, respectively. The acetic acid level in the samples on days 45 and 60 following the onset of acetic acid fermentation was found to be significantly different from those of the fruit juice and wine samples.

Çevik (2013) found malic acid in the range of 5.64-40.4 mg/L in the organic acid analysis they performed in 11 different sour cherry juices. The results obtained in the present study were determined to be 12361.04 and 13481.9 mg/L in production from sour cherry and in production from concentrated sour cherry juice, respectively.

Budak et al. (2010), in the production of grape vinegar using different production techniques, have reported the concentration of acetic acid in the range of 143.6 -82.81 g/L.

The tartaric acid value was determined in the range of 3795.37- 4951.58 mg/L in the samples taken during the fermentation stage obtained from sour cherry juice and the tartaric acid value was determined in the range of 2257.58- 4378.46 mg/L in the samples taken during the fermentation stages obtained from the concentrated cherry juice.

Lower levels of lactic acid were detected than the other organic acids determined in the samples. In the cherry juice samples, the lowest lactic acid value was 12.29 mg/L in the FCJ-0 day sample, while the highest was 29.69 mg/L in the FCW-30 day sample.

Examining the organic acid contents of vinegar produced from apple and wine collected from the markets of different countries, wine vinegar was found to be rich in terms of tartaric acid with 1.53 g/L, and apple cider vinegar was determined to be rich in terms of malic (0.94 g/L) and lactic acid (0.72 g/L). was determined (Gerbi et al., 1998). In the present study, the tartaric acid level was determined in the range of 3795.37- 4951.58 mg/L in the samples taken during the fermentation stage obtained from sour cherry juice, while the tartaric acid level was determined in the range of 2257.58- 4378.46 mg/L in the samples taken during the fermentation stages obtained from concentrated sour cherry juice.

CONCLUSIONS

Sour cherry is one of the important fruits that have beneficial health effects due to its organic acid components and antioxidant properties. In the present study, it has been predicted that, due to its different taste and aroma, sour cherry vinegar will appeal to consumers who are searching for alternatives.

Cherry vinegar gains attention due to its tartaric, malic, and acetic acid content in the production stages. The dominant organic acid in sour cherry juice was malic acid whereas the dominant organic acid in vinegar was determined to be acetic acid. In the antioxidant activity analysis by the DPPH method, it was determined that the inhibition level of sour cherry vinegar in % was higher than sour cherry juice and cherry wine. No differences were observed in the analyses of the sour cherry vinegar samples made from two different raw materials. Therefore, considering that the harvest time of sour cherry is very short, it was determined that sour cherry vinegar can be produced from concentrated sour cherry juice regardless of the harvest season. The results of this research will provide valuable information for producers who want to produce sour cherry vinegar on an industrial scale throughout the year and contribute to the economy.

Acknowledgement

I would like to thank Tuğba Kök Taş and Bilge Ertekin Filiz for their support of this research.

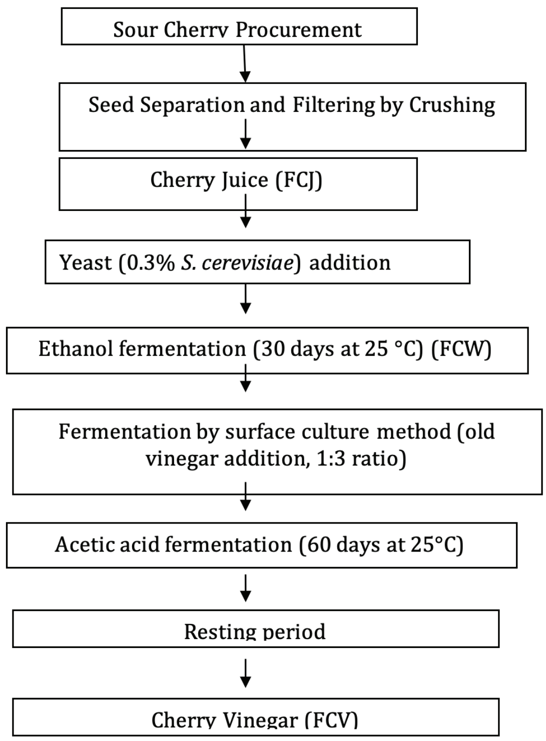

Figure 1. Vinegar production flow chart from cherry fruit

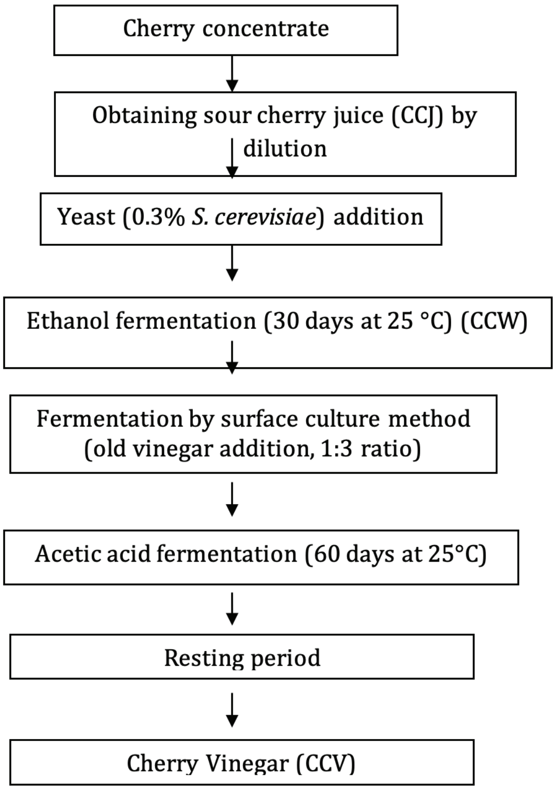

Figure 2. Flow chart of vinegar production from sour cherry concentrate

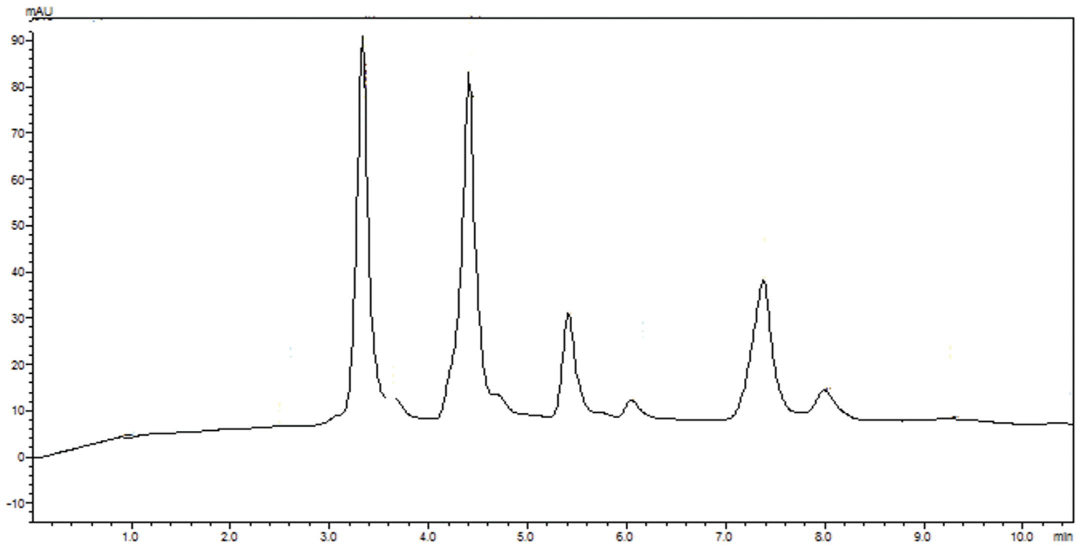

Figure 3. Sample mix chromatogram of organic acid standards

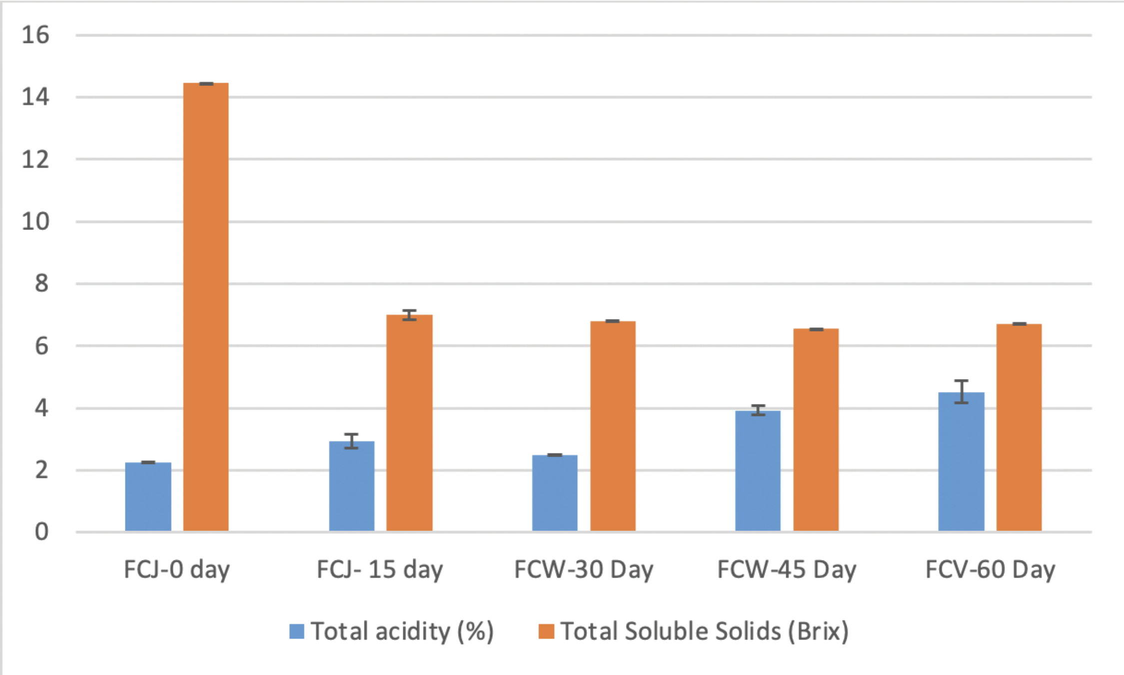

Figure 4. Juice (FCJ), wine (FCW) and vinegar (FCV) produced using fresh sour cherry juice

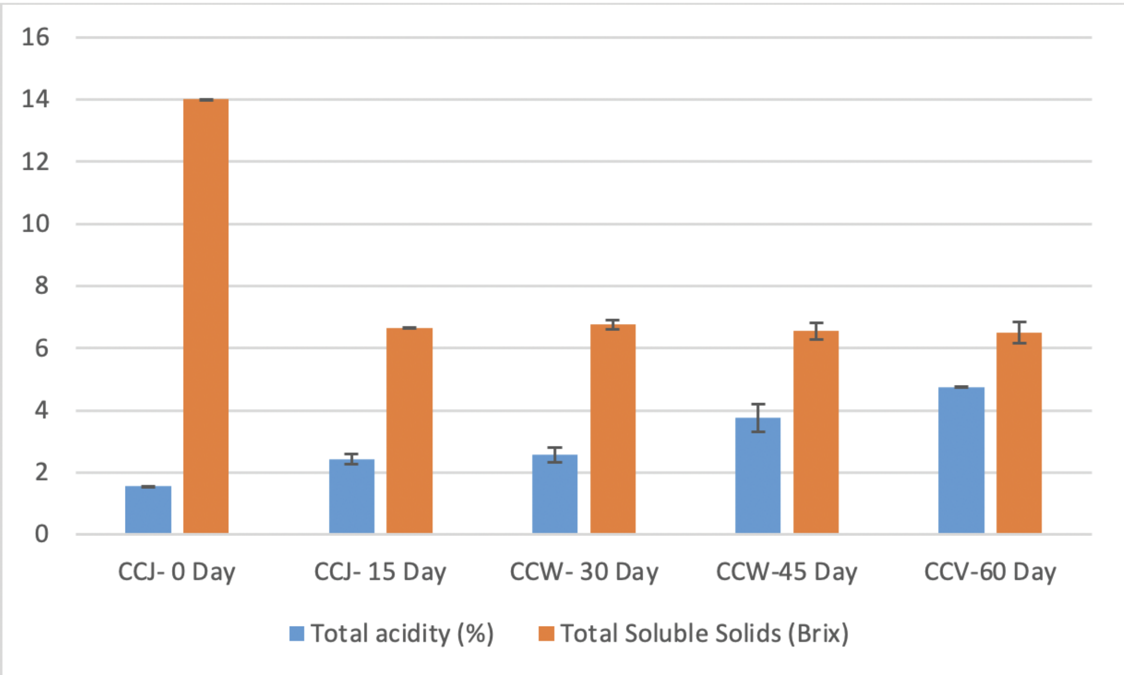

Figure 5. Juice (CCJ), wine (CCW) and vinegar (CCV) produced using concentrated sour sherry

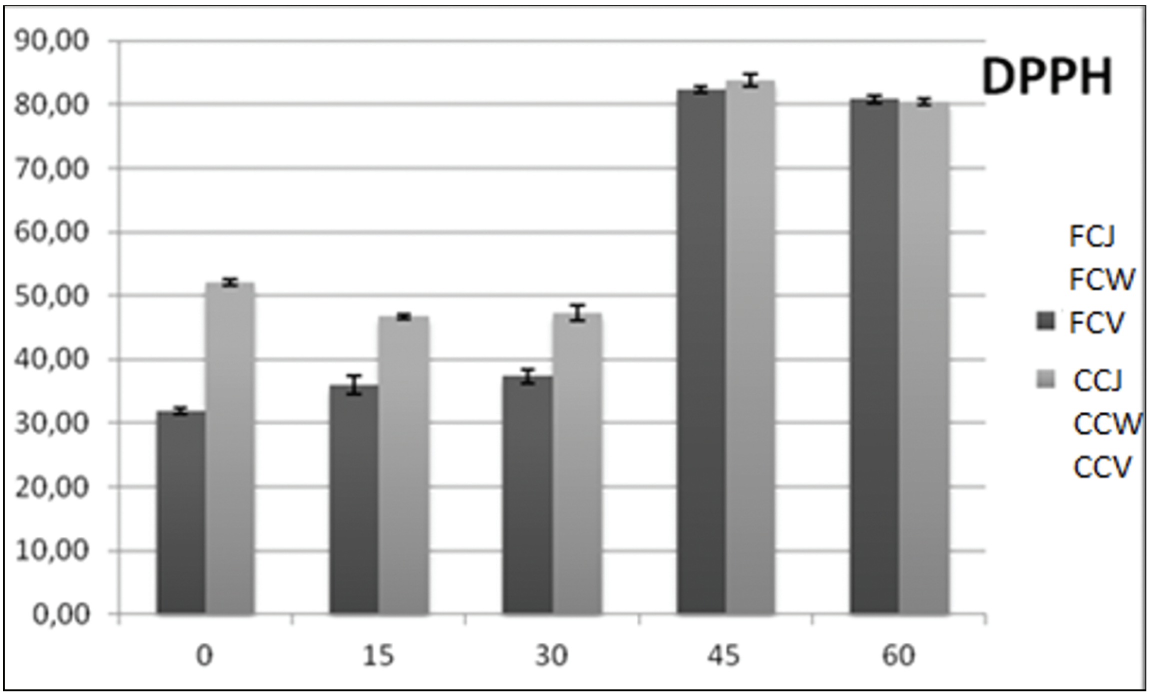

Figure 6. DPPH results of vinegar samples produced from our cherry and concentrated sour cherry

Table1. Organic acid results in vinegar samples

Samples	Fermentation days	Tartaric acid (mg/L)	Malic acit	Lactic acid (mg/L)	Acetic acid (mg/L)
FCJ	0	4951.58±122.47^{a}	12361.04±311.27^{a}	12.29±0.99 ^{a}	339.01±11.16^{a}
	15	4741.20±109.69 ^{a}	15776.48±571.20^{a}	27.07±0.50^{c}	335.63±10.16^{a}
FCW	30	3795.37±117.59 ^{a}	13655.7±535.37 ^{a}	29.69±0.90^{c}	262.23±58.08^{a}
	45.	4457.17±177.15 ^{a}	8114.55±530.50^{c}	20.99±1.52^{b}	3233.80±107.04^{b}
FCV	60	4585.77±199.92 ^{a}	2648.99±554.51^{b}	24.64±2.87^{b}	2663.09±128.29^{b}
CCJ	0	4378.46±104.05 ^{b}	13481.9±1450.31^{c}	30.74±0.93^{a}	389.12±51.81^{a}
	15	3413.21±158.45 ^{ab}	13710.71±476.81^{c}	66.31±1.96^{b}	175.46±21.43^{a}
CCW	30	2257.58±177.31 ^{a}	9766.21±309.03^{b}	41.34±0.21^{ab}	124.64±30.54^{a}
	45	3972.58±103.89 ^{ab}	2063.87±192.74^{a}	43.60±0.56^{ab}	2694.09±114.03^{b}
CCV	60	3690.49±124.52 ^{ab}	1089.92±90.74^{a}	23.66±1.46^{a}	2978.71±110.44^{b}

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A Taste Cracking the Palate-Burdur Walnut Paste

Seval Sevgi KIRDAR [1]

Abstract

Turkey is a country with a high geographical indication potential depending on the conditions provided by its geographical location characteristics. According to the Turkish Patent Institute data in 2021, geographical indications were obtained on 945 products, and 744 applications are going through the announcement process. As of 2021, "Antep Baklava/Gaziantep Baklava", "Aydin Fig", "Malatya Apricot", "Aydin Chestnut", "Taşköprü Garlic", "Milas Olive Oil" and "Bayramiç White" were registered in the EU's geographical indication list. However, we have only seven internationally approved products.

The Chamber of Industry and Commerce received the "Burdur Walnut Paste" Geographical Indication registration certificate as a geographical indication in 2009. This study will give information about Burdur walnut paste.

Keywords: Geographical indication, Burdur Walnut Paste, Production procedure, Nutritional value

TÜBİTAK ULAKBİM

1 Burdur Mehmet Akif Ersoy University, Burdur Food Agriculture and Livestock Vocational School, Food Processing Department, Burdur, Turkey

1. Introduction

The cultural heritage of societies is their most valuable treasure. The traditional diversity in food and agricultural products is part of this treasure. Global competition and commercial concerns necessitate the protection of traditional food and agricultural products and necessitate taking measures on sustainability. In this process, it is possible to reveal the advantages of geographically indicated products as a development tool at every stage of the economic value chain and to benefit from it at the micro and macro level (Artık, 2021).

A geographical indication is a distinctive feature, reputation or It is a sign indicating a product that is identified with the region, area, region or country of origin in terms of other characteristics. In geographical indication registration, the quality that the region-specific features bring to the product and the subjectivity that enables it to be distinguished from similar products are the most basic objectives. With this registration method, it is possible to protect the products in question. Protection of products with geographical indication; It provides advantages such as increasing marketing opportunities, protecting the producer and contributing to economic gain and rural development (Ayber, 2005, Tekelioğlu, 2021a,b).

According to the data of the Turkish Patent Institute in 2021, geographical indications were obtained on 945 products and 744 applications are going through the announcement process. As of 2021, "Antep Baklava/Gaziantep Baklava", "Aydin Fig", "Malatya Apricot", "Aydin Chestnut", "Taşköprü Garlic", "Milas Olive Oil" and "Bayramiç White" were registered in the EU's geographical indication list. However, we have only seven internationally approved products.

2. Burdur Walnut Paste

Burdur is a region suitable for alternative tourism activities such as camping and caravan tourism, angling, windsurfing, bird watching, and cultural tourism with its museums and ruins. The province of Burdur contains traces and assets of different cultures from the Neolithic Age to the present day. Moreover, Burdur is the spiritual capital of the "Teke Region," the historical name of the Western Mediterranean Region.The local product of Burdur, which is known and loved throughout the country, is walnut paste. Walnut paste, a new product in the confectionery and dessert industry, can become a national brand. Burdur walnut paste, which is taken abroad by our expatriate citizens because mercenary training was held in this city for a long time, has also had the opportunity to export to the regions where they live densely (Kırdar 2021).

Seeing the potential of walnut paste to open up to national markets, the Chamber of Industry and Commerce received the "Burdur Walnut Paste" Geographical Indication registration certificate as a geographical indication on 06/02/2009 (Registration No.117) (Figure 1). There are nine geographical indication registered products in Burdur Province. It is seen that the majority of the institutions that have registered geographical indications in the Burdur region are composed of Municipalities and Chambers of Commerce and Industry. (Table 1).

Among the Burdur walnut paste producers, some produce as the 4th generation, those who start production at home and then open a shop, and those who create this business later gain great acclaim. Walnut paste in Burdur is made through 18 micro-enterprises in the SME classification, which sell what they produce themselves.

Burdur walnut paste is a very healthy food because no other oil is mixed except the original oils of walnuts and semolina and because of the cholesterol-preventing feature of walnuts. This food, formed by adding and mixing walnuts and semolina into boiling syrup, is a light and healthy food item since it is not boiled, roasted, tempered, or otherwise processed. With this production method, since the natural and chemical structures of walnuts (Table 2) and semolina (Table 3) do not deteriorate, the contribution and benefits of these substances to the body are preserved (Anonim, 2021c, Kırdar 2021).

2.1. Distinctive Feature

The distinctive feature of Burdur walnut paste is its unique formula structure, production method, and its unique structure that differs from other similar desserts and foods. Another feature is that it is produced from walnuts with a unique taste and aroma grown in the Lakes Region and Burdur region and from semolina obtained from hard wheat produced in the same area. Walnut is made in Burdur, and its region has a humidity rate of 6.3%. This ratio, which is lower than other walnut types, means minor foreign matter. In this case, the taste of walnuts is fuller. This is the ratio required for the full flavor of walnut paste.

2.2. Production Method

2.2.1. Preparation of the Mixture

Walnuts are broken and separated from their shells and diaphragms. Dry and blackened walnuts and stale and bitter walnuts are not used. Otherwise, the taste and flavor of the walnut paste will deteriorate, and its color will appear black and brown. Fine semolina obtained from flour factories in the Burdur region is used as semolina. The semolina must be fresh, moisture-free, and dry. On the other hand, sugar is preferred to be produced from beet in the Burdur region. The most important factor here is the necessity of using natural sugar. Natural or synthetic sweeteners such as glucose, lactose, or other sweeteners are never used. It is recommended that the water used to dissolve sugar and wax should be spring water with low lime content (Kırdar 2021).

2.2.2. Production of Walnut Paste

The original formula, which was produced when it first appeared, is the main element that creates the reputation and taste of the walnut paste. For this reason, keeping the original formula intact and producing it according to its original form is essential for maintaining the traditional taste and preserving its cultural values. According to the procedure transferred from the old confectioner masters, it consists of 1 measure of sugar (1000g)-1 measure of semolina (800 g)-1 measure (600g) of walnuts. The same measuring cup should be used for the materials. The tolerance in the measure or gram weight of the materials used in crushing cannot exceed ±5%. In addition, other than the ingredients in the original formula and water, no materials or additives such as flour, starch, bread flour, biscuit powder, and peanuts are added to the Burdur walnut paste and are never added (Anonim, 2016a, Kırdar 2021).

From the materials prepared by the properties and dimensions described, sugar is preferably put in a tinned copper deep cauldron/pot, and ¼ of the sugar is added to the boil to make sherbet (Figure.1). On the other hand, walnuts are pounded in a mortar and thoroughly crushed. It is also recommended to grind half of the walnuts very finely and leave the other half large enough to reach the tooth. In the walnut paste produced in this way, the walnut flavor will be more dominant as the walnuts left large will be felt more in the mouth during eating. Walnuts can be prepared both ways; the important thing is to add the specified amount of walnuts. The walnuts should be plump, white, and oily. The less semolina is added, the better the quality and longevity of the walnut paste (Anonim, 2021a, Kırdar 2021).

The walnuts and semolina, which are pounded in a separate bowl, are mixed and blended well, so that some of the natural oil of the walnut is absorbed by the semolina. The mixture of semolina and walnuts is added to the syrup, which is boiling and has a consistency, and it is mixed quickly and the pot is removed from the stove, the lid is closed and left to rest. The tray on which Burdur walnut paste will be poured should preferably have four corners and a maximum height of 2.5 cm (Fig.2). Preparations are completed by sprinkling powdered sugar of equal thickness under this tray. The mixture, which is rested in the pot for 5-6 minutes, ensures that the sugar bonds with the semolina and walnuts. This mixture, mixed again by opening the lid, is poured into the prepared tray and compressed by spreading evenly and smooth with a rolling pin or roller. Finally, powdered sugar is poured evenly over the paste that has started to cool. The best time to cut and slice the paste is when it is warm. If the paste cools completely, it cannot be cut and crumbled. The original cutting method of walnut paste is lozenge cut, the paste in the tray is cut into 1.7 cm transverse strips, and the cutting process is completed . For the paste to be sliced (Fig.2) and ripened, it is recommended to put it on the market one day after it is produced. Produced with its authentic structure and original formula, Burdur walnut paste can preserve its flavor for up to 3 months when stored in a dry environment and packed without air (Anonim, 2021a, Kırdar, 2021).

3. Nutritional Value

Due to the phosphorus and calcium it contains, walnuts relieve mental fatigue, strengthen bones and teeth, and are rich in potassium. Potassium is necessary for the stimulation of nerves and the functioning of muscle tissue. Since it contains magnesium, it contributes to muscle-relaxing red blood cells. In addition, it is a very rich nutrient in terms of iron, which helps transport oxygen from the lungs to the tissues and prevents anemia. Since walnut, which is recommended to be eaten in specific amounts every day, is found in its natural state in Burdur walnut paste, eating this dessert during the day will ensure that the body needs walnuts. In addition, the semolina and sugar in the walnut paste will keep the body vigorous and fit as it will meet a significant part of the carbohydrates and energy that the body will need during the day. Due to these properties, Burdur walnut paste is a healthy and balanced food item (Anonim, 2021c, Kırdar, 2021).

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CONCLUSION

Burdur walnut paste is unique to Burdur as defined in the registration certificate. It is estimated that while it was made only in Burdur before, it was produced in the wide area of Antalya-Isparta-Burdur by the people of Burdur, who settled in this region from Burdur over time, following the conditions written in the registration certificate and using walnut and semolina, which are the products of origin. Commercial enterprises that produce Burdur walnut paste will be able to make and sell by following the production rules and recipes and inspection conditions specified in the annex of the geographical indication registration certificate and obtaining authorization from the institutions authorized by the relevant commission in the inspection department.

Commercial enterprises that produce Burdur walnut paste will be able to make and sell by following the production rules and recipes and inspection conditions specified in the annex of the geographical indication registration certificate and by obtaining authorization from the institutions authorized by the relevant commission in the inspection department.

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Figure 1 Burdur Walnuts paste

Figure 2. Burdur Walnuts paste production

Table.1. Registered products of Burdur province

Name of Geographical Indication	Registration date	Type	Product group	Applicant/Registrar
Burdur Walnut Paste	13.10.2009	Geographical Indication	Chocolate, confectionery and derivative products	Burdur Chamber of Commerce and Industry
Burdur Shish Meatballs	20.3.2012	Geographical Indication	Meals and soups	Burdur Chamber of Commerce and Industry
Melli Fig	30.7.2018	Protected Desination of origin	Processed and unprocessed fruits and vegetables and mushrooms	Bucak Municipality
Karaman Walnut	28.8.2020	Protected Desination of origin	Processed and unprocessed fruits and vegetables and mushrooms	Karamanli Municipality
Coriander from Karaman	28.9.2020	Protected Desination of origin	Processed and unprocessed fruits and vegetables and mushrooms	Karamanli Municipality
Dirmil Sips	30.10.2020	Geographical Indication	Other products	Altınyayla District Governorate
Karaman Fennel	4.1.2021	Protected Desination of origin	Processed and unprocessed fruits and vegetables and mushrooms	Karamanli Municipality
Bucak sahlep	10.8.2021	Geographical Indication	Soft drinks	Bucak Chamber of Commerce and Industry
Tefenni Fennel	6.9.2021	Protected Desination of origin	Processed and unprocessed fruits and vegetables and mushrooms	Burdur Tefenni District Governorate
Golhisar Roast		Geographical Indication	Processed Unprocessed Meat Products	Golhisar Municipality
Bucak Black Cumin		Protected Desination of origin	Condiments/flavors, sauces and salt for food	Bucak Chamber of Agriculture
Bucak Black Cumin Oil		Protected Desination of origin	Condiments/flavors, sauces and salt for food	Bucak Chamber of Agriculture
Burdur Poppy Halva		Geographical Indication	Chocolate, confectionery and derivative products	Burdur Poppy Halva
Yassıgüme grape		Geographical Indication	Processed and unprocessed fruits and vegetables and mushrooms	Burdur Province Central District Village Service Union
Ibecik Cloth		Protected Desination of origin	Weavings	Golhisar Municipality

Table.2. Nutritional Value of 100g Walnuts

General Components (%)		Mineral substances (mg)		Vitamins (mg)	
Protein	20.5	Calcium	99	Vitamin A(IU)	30
Fat	70.80	Phosphorus	380	Thiamine	33
Carbohydrate	6.9	Iron	3.1	Riboflavin	13
Ash	1.8	Sodium	2	Niacin	9
Calorie	700	Potassium	450	Ascorbic acid	2
Water	3.5	Magnesium	131	Energy (cal)	700

Table.3. Average Energy and Nutritional Value of 100g Semolina

Energy (kcal)	354
Protein (%)	10.5
Carbohydrate (%)	75

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Proceeding Article

Determination of Some Physical and Chemical Properties of Crimson Seedless Grape Variety Soils in Vineyards of Alaşehir for Growing Quality Grape

ATEŞ, Fadime[1]* KUŞTUTAN, Fulya[1]

Abstract

This study was conducted in 2015 aimed to determine some physical and chemical properties of Crimson Seedless grape variety grown soils in vineyards of Alaşehir district, which is the largest grape producing vineyard area of Manisa Province in Turkey. According to the results of vineyard soil samples analyses; 80% loamy and 20% soil samples had clay–loamy textures; 20% soil samples were found with strong alkaline, the 60% having slight alkalineand 20% Mild acid, 100% were salt–free. These soil samples are placed into low class category in terms of total organic matter due to its 80% low and 20% calcareous level. Soil samples contain 60% medium, 20% high and 20% very high level of P; 20% very low, 30% low and 50% medium level of K; Soil samples having 20% low, 40% medium and 40% high Mg level; also containing 40% very low, 20% low and 40% medium level of Ca; Soil samples possessing 40% low and 60% critical level of Zn; also having 60% critical and 40% adequate Fe; Nitrogen contents were found low while Cu and Mn contents in sufficient amount in case of all soil samples. In addition to this, the presence of significant bilateral relations relating to some physical and chemical properties of vineyard soils were also determined.

Keywords: Vitis vinifera L., Crimson Seedless grape variety, Physical and chemical properties of soil, Nutrient, Alaşehir/Manisa.

TÜBİTAK ULAKBİM

1Manisa Viticulture Research Institute, Republic of Türkiye Ministry of Agriculture and Forestry, 45125 Manisa, Türkiye
*corresponding author: fadimeates2@yahoo.com

Introduction

Grape; diversity of assessment forms, domestic market consumption and share of exports have important place in the agriculture of Turkey. For this reason, it is a valuable product that constitutes a large farmer's field of work and a direct source of income. Turkey situated on the most favorable belt for grape production in the view point of climate and soil condition in the world, has a potential for rich genetic resources with a very old and rooted viticulture culture due to its geographical location where the gene centers of the temple are intersected and cultivated for the first time (Çelik, 2011).

Turkey is a major producer of grapes in the world and viticulture is one of the major branches of agriculture with respect to production area and its large share of income in Turkish national economy. Grapevine is grown in almost all parts of Turkey and has been produced commercially in many regions of the country for many years.

Turkey is among the largest grapevine growing countries of the world with approximately 468.792 hectares of vineyard area and 4.01 million tons of grape production (5th in area; 6th in production). Grape production are mainly consumed. For table grapes (52.8%), raisins (36.4%) and must-wine (10.8%) in Turkey (Anonymous, 2015 a).

The Aegean Region (especially Manisa and its environs) compared to other regions is in the first place, accounting for 28% of total vineyard area and 45% of production. According to the statistical data obtained; In Alaşehir, 19.860 hectares grape are grown and 492.121 tons of fresh grapes are produced (Anonymous, 2015 b).

Mineral nutrients are divided into two types: macronutrients and micronutrients. Macronutrients are further divided into primary and secondary. Primary nutrients are used in large quantities by plants and they include nitrogen, phosphorus and potassium. Secondary nutrients include calcium, magnesium and sulfur. Micronutrients are needed in very small amounts and they include boron, copper, iron, manganese and zinc (Harry and Brady, 1969).

Soil analysis has been routinely used to assess soil conditions for plant growth and the need for supplemental fertilizers (Havlin et al., 2005). Chemical soil analysis indicates the potential availability of some nutrients that roots may take up under conditions favourable for plant growth (Römheld, 2012). Soil analysis can also be informative concerning possible toxicities of salt and boron. Soil pH can also be useful in predicting mineral nutritional problems. In spite of the importance of soil analysis in the fertilizer recommendation programmes for annual crops, it has lostfavour over the years for perennial deep-rooted crops, such as fruit trees and vines, because of the difficulty in defining with sufficient accuracy the root zones from which deep-rooting plants take up most of their nutrients (Winkler et al., 1974; Römheld, 2012)

The objective of this study was to determine some physical and chemical properties of Crimson Seedless grape variety grown soils in vineyards of Alaşehir district, which is the largest grape producing vineyard area of Manisa Province in Turkey.

Material and methods

Materials

Experimental site

Experiments were conducted in 2015 in Alaşehir district of Manisa in West Turkey (38°20′N, 28°38′W). Alaşehir district is the largest grape producing vineyard area of Manisa Province. The area has a transition towards a continental climate from a Mediterranean climate. The annual average temperature of 16.7 ^{0}C and a mean annual rainfall of 598 mm, The summer months, including the harvest period, are quite hot with mean temperatures of 30 ^{0}C.

Crimson Seedless grape variety

'Crimson Seedless' is a late-ripening, red seedless table grape developed by the U.S. Dept. of Agriculture Horticultural Crops Research Laboratory at Fresno, Calif. (Ramming et al., 1995). 'Crimson Seedless' is currently the latest ripening seedless table grape grown in California, extending the availability of fresh fruit into the late fall. The cultivar has firm, crunchy berries and excellent flavor. However, inadequate color development and small berry size can detract from its quality (Dokoozlian et al., 1995).

Methods

The soil samples taken from total of 20 vineyars representing in Alaşehir district of Manisa where Crimson Seedless grape variety growing areas at fruit setting period at depths of 0-60 cm and brought to the laboratory. The texture of the soil was determined according to Bouyoucos (1955); pH values were determined in 1:2.5 soil:water dilution according to Jackson (1967); soil salinity (%) were determined as electrical conductivity (EC) of a 1:5 soil:distilled water suspension set have been different places of according to Richards (1954); Organic matter was determined using a wet oxidation technique (Nelson and Sommer, 1982); The amount of lime (CaCO3) was determined according to Çağlar (1958); Total nitrogen (N), was determined by the Kjeldahl method (Kacar, 1995); Available phosphorus (P) was determined according to Olsen et al., (1954); Available calcium (Ca), magnesium (Mg) and potassium (P) were determined by extraction with 1 N ammonium acetate according to Bayraklı (1987); Available iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) by extraction with 0.05 DTPA-TEA, according to Lindsay and Norvell (1978).

Some physical and chemical properties of soils assessed by Pearson correlation coefficient and relations with each other are examined.

Results and discussion

Soil Analysis Results

The minimum, maximum and average values of soil samples analyzed soils of Crimson Seedless grape variety are given in Table 1 collectively.

Table 1. Analysis results of some physical and chemical properties of soils of Crimson Seedless grape variety

The lime content of soil samples varied between 35.42-53.79 %. The trial soils were classed to 80% loamy and 20% soil samples had clay–loamy textures. The trial areas often had loamy textures (Table 1).

As can be seen from Table 1, soil sample pH values seem to show differences between 5,86 - 8,56. The trial soils were classed to %20 strong alkaline (8.50-9.00), 60% light alkaline class (7.0-7.9) and 20% mild acid (5.60-60) according to Jackson (1967) and Kacar (1995). The optimal pH values for vineyards vary between 5.50-8.50, according to Çelik (2011). The soil pH was the limiting factor for viticulture (Table 1).

The soil salinity of the samples varied between 0.02-0.14%. According to Soil Survey Staff (1951), the trial soil samples were found that they were at saltless level (0.00-0.15 %). The salt values of the vineyard soils were not a limiting factor (Table 1).

In Table 1, the lime content of the samples varied between 0.81-10.62 %. The trial soils were classed to 80% low lime level (0.00-2.50%) and 20% above the critical value (10.00-20.00%). According to Evliya (1964), the soil samples were sufficient in lime (2.50-5.00%).

The soil organic matter of the samples varied between 0.80%-1.00%. Organic materials of all trial soil were determined to be in the low (<2.00%) class to according to Rauterberg and Kremkus (1951), According to Özbek (1975), the importance of organic material for grapes is much more than for other nutrient materials (Table 1).

The total nitrogen content in the trial soil varied between 0.04-0.05%. All the samples were found to be low nitrogen level which was determined by Anonymous (1990) to be 0.045 % (Table 1).

As can be seen from Table 1, the phosphorus content of the samples varied between 6.66-89.71 ppm. The trial soils phosphorus were classed to 60% adequate level (7.00-20.00 ppm), 20% above the critical value (20.00 ppm<) and 20% very high level (>20.00 ppm)to according to Olsen et al. (1965).

In Table 1, the potassium content of the samples varied between 0.04-30.51 ppm. The trial soils potassium were classed to 20% very low level (100.00-200.00 ppm), 30% low level and 50% adequate value (200.00-250 ppm) to according to Kacar (1995).

As can be seen from Table 1, the calcium content of the samples varied between 236.10-2008.00 ppm. The trial calcium of the trial soils were

Looking at the correlations among nutrient element contents of the soil characteristics of the soil in 0-60 cm depth, the correlation was significant and positive between saturation percentage (SP) and salt at the 5% significance level (0.487); significant and negative between SP and lime content at the 5% significance level (-0.457); significant and positive between SP and organic matter at the 1% significance level (0.526); significant and positive between SP and nitrogen at the 1% significance level (0.526); significant and negative between SP and phosphorus at the 1% significance level (-0.563); significant and positive between SP and potassium at the 1% significance level (0.871); significant and positive between SP and magnesium at the 1% significance level (0.500); significant and positive between SP and calcium at the 5% significance level (0.470); significant and positive between pH and magnesium at the 1% significance level (0.833); significant and positive between pH and calcium at the 1% significance level (0.699); significant and negative between pH and iron at the 1% significance level (-0.941); significant and positive between pH and copper at the 5% significance level (0.407); significant and negative between pH and manganese at the 1% significance level (-0.944); significant and positive between salt and potassium at the 1% significance level (0.675); significant and negative between salt and zinc at the 1% significance level (-0.525); significant and positive between salt and iron at the 1% significance level (0.631); significant and positive between salt and manganese at the 1% significance level (0.572); significant and negative between lime and organic matter at the 1% significance level (-0.993); significant and negative between lime and nitrogen at the 1% significance level (-0.993); significant and positive between lime and phosphorus at the 1% significance level (0.987); significant and negative between lime and potassium at the 1% significance level (-0.524); significant and positive between organic matter and nitrogen at the 1% significance level (1.000); significant and negative between organic matter and phosphorus at the 1% significance level (-0.998); significant and positive between organic matter and potassium at the 1% significance level (0.618); significant and positive between organic matter and calcium at the 5% significance level (0.405); significant and negative between nitrogen and phosphorus at the 1% significance level (-0.998); significant and positive between nitrogen and potassium at the 1% significance level (0.618); significant and positive between nitrogen and calcium at the 5% significance level (0.405); significant and negative between phosphorus and potassium at the 1% significance level (-0.651); significant and positive between potassium and magnesium at the 1% significance level (0.699); significant and positive between potassium and calcium at the 1% significance level (0.743); significant and negative between potassium and zinc at the 5% significance level (-0.448); significant and positive between magnesium and calcium at the 1% significance level (0.974);

significant and negative between magnesium and zinc at the 1% significance level (-0.535); significant and negative between magnesium and iron at the 1% significance level (-0.637); significant and positive between magnesium and copper at the 5% significance level (0.564); significant and negative between magnesium and manganese at the 1% significance level (-0.608); significant and negative between calcium and zinc at the 1% significance level (-0.627); significant and negative between calcium and iron at the 5% significance level (-0.487); significant and positive between calcium and copper at the 1% significance level (0.632); significant and negative between calcium and manganese at the 5% significance level (-0.427); significant and negative between zinc and copper at the 1% significance level (-0.551); and significant and positive between iron and manganese at the 1% significance level (0.962).

Conclusions

According to the results of soil samples analyses of Crimson Seedless grape variety vineyards; 80% loamy and 20% soil samples had clay–loamy structure; 20% soil samples were found with strong alkaline, the 60% having slight alkalineand 20% Mild acid, 100% salt–free.

These soil samples are placed into low class category in terms of total organic matter due to its 80% low and 20% calcareous level. Soil samples contain 60% medium, 20% high and 20% very high level of P; 20% very low, 30% low and 50% medium level of K. Soil samples having 20% low, 40% medium and 40% high Mg level; also containing 40% very low, 20% low and 40% medium level of Ca. Soil samples possessing 40% low and 60% critical level of Zn; also having 60% critical and 40% adequate Fe.

Nitrogen contents were found low while Cu and Mn contents in sufficient amount in case of all soil samples. In addition to this, the presence of significant bilateral relations relating to some physical and chemical properties of vineyard soils were also determined.

As a result of this research, it is determined that it would be beneficial to enrich vineyard areas of Crimson Seedless grape variety in Alaşehir/Manisa, where the organic matter is decomposed rapidly due to high temperatures.

At least once in every two years regularly with old barnyard manure as well as supplementing. And also it is supplemented with nitrogenous and zinc fertilizers to research areas where N and Zn deficiencies are found in the soil.

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Table 1. Analysis results of some physical and chemical properties of soils of Crimson Seedless grape variety

Soil properties	**Average**	**Maximum**	**Minimum**
Saturation (%)	43.12	53.79	35.42
Texture	Loamy	Clay-loamy	Loamy
pH	7.86	8.56	5.86
Soil salinity (%)	0.06	0.14	0.02
Lime ($CaCO_3$)	3.09	10.62	0.81
Organic matter (%)	0.96	1.00	0.80
N (%)	0.05	0.05	0.04
P (ppm)	24.81	89.71	6.66
K (ppm)	125.30	305.10	40.00
Mg (ppm)	158.82	234.10	60.82
Ca (ppm)	1131	2008	236.10
Zn (ppm)	0.48	0.74	0.30
Fe (ppm)	4.33	8.55	2.04
Cu (ppm)	1.51	3.38	0.70
Mn (ppm)	3.29	7.86	1.49

Soil	Saturasyon (%)	pH	Soil salinity (%)	$CaCO_3$ (%)	Organic matter (%)	N (%)	P (ppm)	K (ppm)	Mg (ppm)	Ca (ppm)	Zn (ppm)	Fe (ppm)	Cu (ppm)	Mn (ppm)
Saturation (%)	1	0.363 ns	0.487*	-0.457*	0.526**	0.526**	-0.563**	0.871**	0.500**	0.470*	0.021 ns	-0.251 ns	-0.360 ns	-0.218 ns
pH		1	-0.384 ns	0.140 ns	-0.111 ns	-0.111 ns	0.050 ns	0.336 ns	0.833**	0.699**	-0.107 ns	-0.941**	0.407*	-0.944**
Soil salinity (%)			1	-0.302 ns	0.395 ns	0.395 ns	-0.385 ns	0.675**	0.074 ns	0.183 ns	-0.525**	0.631**	-0.316 ns	0.572**
$CaCO_3$ (%)				1	-0.993**	-0.993**	0.987**	-0.524**	-0.184 ns	-0.336 ns	-0.034 ns	-0.121 ns	-0.115 ns	-0.358 ns
Organic matter (%) (%)					1	1.000**	-0.998**	0.618**	0.253 ns	0.405*	-0.053 ns	0.131 ns	0.108 ns	0.351 ns
N (%)						1	-0.998**	0.618**	0.253 ns	0.405*	-0.053 ns	0.131 ns	0.108 ns	0.351 ns
P (ppm)							1	-0.651**	-0.306 ns	-0.450*	0.061 ns	-0.077 ns	-0.121 ns	-0.296 ns
K (ppm)								1	0.699**	0.743**	-0.448*	-0.104 ns	0.006 ns	-0.070 ns
Mg (ppm)									1	0.974**	-0.535**	-0.637**	0.564**	-0.608**
Ca (ppm)										1	-0.627**	-0.487*	0.632**	-0.427*
Zn (ppm)											1	-0.203 ns	-0.551**	-0.129 ns
Fe (ppm)												1	-0.334 ns	0.962**
Cu (ppm)													1	-0.243 ns
Mn (ppm)														1

Table 2. Soil characteristics of Crimson Seedless grape variety vineyards and correlation coefficients of some nutrients

*= significant at 5% ** = significant at 1% ns: not significant

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Use of Some Functional Flours for Development of Prebiotic Gluten-Free Cookies

Çelik Hekimoğlu Fulya[1], Gok İlkay[1] *

Abstract

In this study, five different gluten-free and prebiotic products were developed by using chickpea, dried beans, wheat, rice, buckwheat, and carob flours and some chemical and sensory analysis were examined. Cookies were evaluated by 70 untrained panelists in terms of sensory analysis with appearance, texture, smell, taste, general liking, and consumption criteria. The first three products, which were liked at the highest score were analyzed to determine their nutritional values like dietary fiber, energy, ash, carbohydrate, protein, moisture, fat, and starch amounts were investigated.

Among the products, chickpea flour cookies were determined as higher nutritional value and liked much more than other cookies. In case of sensory analysis, the least liked cookie was the rice flour cookie. As a result of the study, four tasty gluten free cookie was prepared with functional foods. They are suitable for general consumption preferences and can be an alternative to wheat flour cookies. It was observed that consumers tend to consume these alternative products. As a result, gluten-free and prebiotic products can be developed by functional foods and can be consumed with a high degree of liking.

Keywords: Functional food, Sensory analysis, Gluten-free, Prebiotic, Cookie

TÜBİTAK ULAKBİM

1Manisa Viticulture Research Institute, Republic of Türkiye Ministry of Agriculture and Forestry, 45125 Manisa, Türkiye
*corresponding author: fadimeates2@yahoo.com

1. Introduction

Functional foods, which are basic nutrients, have special components that have advantageous physiological effects that can benefit people in terms of health and reduce disease risks (Hasler, 2012; Siro et al., 2008). Although all foods can be considered functional, the term "functional foods" refers to a variety of foods that have certain common characteristics. Functional foods are biologically active ingredients that have the potential to reduce disease risk when consumed as part of a normal diet. These foods are beneficial to health above and beyond traditional nutritional value (Gok & Ulu, 2019). According to the European consensus document (Diplock et al., 1999), a food product is considered functional food if, beyond adequate nutritional effects, it improves one or more target functions in the body, reducing the risk of developing a disease.

Jonas and Beckmann (1998) have classified functional foods into two different categories as modification and enrichment. The modification involves the artificial regulation of genes by biotechnological methods to reduce harmful substances in food content or to increase the value of nutrients in food. Enrichment, on the other hand, involves the acquisition of new foods by adding essential nutrients that are or are not naturally present in food such as probiotic yogurt (Öncebe et al., 2019).

Prebiotics, a special dietary fiber, are known for their health benefits and reduction in cancer risk in humans, including increased bioavailability of minerals, modulation of the immune system, prevention of gastrointestinal (GI) infections, modification of inflammatory conditions, regulation of metabolic diseases (Roberfroid, 2010; Davani et al., 2019). They are not affected by heat, cold, acid, or time, provide a wide range of health benefits and feed the good bacteria that everyone has in their intestines. A prebiotic is a beneficial food item that affects the host by selectively stimulating growth or

activity, or both of the limited number of bacterial species found in the colon (Nagpal, 2011). Known as a functional food, Kefir is a fermented milk product and a natural probiotic that consumes prebiotics. Kefir grains contain lactic acid bacteria, acetic acid bacteria, and yeasts (Karaca et al., 2018). Fermented foods such as pickles and functional foods containing compounds such as probiotics are also functional foods.

Celiac disease or gluten sensitive enteropathy is a chronic disorder of the small intestine caused by exposure to gluten in the genetically predisposed individuals (Man et al., 2014). It is characterized by a strong immune response to certain amino acid sequences found in the prolamin fractions of wheat, barley and rye (Hussein et al., 2012). When people with celiac disease eat foods or use products containing gluten, their immune system responds by damaging or destroying the intestinal villi leading to the malabsorption of nutrients, thus adversely affecting all systems of the body (Hussein et al.,2012). Intestinal symptoms can include diarrhea, abdominal cramping, pain and distention and untreated celiac disease may lead to vitamin and mineral deficiencies, osteoporosis and other extra intestinal problems. The gluten-free diet remains until now the only treatment for celiac disease. Gluten free diet has benefits such as the recovery of the villi of the small intestine and risk reduction of malignant complications (Man et al., 2014).

In our country, is between one thousand to 1 percent prevalence of celiac disease 3, while it is estimated celiac from 250 thousand to 750 thousand in Turkey but considering that diagnosis to 10 percent is expected that patients diagnosed between 25 thousand to 75 thousand. Undiagnosed patients are the invisible part of the iceberg. Our Ministry of Health Information According to the data obtained from the system according to the region in the number of diagnosed celiac disease in Turkey distribution but follows for 2017 along with 2019 in May as of our country Celiacs number is 68123 (Aydoğdu et al., 2005)

The development of a gluten-free alternative product for consumers with gluten intolerance is a subject of research all over the world. Increasing the variety of gluten-free products with the increase of gluten-sensitive individuals is of great importance as it will positively affect both the economic and social comfort of the people (Benjamin et al., 2018). Besides, it is of great importance to make gluten-free products functional by increasing their nutritional value (Hosseini et al., 2018). In this study, it was aimed to develop prebiotic products with four different gluten-free and one gluten-containing functional foods as a control, and to make both sensory and nutritional value analyzes of the developed products (Güngör, 2019).

2. Materials and Methods

2.1. Material Production

Five different cookie recipes were created by using four gluten-free (chickpea flour, dried bean flour, rice flour, buckwheat flour, carob flour, teff flour) and one gluten-containing flour (wheat flour) and their both sensory and nutritional analyzes were made. In order to prepare the cookies the following materials has been purchased from local market: chickpea flour, dried bean flour, rice flour, buckwheat flour, carob flour, teff flour, wheat flour, butter, oil, eggs, powdered sugar, baking powder, vanilla, wheat starch, amaranth flour, rose water. The recipes of cookies is given in *Table 1*.

Butter, powdered sugar, vanilla, baking powder were used as fixed materials in different proportions in each recipe due to the difficulty in making and shaping of flours, except for wheat flour, because of their gluten-free nature.

2.2. Sensory analysis

Sensory evaluation of cookies was applied to the group of 70 untrained panelists. Evaluation focused on overall sensory quality of cookies based on appearance, texture, smell, taste, and general consumption criteria with a hedonic scale of five points from "dislike extremely" to "like extremely". The cookies presented to the panelists were numbered randomly with three-digit codes. Evaluation form were used to analyze sensory parameters. After evaluation were completed, the averaged data were tabulated. It aims that the taster can evaluate without prejudice and without being affected by the ranking. The prepared cookies (Chickpea flour cookie-NK, Dried bean flour cookie-KK, Wheat flour cookie-BK, Rice flour cookie-PK, Buckwheat and Carob cookie- KVK) were shaped in the same molds and quantities. The sensory characteristics of the samples were tested in the laboratory using the Organoleptic instrument, with the related product notice analysis method of the Turkish Standards and Turkish Food Codex regulations.

2.3. Proximate analysis of cookies

The first three products (BK 3.56; NK 3.36 and KVK 3.21) with highest mean value in the general liking criterion were determined their proximate composition was analyzed by AOAC (2005) official method of analysis. Highest scored three cookies analyzed for: moisture content by drying oven device, fat by Soxhlet solvent extraction method, protein by micro-Kjeldahl method (N x 6.25), and ash content by dry ashing method. The dietary Fiber (%) contained in the samples was determined by using the spectrophotometric device; Energy (%) was determined by the analysis method (FAO Food and Nutrition, 2003); Starch amount (%) were determined. Three replications of experiment were performed and mean value of each parameter with standard deviation were calculated.

2.4. Statistical analysis

Statistical analysis of the evaluation results of the sensory was carried out by the SPSS software, version 17.0. The conformity of the variables to normal distribution was examined with the Kolmogorov Smirnov test. Mean, standard deviation, and median values were utilized in presenting descriptive analyzes. The Mann-Whitney U Test was employed when evaluating non-parametric variables between two groups, and the Kruskal Wallis test was employed when evaluating variables between more than two groups. The cases where the p-value was less than 0.05 were considered statistically significant. The results of the food analysis and the statistical analysis were discussed together, and the panelists' evaluations and the health characteristics of the foods were compared (Olcay A, 2014).

3. Study Results and Discussion

The preferences characteristics of cookies identified with sensory tests in terms of appearance, texture, smell, taste, general liking, and product consumption. A total of 70 people, 35 males and 35 females, participated in this study. 27 people were under 30 years old, 38 people were between 30-50 and 5 people were over 50 *(Figure 2)*.

Scores given for appearance, texture, smell, taste, product consumption *(Table 2)*, and general liking *(Figure 3)* were compared by gender; it was determined with Mann Whitney U Test that there was no significant difference between males and females.

Samples were compared for Appearance, Texture, Smell, Taste, General liking, and Consumption. No significant difference was found in terms of appearance and smell between samples. It was observed that there was a significant difference between the samples in terms of texture, taste, general liking, and consumption. Posthoc analysis results performed in terms of taste, the score of the PK sample was lower than BK and KVK samples.

When looking at the general liking scores, the score of the BK sample was higher than the KK, PK, and KVK samples. In terms of consumption scores, the score of the NK sample was higher than the scores of the KK, PK, and KVK samples. Similarly, the score of the BK sample was higher than the scores of the KK, PK, and KVK samples *(Figure 4)*.

Posthoc analysis was conducted to examine whether there was any difference between the samples in texture, taste, general liking, and consumption *(Table 3)*. In terms of texture, the score of the NK sample was higher than the other 4 samples. In terms of taste, the score of the PK sample was lower than the BK and KVK samples. When looking at the general liking scores, the score of the BK sample was higher than the KK, PK, and KVK samples. In terms of consumption scores, the score of the NK sample was higher than the others. Similarly, the score of the BK sample was higher than the scores of KK, PK, and KVK samples.

When the samples were analyzed in themselves with the Spearman Correlation Test, there was a same directional correlation between "smell" and "appearance", between "taste" and "appearance and smell", between "general liking" and "appearance, smell, and taste", between "consumption" and "appearance", between "taste" and "general liking" in the NK sample. In the KK sample, there was a same directional correlation between "smell" and "appearance", between "taste" and "appearance and smell", between "general liking" and "appearance and taste", between "consumption" and "taste and general liking". In the BK sample, there was a same directional correlation between "smell" and "texture", between "taste" and "texture and smell", between "general liking" and "texture, smell, and taste", between "consumption" and "appearance, texture, taste, and general liking". In the PK sample, there was a same directional correlation between "smell" and "texture", between "taste" and "smell", between "general liking" and "appearance, smell, and taste", between "consumption" and "texture, smell, taste, and general liking". In the KVK sample, there was a same directional correlation between "smell" and "appearance and texture", between "taste" and "appearance, texture and smell", between "general liking" and "taste", between "consumption" and "general liking" *(Table 4).*

As a result of the food analysis evaluation of the top three products (BK 3.56; NK 3.36 and KVK 3.21) in the general liking criterion, Buckwheat and Carob Cookies had a dietary fiber rate of 2.20%, Chickpea flour cookies had 7.20%, wheat flour cookies had 1%. When looking at the energy level results of the samples, BK wheat flour cookies had the highest ratio (520.46 kcal/100g). As a result of food analysis, it was determined that the highest ash percentage was found in chickpea flour cookies with 1.30%. The highest rate in terms of carbohydrate levels was 63.83% in KVK - Buckwheat and Carob flour cookies.

Chickpea flour, buckwheat, and carob flour, three of the gluten-free flours used in the study, are the flours for which protein levels were not expected to be high due to their structure. The food analysis result supported this study. The highest protein percentage was in wheat flour cookies with 8.48. As a result of the analysis, the highest humidity was in Buckwheat - Carob cookie with 8.48%. Butter was used in similar proportions in all recipes. However, the amount of material varies according to the consistency of the cookies. For this reason, chickpea flour (27.85%) and wheat flour (27.46) cookies, in which a significant difference between fat percentages was not found, required similar fat content in terms of consistency. Buckwheat and carob cookies (19.32%) on the other hand, came to its proper consistency with less amount of butter because of the binding characteristics of the carob.

Starch constitutes the majority of wheat flour with 71%. As a result of the analysis, the starch amount of the wheat flour cookie was the highest with 40.3%, per the quality of the flour used *(Table 5).*

4. Conclusion

Within the scope of the study, five different cookie recipes were created and analyzed by combining four gluten-free and one gluten-containing flour with functional foods. According to the analysis results, the sample with the highest dietary fiber rate was NK chickpea flour cookie with 7.20%. The lowest dietary fiber was in wheat flour cookies with 1%. BK Wheat flour cookie was found to contain higher starch with 40.3% than the other two samples. Wheat flour cookies again have the highest rate in energy analysis. Food analysis results gave expected results depending on whether the flours used contain gluten or not. Although there was no significant difference between the used fat and sugar rates, some flours need more fat to obtain consistency due to their structure. The fat percentage criterion in the analysis, therefore, did not give a meaningful result. In terms of carbohydrate content, a 63.83% result was seen in wheat flour cookies. However, the percentages in the other two cookies did not differ greatly in terms of carbohydrates.

The majority of panelists preferred BK wheat flour cookie, which is a widely known recipe in terms of appearance, taste, general liking, and consumption, while they preferred NK chickpea flour cookie in terms of smell and texture. The scores given by 35 males, and 35 females participating in the study for appearance, texture, smell, taste, general liking, and product consumption were compared; it was observed that there was no significant difference between males and females.

In terms of consumption scores, NK was higher than the other three cookies made with gluten-free flour. When the sensory analysis results of cookies prepared with functional foods and gluten-free products were examined, it was seen that they could be preferred by most of the panelists.

When the factors affecting the purchasing decisions of today's functional food consumers were examined, they were seen to be the factors such as the taste of the functional product, the brand reputation of the product, the level of education of the consumer, avoiding giving confusing and difficult information about the product, emphasizing the health benefits of the product, carrying out promotional and tasting studies about the product, choosing the most suitable markets for the target consumer group (Sevilmiş, 2008).

In this study, four new products prepared with different gluten-free flours and enriched with functional foods were developed, which are suitable for general consumption habits and can be an alternative to NK wheat flour cookies, which the majority are accustomed to. It was observed that these cookies prepared with different flours attract the attention of consumers and that consumers tend to consume these different products.

The study has shown that if people gain awareness and find consumption opportunities, the widespread use of functional and gluten-free foods, the production of alternative products, and the idea that these foods are not medicines but only a supplementary element to healthy nutrition will be adopted.

Only 10% of those who do not use functional products say that they can use these products if they are informed, and 52% of them say that they would not use these products even if they are informed. This 10% section, on the other hand, prefers to be informed mostly by the opinions of experts. Since the contradictory news about these products in media channels causes people to be insecure about them, the statements made by the experts on the subject are more effective in guiding the consumers.

Due to the high prices of such foods and the lack of a widespread understanding of their usage and places in Turkey, it is thought that increasing the alternatives on this subject would be beneficial. A study on functional foods has shown that the level of use of these foods has increased significantly. Participants were asked "how often do you use functional foods" and their answers are as follows: 10.4% stated that they use it every day, 20.8% once a week, 24.7% 2-3 days a week, 13.0% once a month, and 23.1% rarely. As can be understood, 55.9% of functional food consumers consume functional products at least once a week (Karaağaç, 2010).

At the 6th Meeting of the International Scientific Association of Probiotics and Prebiotics (ISAPP) in 2008, the definition of "diet prebiotics" was defined as substances that benefit the gastrointestinal microbiota. With this definition, it has been reported that prebiotics is useful not only in the colon but also in many places such as the oral cavity and the urogenital system (Valcheva et al., 2016). With the production/consumption of functional foods together with probiotic microorganisms and prebiotic substances, it is possible to strengthen the defense mechanism of the body and reduce the risk of disease and health problems (Green et al., 2020).

In this study, it was seen that gluten-free and prebiotic products could be developed with functional foods, and it was concluded that they could be consumed with a high degree of liking by consumers, and it is thought that these and similar products will become widespread with similar studies.

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Table 1. The recipes of cookies

Chickpea Flour Cookie	500 g chickpea flour, 150 g butter, 200 g powdered sugar, 2 tablespoon rose water, 1 teaspoon cardamom, 200 ml oil, 1 table spoon amaranth flour, 5 g sugared vanilla, 1 teaspoon baking powder
Dried Beans Flour Cookie	250 g dried beans flour, 120 g butter, 200 g powdered sugar, 2 eggs, 1 table spoon amaranth flour, 5 g sugared vanilla,1 teaspoon baking powder
Wheat Flour Cookie	500 g wheat flour, 250 g butter, 100 ml oil, 4 tablespoon wheat starch, 200 g powdered sugar, 5 g sugared vanilla,1 teaspoon baking powder
Rice Flour Cookie	300 g rice flour, 125 g butter, 200 g powdered sugar, 2 eggs, 2 tablespoon rose water, 1 table spoon amaranth flour, 5 g sugared vanilla, 1 teaspoon baking powder
Buckwheat and Carob Flour Cookie	200 g buckwheat flour, 2 tablespoon butter, 2 tablespoon carob flour, 2 tablespoon teff flour, 2 table spoon powdered sugar, 1 egg, 5 g sugared vanilla, 1 teaspoon baking powder

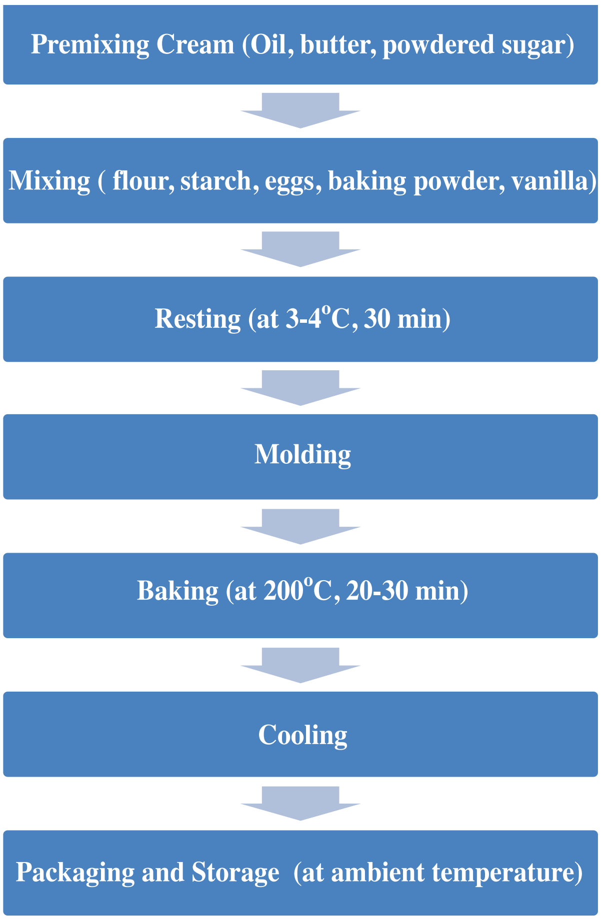

Fig. 1. Flow chart for cookies preparation

		Gender of the panelist				P
		Male		Female		
		Mean	±SD	Mean	±SD	
Appearance	NK	3.66	±1.00	3.49	±1.27	0.689
	KK	3.49	±1.09	3.77	±1.06	0.273
	BK	3.97	±0.86	4.03	±0.86	0.855
	PK	3.86	±0.91	4.00	±0.77	0.617
	KVK	3.77	±1.03	3.91	±0.89	0.627
Texture	NK	3.74	±1.09	3.89	±1.08	0.559
	KK	3.37	±1.06	2.97	±1.10	0.113
	BK	2.57	±0.92	2.83	±0.98	0.216
	PK	2.46	±0.95	2.63	±1.00	0.562
	KVK	2.94	±1.16	3.31	±1.08	0.129
Smell	NK	3.40	±0.81	3.57	±1.04	0.382
	KK	3.46	±1.04	3.49	±0.85	0.877
	BK	3.37	±0.97	3.49	±0.85	0.573
	PK	3.09	±0.98	3.14	±0.88	0.592
	KVK	3.43	±1.01	3.46	±1.09	0.897
Product Consumption	NK	3.31	±0.93	3.26	±1.29	0.942
	KK	2.71	±0.89	2.57	±0.98	0.619
	BK	3.37	±1.09	3.66	±1.14	0.264
	PK	2.89	±1.02	2.89	±0.90	0.812
	KVK	2.69	±1.05	2.97	±1.07	0.288

Table 2. The scores of appearance, texture, smell, taste, general liking, and product consumption by gender

	NK-KK	NK-BK	NK-PK	NK-KVK	KK-BK	KK-PK	KK-KVK	BK-PK	BK-KVK	PK-KVK
Texture	<0.001	<0.001	<0.001	<0.001	0.006	<0.001	0.761	0.363	0.015	0.002
Taste	0.545	0.053	0.268	0.405	0.242	0.092	0.933	0.002	0.248	0.043
General liking	0.173	0.351	0.091	0.287	0.020	0.768	0.514	0.008	0.041	0.347
Consumption	<0.001	0.252	0.014	0.014	<0.001	0.161	0.269	<0.001	<0.001	0.868

Table 3. Posthoc analysis results

	Texture	**Smell**	**Taste**	**General liking**	**Consumption**
NK					
Appearance	-0.096^{c}	0.322^{a}	0.239^{b}	0.321^{a}	0.335^{a}
Texture		0.024^{c}	0.225^{c}	0.150^{c}	-0.085^{c}
Smell			0.254^{b}	0.283^{b}	0.215^{c}
Taste				0.699^{a}	0.346^{a}
General liking					0.385^{a}
KK					
Appearance	-0.044^{c}	0.292^{b}	0.430^{a}	0.348^{a}	0.117^{c}
Texture		-0.043^{c}	-0.016^{c}	0.064^{c}	0.218^{c}
Smell			0.374^{a}	0.201^{c}	0.174^{c}
Taste				0.643^{a}	0.301^{b}
General liking					0.527^{a}
BK					
Appearance	0.094^{c}	-0.062^{c}	0.120^{c}	0.199^{c}	0.340^{a}
Texture		0.264^{b}	0.271^{b}	0.286^{b}	0.280^{b}
Smell			0.441^{a}	0.361^{a}	0.196^{c}
Taste				0.788^{a}	0.415^{a}
General liking					0.400^{a}
PK					
Appearance	0.041^{c}	0.052^{c}	0.174^{c}	0.247^{b}	0.096^{c}
Texture		0.307^{a}	0.166^{c}	0.230^{c}	0.321^{a}
Smell			0.339^{a}	0.293^{b}	0.270^{b}
Taste				0.703^{a}	0.322^{a}
General liking					0.481^{a}
KVK					
Appearance	0.232^{c}	0.311^{a}	0.304^{b}	0.234^{c}	-0.009^{c}
Texture		0.333^{a}	0.371^{a}	0.187^{c}	0.077^{c}
Smell			0.591^{a}	0.146^{c}	0.107^{c}
Taste				0.343^{a}	0.148^{c}
General liking					0.655^{a}

* a:p<0.010 b: p 0.050 c: p 0.050

Table 4. The correlation of the scores given within the samples themselves

	Dietary fiber (%)	**Energy (kcal/ 100g)**	**Ash (%)**	**Carbohydrate (%)**	**Protein (%)**	**Moisture (%)**	**Fat (%)**	**Determination of starch amount (%)**
Chickpea flour cookies	7.20	492.45	1.30	54.99	5.46	3.20	27.85	20.4
Buckwheat and Carob cookies	2.20	450.36	0.88	63.83	5.29	8.48	19.32	35.7
Wheat flour cookie	1	520.46	0.50	59.85	8.48	2.71	27.46	40.3

Table 5. Food analysis results of the samples

Sample 244	**Sample 167**	**Sample 984**	**Sample 745**	**Sample 307**
NK	**KK**	**BK**	**PK**	**KVK**

Figure 5. Photos of cookies made from 5 different flours

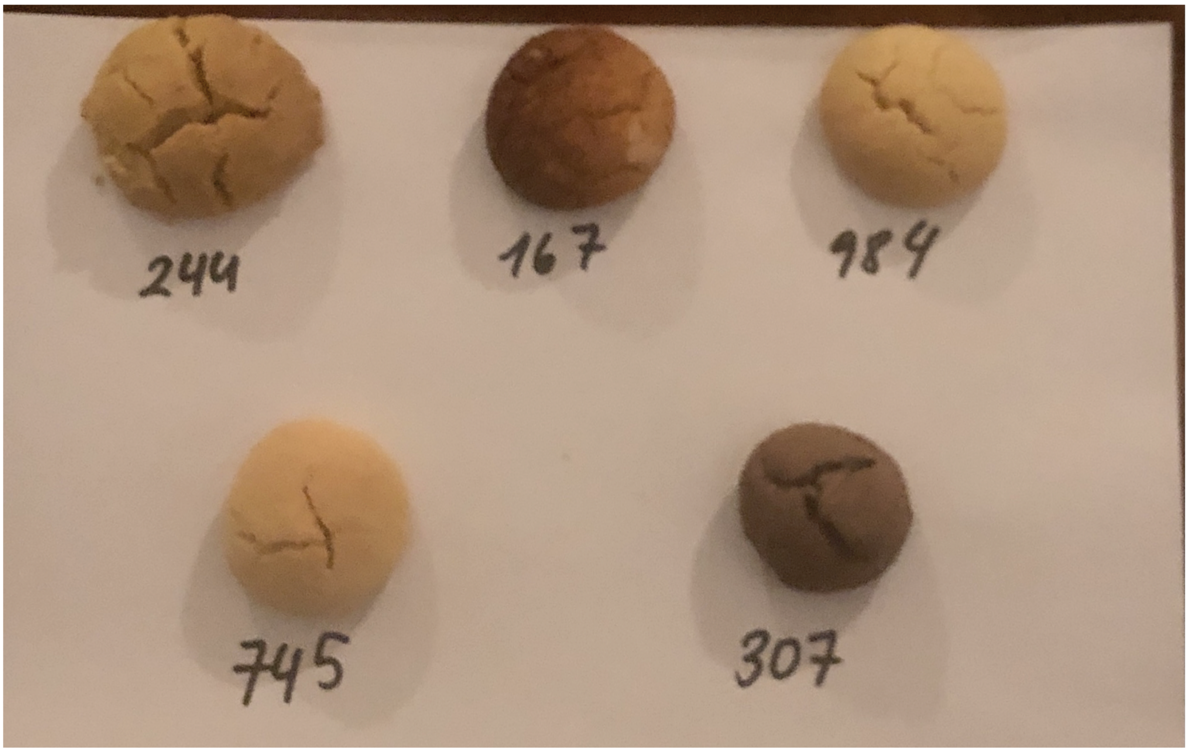

Figure 6. Samples of cookies (code : 244 – 167 – 984 – 745 – 307)

BK NK KVK

Figure 7. The first three products, which were liked at the highest score

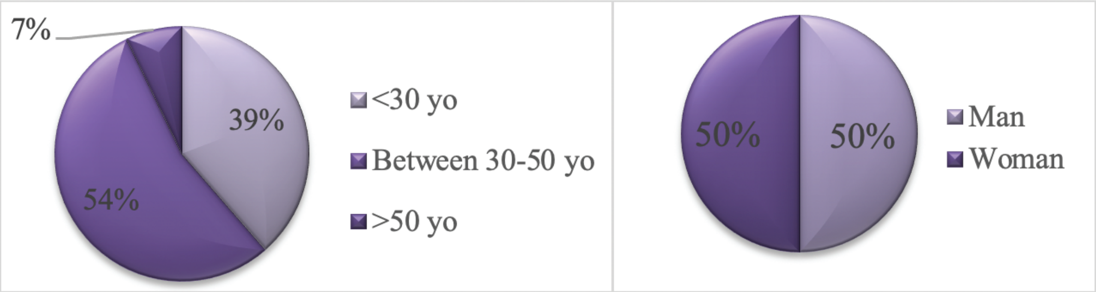

Figure 1. Gender and age rates of the panelists

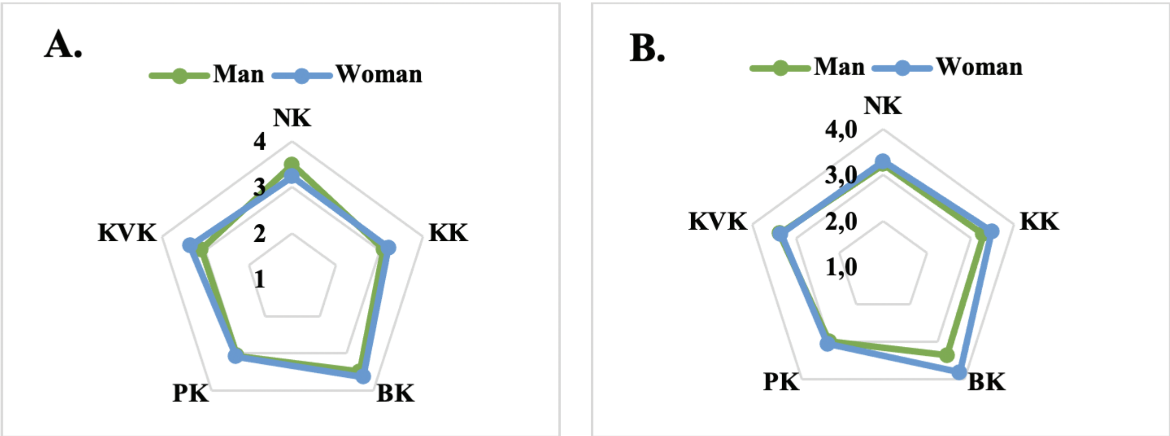

Figure 2. General liking (A.) and taste (B.) status of the panelists

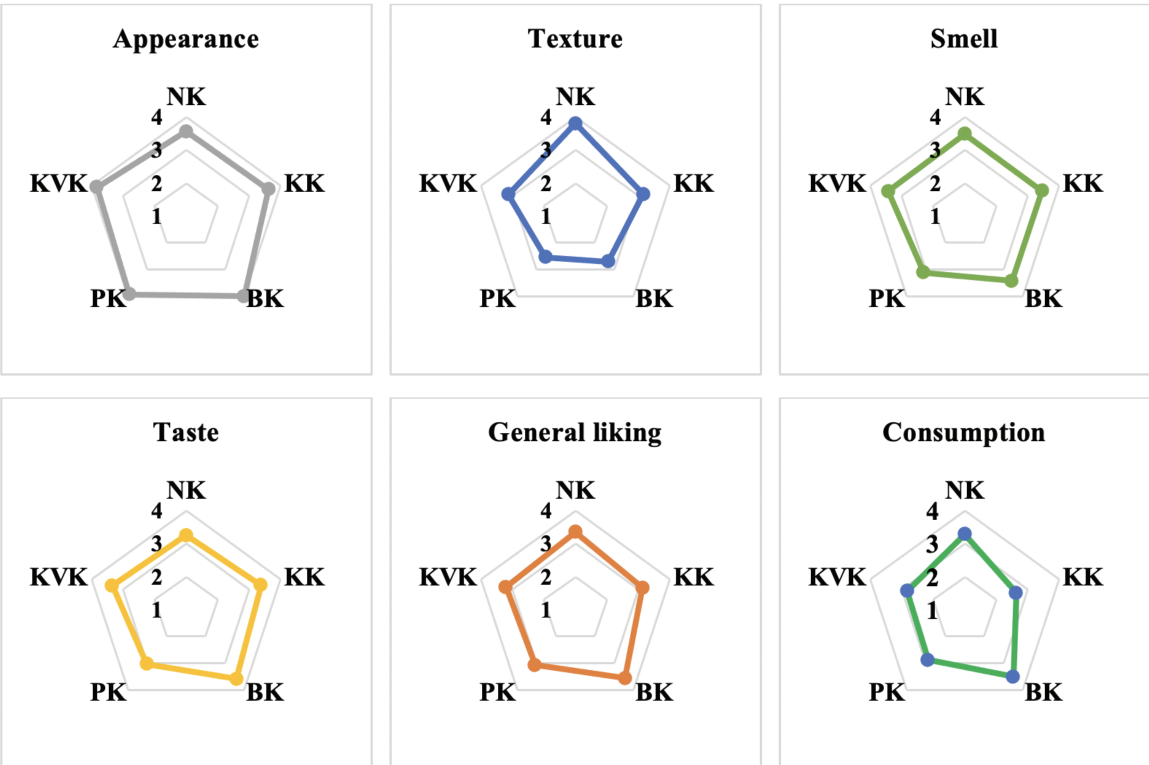

Figure 3. Samples' scores of appearance, texture, smell, taste, general liking, and product consumption