Italian Journal of Food Science, 2023; 35 (3): 55–74

Grape-based traditional foods produced in Turkey

Simge Aktop[1]*, Pınar Şanlıbaba[1], Yalçın Güçer[2]

[1]Department of Food Engineering, Engineering Faculty, Ankara University, 50th Year Settlement, Gölbaşı, Ankara, Turkey; [2]Department of Cookery, Beypazarı Vocational School, Ankara University, Beypazarı, Ankara, Turkey

***Corresponding Author:** Simge Aktop, Department of Food Engineering, Engineering Faculty, Ankara University, 50th Year Settlement, 06830, Gölbaşı, Ankara, Turkey. Email: saktop@ankara.edu.tr

Received: 22 February 2023; Accepted: 12 July 2023; Published: 2 August 2023

REVIEW ARTICLE

Abstract

Turkey is considered the gene centre of the vine, and it has remained one of the most important trading centres of viticulture and grape-based foods for a long time. The grapes grown in Anatolia and the foods obtained by processing these grapes contribute greatly to the economy of the nation. In addition to economic outcomes, grape-based traditional foods provide anti-carcinogenic, anti-inflammatory, antioxidant and cardiovascular disease–preventing benefits when consumed. A few examples of these grape-based traditional foods are molasses, wine, Turkish Rakı, hardaliye and pestil. In this review, the production processes of certain grape-based Turkish traditional foods are summarized.

Keywords: grapes; process; traditional foods; Turkey

Introduction

Traditional foods of a society or region are representative of its lifestyle, culture, history, climate and geography, and are, therefore, considered one of the most permanent elements of cultural heritage. The traditional foods passed down from generation to generation present several health benefits due to their richness in nutrition and flavour. Therefore, present-day consumers worldwide are opting for traditional foods, resulting in a sharp increase in the demand for these products (Ademoğlu and Özkaya, 2021; Bulut-Solak, 2021; Tamer *et al*., 2019).

The history of grapes dates back to 5000 BC, rendering it one of the oldest fruits cultivated on earth. The Asia Minor region, which includes Anatolia and the Caucasus, is considered the homeland of grapes. Consequently, viticulture is an ancient and deep-rooted culture in the Anatolian lands, and as well as in Turkey (Batu, 2006; Yakar, 2018). Over 10,000 varieties of grapes exist, among which nearly 1200 are cultivated in Anatolian lands, while only 50–60 are cultivated commercially (KOP, 2021).

Grapes are a rich source of vitamins, minerals, carbohydrates and proteins, as well as phenolic compounds (Coskun, 2017; Dolgun *et al*., 2020). The phenolic compounds present in grapes, including catechin, gallic acid, myricetin, quercetin, kaempferol and coumaric acid, exert several positive effects on human health due to their richness in anthocyanins and other flavonoids (Amoutzopoulos *et al*., 2013). A few of these positive effects of grapes on health are antioxidant, cardiovascular disease-preventing, anti-carcinogenic, anti-inflammatory and anti-allergic effects (Coskun, 2017).

The majority of the grapes produced in Turkey are consumed fresh and sun-dried, although a small proportion is also processed into various grape-based traditional foods. The perishable nature of grapes, the shortness of the grape harvest season and the necessity of cold storage requirements have effectively led to the popularity of grape-based traditional foods. The processing of grapes into traditional foods not only extends their shelf life but also adds several sensory and health-enhancing properties to the foods (Nakilcioğlu-Taş *et al*., 2018;

Tamer *et al.*, 2019). A few examples of these grape-based food products are must, hardaliye, wine, molasses, tarhana and pickles (Bayram *et al.*, 2015; Cangi and Yağcı, 2012). The production of these traditional foods may or may not include the fermentation process. The production regions for certain grape-based traditional foods in Turkey are depicted in Figure 1.

In this review, the production processes of certain grape-based Turkish traditional foods, such as hardaliye, wine, molasses, must, raisins, walnut sausage (köme), köfter, pestil, grape tarhana, unripe grape pickle, verjuice, bulama, brined vine leaf and Turkish Rakı, are summarized.

Fermented Grape-based Traditional Foods

Fermentation is one of the most common methods used for food preservation since ancient times. Several people around the world include fermented foods in their daily diet. Microorganisms play an important role in food fermentation. Fermentation adds certain peculiar properties to the foods, and the aroma, acidity and textural properties of the food product also usually change after fermentation. The final product often has a better taste, with increased health benefits, has a greater shelf-life and the development of pathogens is also inhibited in most cases (Altay *et al.*, 2013; Coskun, 2017; Piergiovanni, 2012). The most important grape-based Turkish traditional foods produced using fermentation are hardaliye, wine, unripe grape pickle, brined vine leaf and Turkish Rakı.

Hardaliye

Hardaliye is a traditional non-alcoholic, grape-based, fermented beverage that is produced widely in the Thrace region of Turkey (Bayram *et al.*, 2015; Bulut-Solak, 2021). It is produced to consume the huge amounts of grapes harvested in the limited period of the summer season and allow for their consumption in other seasons. Kırklareli province is the region where hardaliye is geographically indicated (Aşkın, 2018; Bayındır and Önçel, 2019).

Hardaliye is a salt-free and low-fat beverage that is preferred by various consumer groups. It has a bitter taste and a refreshing characteristic. It is reported that a cup of hardaliye provides 170 kcal of energy to one who consumes it. Hardaliye may also be consumed by children as it lacks alcohol (Aktaç *et al.*, 2015; Amoutzopoulos *et al.*, 2013; Coskun, 2017). Moreover, because hardaliye does not contain milk and dairy products, it may also be consumed by those with milk intolerance and vegans. The raw material used for producing hardaliye is the black grapes, which have a high nutritional content, and consequently, it is also reported to be rich in monomeric anthocyanins and phenolic compounds (Aşkın, 2018; Coskun, 2017).

Hardaliye is obtained by malolactic fermentation of grape juice, mainly performed by lactic acid bacteria (LAB). Therefore, hardaliye serves as a non-dairy probiotic beverage (Bayram *et al.*, 2015). *Lactobacillus casei* spp. *pseudoplantarum* and *L. paracasei* spp. are frequently isolated from hardaliye (Altay *et al.*, 2013; Bulut-Solak, 2021; Otles and Ozyurt, 2019). It is reported that the number of LAB during fermentation ranges from 1×10^2

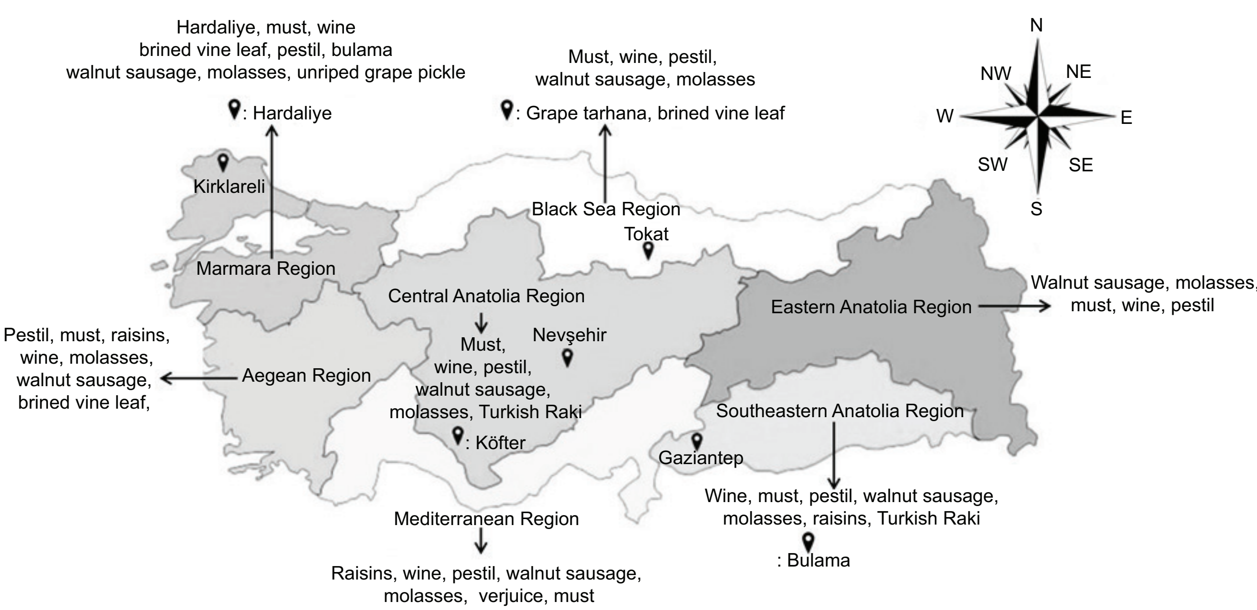

Figure 1. Production sites for certain grape-based traditional foods in Turkey (modified from Anonymous, 2021).

to 4 × 10^4 CFU/mL. *L. acetolerans, L. brevis, L. sanfranciscensis* and *L. pontis* have also been isolated from hardaliye (Arici and Coskun, 2001).

Grape varieties, such as Papazkarası, Cardinal, Cabernet, Hamburg Muscat, Cinsault, Shiraz, Merlot and Alphonse Lavallée are generally used as raw materials in the production of hardaliye (Bayındır and Önçel, 2019; Bayram *et al*., 2015; Bulut-Solak, 2021). In hardaliye production, black mustard seeds (*Brassica nigra* (L.) *Koch*) are usually mixed with the grape marc as a whole or as crushed grains at various concentrations, even though heat-treated black mustard seeds may also be used (Tamer *et al*., 2019). Substances such as sour cherry leaf (*Prunus cerasus* L.) and benzoic acid may be used as the preservative and aroma source during hardaliye production (Bulut-Solak, 2021; Coskun, 2017; Otles and Ozyurt, 2019). Hardaliye is usually produced and stored in stainless steel tanks, oak barrels or large glass or plastic barrels (Bayındır and Önçel, 2019). Its production is generally conducted using traditional small-scale processing methods, due to which only the traditional methods for the production of hardaliye are generally reported in the literature (Aydoğdu *et al*., 2014; Gucer *et al*., 2009; Tamer *et al*., 2019).

Hardaliye has antioxidant properties owing to its high content of phenolic compounds and ascorbic acid. It, therefore, has protective effects against cardiovascular diseases. In addition, its high antioxidant effect prevents the formation of cancer cells by preventing oxidative stress and causes a decrease in the plasma lipid peroxidation parameters (Aşkın, 2018; Bulut-Solak, 2021; Coskun, 2017). However, due to its short shelf-life, it is necessary that we pay attention to its storage conditions.

The health benefits of hardaliye are also associated with the essential oil content of mustard seeds. Mustard oil has antibacterial properties that are effective in the control of diseases, such as bronchitis, cold and circulatory disorders (Bulut-Solak, 2021). Sinigrin in mustard seeds exerts an anti-carcinogenic effect, while the allyl isothiocyanate in it serves as a chemo preventive agent against cancer (Coşkun, 2017; Gucer *et al*., 2009; Zhang, 2010). The allyl isothiocyanate is also reported to reduce the number of microorganisms, and its presence is actually responsible for the inhibition of alcoholic fermentation in hardaliye. In addition, the compounds released from sour cherry leaves were reported to play a role in preventing coronary heart diseases and have an effect on the digestive system (Amoutzopoulos *et al*., 2013; Bayram *et al*., 2015; Tamer *et al*., 2019).

The production of hardaliye includes several steps. The grapes are collected, washed, separated from their bunch and then crushed. Meanwhile, a mixture of black mustard seeds and benzoate is prepared. The crushed grapes are then placed in an oak barrel and fermented (Bayındır and Önçel, 2019; Bayram *et al*., 2015). A layer of the prepared mixture is then added to the barrel. If desired, crushed sour cherry leaves may also be added to this mixture to enhance the aroma. At this stage, most of the components in the fermented grape juice have passed into hardaliye. After the fermentation begins, the hardaliye in the barrel is collected through the tap and added back to the barrel from the top. This cycle is continued several times on the first day (Bayram *et al*., 2015). The entire process of Day 1 is continued for 5–10 days to ensure the complete fermentation of the product (Yılmaz, 2022). Finally, the fermented hardaliye is filtered, bottled and stored under appropriate cold conditions. The flow chart for hardaliye production is presented in Figure 2.

Wine

Turkey is one of the most important nations in the world in terms of its vineyard regions and the amount of grapes produced. In terms of vineyard regions, Turkey ranks alongside nations such as Italy, Spain and France. However, despite the huge amount of grapes produced in Turkey, only 2.5–3.0% of the grapes are used for wine production (Şenuyar *et al*., 2014).

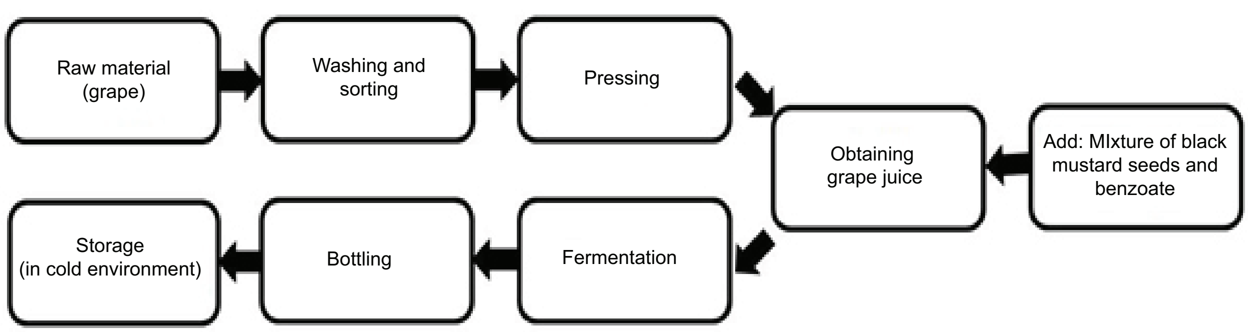

Figure 2. The flow chart for hardaliye production (Bayındır and Önçel, 2019; Bayram *et al*., 2015).

The data obtained from archaeological excavations have revealed that wine is one of the oldest beverages in history. While the exact date of the first wine production remains unknown, it is thought to date back to 7000 years (Kocaadam and Acar-Tek, 2016; Yılmaz and Akay, 2020). Wine production is believed to have spread to different civilizations, such as the Hittites and Lydians from Asia Minor, which is, at present, considered the homeland of the vine. The thousands of years-old goblets, jugs, inscriptions, pictures and coins (Acropolis Ancient Coins) extracted from Anatolian lands have confirmed Anatolia as an important centre of viticulture and wine trade (Kayikcioglu and Arikan, 2020).

Wine is a traditional fermented drink obtained by converting the glucose present in grape juice into ethyl alcohol using microorganisms (Çam and Yıldırım, 2018; Kayikcioglu and Arikan, 2020). At the initial stage of fermentation, the activity of the microorganisms that are intolerant to alcohol is usually inhibited (Gülgör and Korukluoğlu, 2015). Yeasts, however, are generally able to tolerate a small amount of alcohol and, therefore, play an effective role in the initiation of natural grape fermentation. Therefore, 3–4 days after the onset of alcoholic fermentation, yeasts such as *Saccharomyces cerevisiae* become dominant in the fermentation medium. These yeasts play a role in the continuation and completion of the fermentation (Ciani *et al*., 2006; Sun *et al*., 2015).

The chemical composition of wine may vary according to the ecological and physiological properties of the raw material used for its production, which then exerts an impact on the sensory properties and the quality of the wine. In addition, the type and the amount of aroma of wine are affected by various factors. Yeast variety, fruit condition, culturing type, environmental factors, must acidity and sulfur dioxide (SO_2) amount are a few of these factors (Gülgör and Korukluoğlu, 2015).

Wine contains components that affect human health positively, such as polyphenols, resveratrol and quercetin. Wine is also a good source of vitamins A, B and C, in addition to being rich in important minerals such as magnesium, calcium, iron, potassium, phosphorus, zinc, sulfur, copper, manganese, iodine, sodium, cobalt and chlorine that are involved in body metabolism (Barbaros and Kabaran, 2014). Wine has several health benefits owing to the beneficial properties of its components. The components in wine are reported to provide anti-carcinogenic, antioxidant and anti-inflammatory effects, thereby playing a role in the regulation of cholesterol levels. Regular and moderate consumption of wine is reported to have positive effects on health during diseases such as cancer, hypertension and type-II diabetes (Barbaros and Kabaran, 2014). Moreover, it has been associated with the health of the cardiovascular system. The first epidemiological observation was that the French population suffers a relatively low incidence of coronary heart disease (CHD), in spite of a relatively high dietary intake of saturated fatty acids and high intake of dietary cholesterol. This situation was first described by the Irish physician Samuel Black in 1819, and then named the "French Paradox." Several researches have been conducted and several hypotheses have been made in order to explain it (Ellison, 2011; Ferrie`res 2004; Ghahremani and Salami, 2021; Lippi *et al*., 2010). The only clear message is that moderate alcohol drinking has a protective effect against CHD. Moreover, alcohol intake raises high density lipoprotein (HDL) cholesterol concentrations, and also approximately 50% of the risk reduction contributed to alcohol consumption is explained by changes in HDL cholesterol (Lippi *et al*., 2010).

In the past, wine was produced using only traditional methods. However, several modern methods for wine production are available currently. One of the most important steps in wine production is the inoculation of selected yeasts into the grape must. Inoculation with pure culture ensures microbiological control during the fermentation and standardization of the product. *S. cerevisiae* is generally used for inoculation (Gülgör and Korukluoğlu, 2015; Kaya, 2017). *S. cerevisiae* is the dominant microflora in the environment, which prevents the development of other wild yeasts in the environment, and in addition contributes to the completion of fermentation. Inoculation with yeast cultures other than a pure culture of *S. cerevisiae* into the must is not recommended (Jouhten *et al*., 2016). As this might induce the risk of formation of compounds such as acetaldehyde, ethyl acetate, acetic acid and acetone in huge amounts due to uncontrolled fermentation which would then negatively affect the sensory properties of the wine produced (Gülgör and Korukluoğlu, 2015). The components responsible for the colour, taste and aroma of the wine are present in the grape skin, from where these components are transferred to the wine during the production processes. Therefore, small and thick-skinned grape varieties are generally preferred for wine production. The main grape varieties used in wine production which are cultivated in Turkey include Kalecik Karası, Öküzgözü, Semillion, Sultaniye, Narince, Emir, Viognier, Malbec, Ada Karası, Mourvedre, Marsanne, Bornova Misketi, Boğazkere, Grenache and Gamay (Kaya, 2017; Kayikcioglu and Arikan, 2020). The different steps followed in wine production are illustrated in Figure 3.

Unripe grape pickle

Another grape-based traditional food produced in Turkey is the unripe grape pickle. Unripe grape pickle is prepared using bunches or separated grape grains, grape

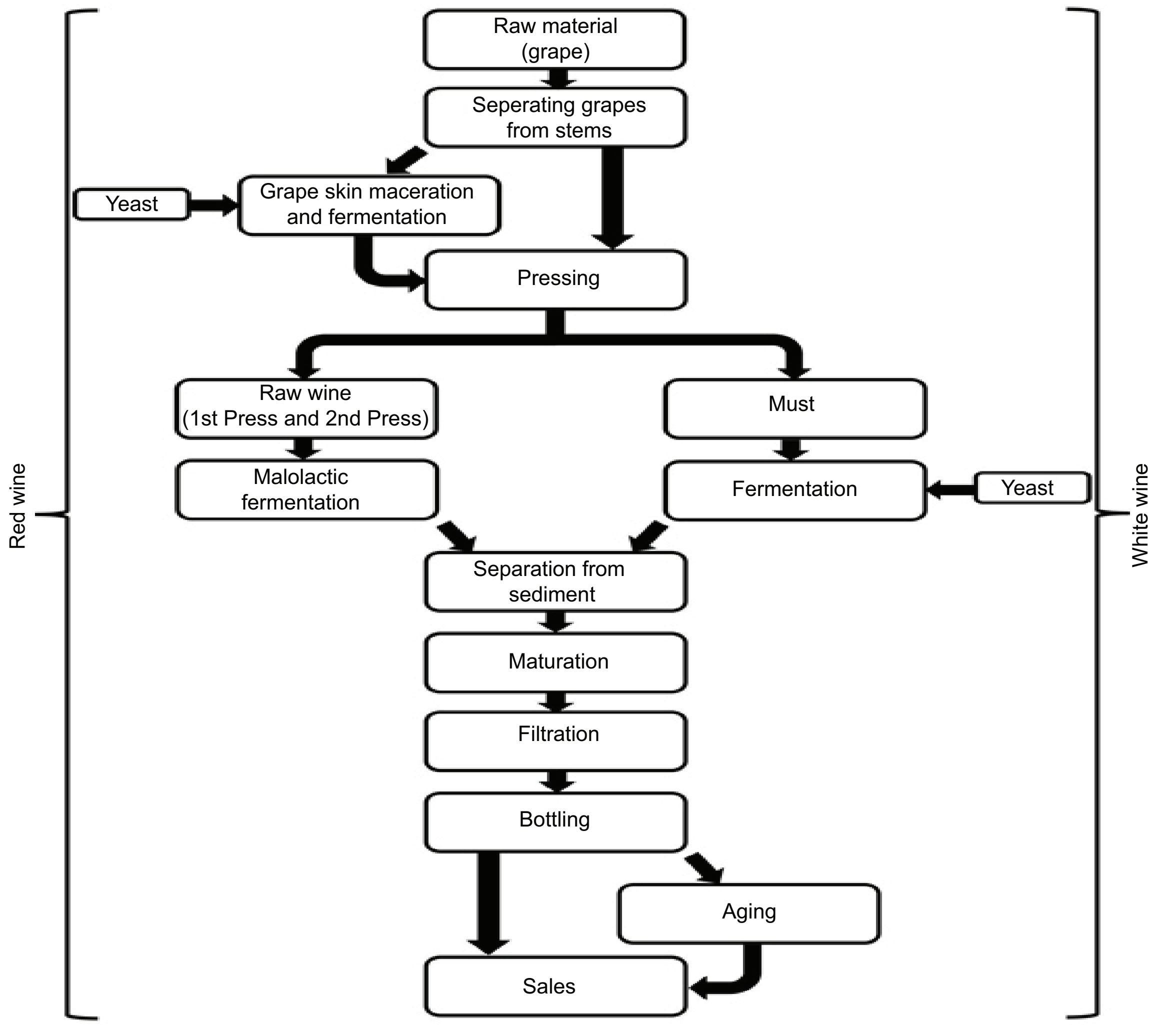

Figure 3. The flow chart for the production of red and white wine (Anlı, 2022).

juice and the roots of *Armoracia rusticana* (horseradish). This product differs from other pickles in that no salt is used in its production. Traditionally, the production of the unripe grape pickle is conducted at homes, and that too has now been limited to a few towns in the Thrace Region of Turkey. The commercial production of the unripe grape pickle is also conducted locally at the scale of small businesses (Adınır, 2011; Becerikli, 2015).

Pickles have been produced traditionally since ancient times to increase the durability of foods and ensure the long-term preservation of food items. Various vegetables and fruits are used for the production of pickles. The preliminary preparation steps for processing fruits and vegetables into pickles include washing, selecting and shredding the fruits and vegetables, after which the fruits and vegetables are left to ferment in a brine containing salt at certain concentrations. The juices of fruits and vegetables may also be used as raw materials in the above process (Adınır 2011; Tokatlı *et al.*, 2012). Under normal conditions, the fermentation period lasts for 2–3 weeks. LAB are particularly effective during the fermentation stage. Among the various LAB species, *L. plantarum, L. brevis, Pediococcus cerevisiae, Enterococcus faecalis* and *Leuconostoc mesenteroides* are the ones frequently involved in pickle production. Among these, *L. plantarum* generally constitutes the dominant microflora in the fermented product, and this species is resistant to low pH values (Adınır, 2011; Karagöz and Güllü, 2017).

The lactic acid fermentation that occurs in pickles has certain other advantages besides increasing the durability of fruits and vegetables, such as improvement in the sensory and textural properties of fruits and vegetables (Tokatlı *et al.*, 2012). Moreover, the lactic acid formed as a result of fermentation lowers the pH of the environment, thereby limiting the development of pathogens in the product. In addition, with pickle formation, the minerals and vitamins in fruits and vegetables are preserved and their digestibility is increased (Adınır, 2011).

Brined vine leaf

Turkey is one of the gene centres of the vine in the world, with a considerably old and culturally-rooted practice of viticulture (Cangi and Yağcı, 2012; Gülcü *et al.*, 2009). In Turkish culture, both fruit and leaves of the vine are used. Several Turkish traditional food dishes use vine leaves to add richness to the cuisine (Gülcü and Torçuk, 2016). In particular, vine leaves are used as the main ingredient in sarma (Turkish stuffed grape leaves), which is a traditional Turkish dish prepared in almost every home in Turkey and consumed lovingly by all residents. Recent years have witnessed an increased demand for edible vine leaves, and the export of vine leaves has also accelerated. Tokat and the Aegean Region are the leading regions with a wide production of edible vine leaves in Turkey (Cangi and Yağcı, 2012; Gülcü, 2010; Gülcü *et al.*, 2009). While fresh vine leaves may also be sent directly to the market for sale, vine leaves canned or processed in brine are sold more commonly (Cangi *et al.*, 2012; Semerci and Cangi, 2020).

Vine leaves differ in their shape, thickness and hairiness, and not all kinds are edible (Gülcü *et al.*, 2009). Only thin, hairless and unsliced vine leaves are used for edible purposes, as these are preferred by consumers (Cangi *et al.*, 2012; Gülcü, 2010). Thick, hairy and over-sliced vine leaves, on the other hand, are usually not preferred by consumers, due to which the selection of the variety of vine leaves becomes important. In addition, selecting the right time to harvest the vine leaves is important. If leaf removal is performed at the beginning of vegetation, the vines weaken. On the other hand, if leaf removal is performed in the late period of vegetation, the edible quality of the vine leaves decreases (Gülcü and Torçuk, 2016; Gülcü *et al.*, 2009).

Brined vine leaf production has been in practice in Anatolian lands since ancient times (Gülcü *et al.*, 2009). The vine leaves are collected in the spring and washed to remove contaminants. Afterwards, the brine prepared using salt, and water is transferred to glass or plastic containers, and the prepared vine leaves are added to this brine for fermentation for 4–5 weeks. In the process, when the brine level in the fermentation containers decreases, more brine is added as required (Gülcü, 2010).

The most widely used varieties in the production of pickled and canned vine leaves in Turkey include Narince from Tokat, Sultani from the Aegean Region and Yapıncak from the Thrace Region (Cangi and Yağcı, 2012; Cangi *et al.*, 2012; Gülcü and Torçuk, 2016). The vine leaves obtained from vine rootstocks, such as Muscat Hamburg, Hesapali (Müşküle), Kober 5 BB, Karaerik, and Kabuğu Yufka, are also used for edible purposes (Semerci and Cangi, 2020).

Vine leaves contain phenolic compounds, amino acids, organic acids, sugars, minerals, and vitamins (Gülcü, 2010; Gülcü and Torçuk, 2016). In the production of brined vine leaves, the organic substances in the vine leaves are altered biochemically by the action of microorganisms. In the fermentation stage, LAB are particularly active. The LAB develop in the brine and produce lactic acid, which increases the acidity of the product and leads to a decreased pH value, thereby limiting the growth of unwanted microorganisms in the product (Gülcü and Torçuk, 2016; Gülcü *et al.*, 2009). This increases the durability of the vine leaves, extends their shelf life, and also contributes to the development of their popular organoleptic properties. The digestibility of the product also increases with fermentation (Gülcü *et al.*, 2009). In addition, during the production of brined vine leaves, easily accessible substances such as water and salt are required, while the requirement for machinery and equipment is minimal. Commercially, brined vine leaves are packaged using vacuum packaging systems and then sent for sale to consumers in every region of Turkey (Gülcü and Torçuk, 2016).

Turkish Rakı

Turkish Rakı is a traditional drink produced through the distillation of suma in different regions of Turkey followed by aromatization using anise (Anli *et al.*, 2007). Suma is a liquid produced by fermenting the must prepared from dried or fresh grapes (Özden, 2015). Traditionally, Turkish Rakı is consumed after mixing it with cold water. It may also be consumed along with other beverages, such as ayran, turnip juice and soda (Süren and Kızıleli, 2021).

While it remains unclear when rakı production first began in Anatolia, the earliest mention of rakı is in the work of Fuzuli from the 16th century. Therefore, it is believed that rakı from the Anatolian lands has a history of at least 500 years, and throughout history, rakı-like beverages have been produced from grapes using the distillation method (Kesmez and Aydın, 2014). The anise-based drinks such as rakı are particularly produced and consumed in Mediterranean nations. A few examples of these drinks from different regions of the world are Ouzo from Greece, Pastis from France, Sambuca from Italy, Zebib from Egypt, and Anesone from Spain (Süren and Kızıleli, 2021). However, such anise-based drinks differ from each other in terms of the production process used and the traditional purposes of usage. Therefore, in 2009, the Turkish Patent Institute obtained the Geographical Indication Registration to protect Turkish Rakı and distinguish it from other anise-based distilled beverages. The registered production area of Turkish Rakı is the "Republic of Turkey" (Bergama, 2017).

Currently, Turkish Rakı is being produced mostly by legal companies, which use modern distillation systems. However, in certain regions in central and southern Anatolia, traditional rakı is also produced at home (Anli *et al.*, 2007). According to the distillate source, two types of rakı are produced in Turkey—one type of rakı is produced using fresh grapes only, while the other type of rakı is produced by adding agricultural product-based ethyl alcohol to the grape suma (Bergama, 2017; Cabaroglu and Yilmaztekin, 2011).

The production process of Turkish Rakı is described ahead. First, the grape suma is produced. The cleaned grapes are pressed and turned into must, which is then fermented to obtain the suma. Afterward, the aromatization process is performed to obtain the characteristic taste and smell of Turkish Rakı. The aromatization step is performed using just 6%–10% anise (*Pinpinella anisum* L.). The next step is the distillation process. Traditional retorts composed of copper, with a maximum capacity of 5000 L, are generally used in the distillation stage, and at least a 65% ratio of suma in alcohol is maintained. The next step is the sweetening of Turkish Rakı by adding sucrose at a concentration of 10 g/L. Afterward, Turkish Rakı is diluted with deionized water and then aged for a minimum of one year. The aged Turkish Rakı is filtered through special filters and pumped into filling machines. In the final stage, Turkish Rakı is bottled and labeled after performing the standardization controls. The alcohol content in the final product should be 40% (v/v), while the anethole content should be a minimum of 0.8 g/L (Anli and Bayram, 2010). The flow chart for the production of Turkish Rakı is presented in Figure 4.

The main grape varieties used in the production of Turkish Rakı are Sultani, Yapıncak, and Dimrit. In recent years, aromatic grape varieties, such as Muscat Blanc, have also been used in the production of Turkish Rakı (Anli and Bayram, 2010). Anise (*Pimpinella anisum* L.) is another raw material used in the production

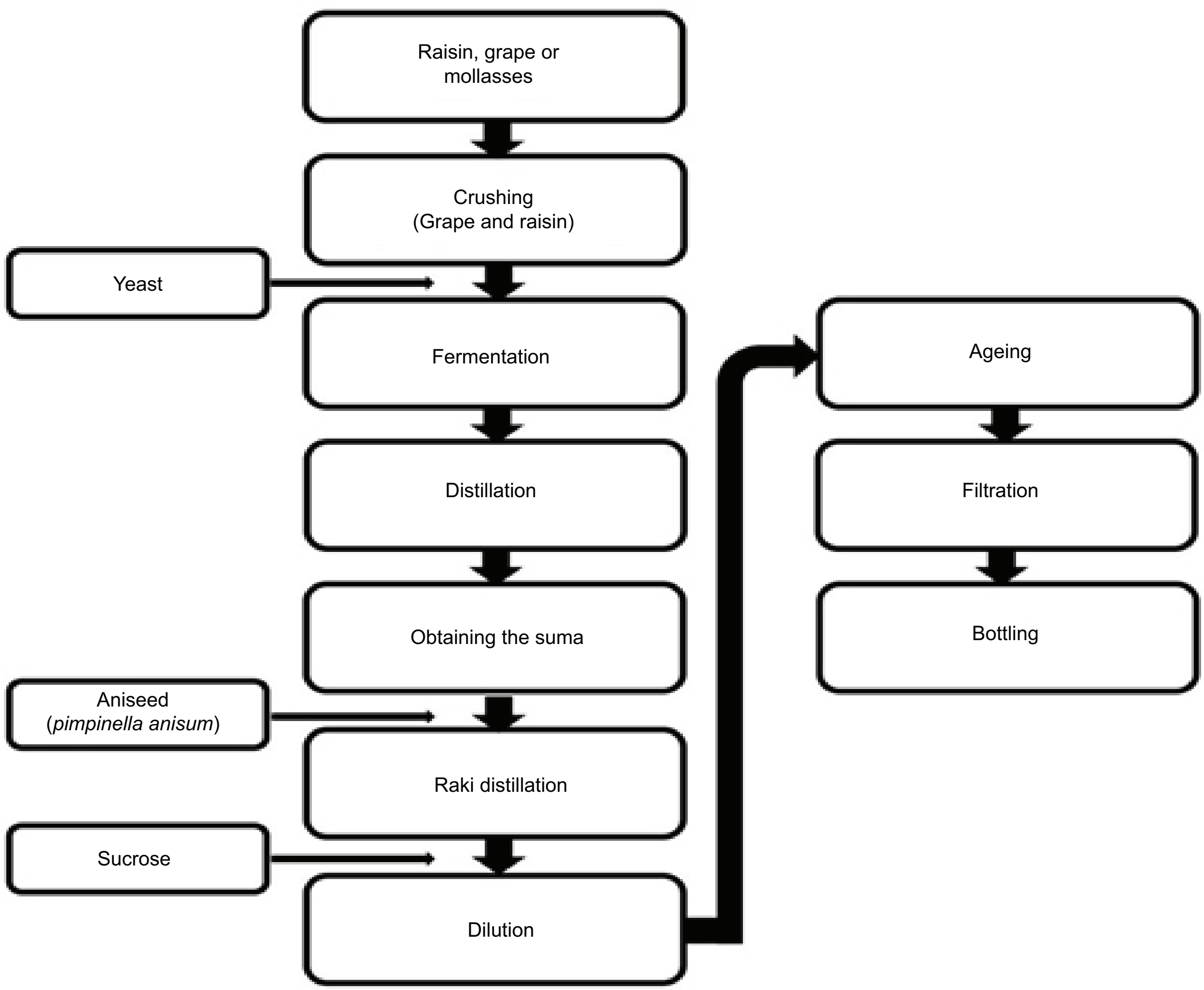

Figure 4. The flow chart for the production of Turkish Rakı (Anli and Bayram, 2010).

of Turkish Rakı. It is used for achieving the characteristic aroma of rakı. The amount of anise used in the production of rakı varies between 6 and 10% depending on various factors, such as the quality of the anise used in rakı production, the rakı variety and the aporak (mixture of the first and final products). Anise has several health benefits, such as pain relieving, respiratory facilitation and bloating relief (Bergama, 2017; Koçarslan, 2002). According to the Turkish Food Codex Communiqué on Distilled Alcoholic Beverages (Communiqué No: 2016/55), Turkish Rakı must contain at least 0.8 g/L of anethole (TFC, 2017a). Trans-anethole is a phenol ether that confers anise its characteristic taste and odour and constitutes 80–90% of the essential oil (Anli *et al.*, 2007).

Non-fermented Grape-based Traditional Foods

Non-fermented grape-based traditional foods are as popular as the other kinds of grape-based foods in Turkey. The main non-fermented grape-based foods are molasses, pestil, raisins, walnut sausage (köme), köfter, grape tarhana, verjuice, bulama and must. The communities in the regions involved in viticulture in Turkey processed the produced grapes in different ways, such as by using drying, cooking, and distillation. Non-fermented grape-based foods, thus, became included in the daily diet of these people. In addition, it facilitated the emergence of Turkey as a gastronomic tourism host for several tourists.

Molasses

Molasses is a traditional Turkish food produced in both liquid and solid forms from sugary fruits, such as grapes, mulberries, beets, apples, and figs. Molasses is high in energy value and rich in minerals (Yildiz *et al.*, 2015). The production of molasses in Turkey dates back to ancient times (Heshmati *et al.*, 2019; Tosun *et al.*, 2014). Grape molasses produced in Turkey are named according to the place of their origin. While almost every region in Turkey that has vineyards produces molasses, the provinces that are known for quality production include Tokat (particularly Zile), Eskişehir, Kastamonu, Balıkesir, Hatay, Afyonkarahisar, Gaziantep, Kırşehir and Kayseri. The molasses produced in these regions are considered high-quality in terms of textural and sensory properties, such as taste, smell, colour and consistency. Molasses may also contain 5-(Hydroxymethyl) furfural (HMF), iron, zinc and certain other metals at concentrations above the limits (Batu, 2006; Uçar, 2015; Yildiz *et al.*, 2015) recommended by the Turkish Food Codex Communiqué on Grape Molasses (Communiqué No: 2017/8), which may lead to adverse effects on human health (Batu and Gök, 2006; TFC, 2017b).

However, considering the chemical composition and the nutritional value of molasses, it is recognized for exerting positive effects on human health as well. Glucose and fructose account for 50–80% of the sugars present in molasses. These are simple sugars, which easily pass into the blood through simple diffusion without the prior requirement for breaking down into simpler molecules, thereby enabling rapid energy production in the human body. The average energy value reported for molasses is 293 kcal per 100 g (Batu, 2006; Türkben *et al.*, 2016). Consequently, molasses are recommended for athletes, children, pregnant women, and individuals who require immediate energy (Heshmati *et al.*, 2019; Türkben and Uylaşer, 2018). Molasses rich in Fe^{2+}, which is utilised easily in the human metabolism and fulfills 35% of the daily iron demand of the human body. Iron content in molasses is in the range of 11.3–20 mg/100 g of molasses (MTech and Venkatasubramanian, 2017). In addition, molasses is a good source of potassium, calcium, and magnesium, which are important for several physiological processes, such as blood coagulation and the functioning of the heart muscles. Molasses is reported as the best source of calcium after milk and dairy products (Batu, 2006; Heshmati *et al.*, 2019; Uçar, 2015).

Grape molasses may be classified under different groups based on the production method. According to the most general classification, the following three categories exist—liquid molasses produced using traditional methods, liquid molasses produced using modern methods and white solid molasses (Batu, 2006). In addition, according to Turkish Standards, molasses with a pH value of 5.0–6.0 is considered sweet molasses, while molasses with a pH value of 3.5–5.0 is considered sour molasses (Batu, 2020; Tosun *et al.*, 2014). The traditional method that is preferred for molasses production in Turkey has remained unchanged for a long time. With advancements in technology, modern production methods for molasses have also emerged (Batu, 2006). In both traditional method and modern methods, the production of liquid molasses from fresh grapes involves four basic steps: obtaining the must, neutralising the free acidity of the must, filtering the turbidity substances and cooking the must (Batu and Gök, 2006).

In the production of liquid molasses using the traditional method, the grapes are washed with water in plastic crates to remove foreign materials, such as straw, garbage, dust and soil. Next, the grapes are crushed by the producers to extract the juice (Batu, 2006). This process is conducted in cans composed of wood or concrete. Another method is to extract the grape juices by squeezing the grapes packed into sacks using a press that is referred to as "vise" (Batu, 2006, 2020). Afterward, the coarse residues in the must are filtered, followed by the addition of the molasses soil which is a white soil type containing 50–90% lime and used to clarify the must in molasses production to the must to reduce the free acidity of the must to the pH of 6.0–6.5. This mixture is then heated at 50–60°C, and during this cooking process, foams that are referred to as kef form on the surface of the must (Batu and Gök, 2006). These foams are removed using a ladle, after which the cooking process is continued until a temperature of 100–110°C is reached. The continuation of cooking is performed under continuous mixing to ensure no caramelization of the molasses. In the traditional method, open boilers with a wider width and a small depth are generally preferred for the cooking of the must, which enables rapid evaporation of the water from the must (Batu, 2006, 2020; Tosun *et al*., 2014). This reduces the cooking time and limits the unwanted browning of the must. Finally, the molasses is filled in glass jars or plastic or lacquered tin cans for sale (Batu, 2006). The flow chart for the production of liquid molasses using the traditional method is presented in Figure 5.

Pestil

Pestil is a traditional food with high nutritional value, prepared in various regions of Turkey, usually for consumption during the winter months (Batu *et al*., 2007; Yildiz, 2013; Yildiz and Boyraci, 2020). Pestil is obtained by laying the wet fruit puree on a cloth placed on a flat surface and allowing the moisture to dry until the desired product texture is obtained. The drying is performed either under the sun or by using hot air dryers. The low moisture content in pestil ensures a long shelf life and no requirement for cold storage. Normal cool and dry conditions are sufficient for the preservation of pestil (Kara and Küçüköner, 2019; Nakilcioğlu-Taş *et al*., 2018).

Fruits such as grapes, mulberries, plums, apricots, apples, and figs are generally used as raw materials for the production of pestil (Kamiloglu and Capanoglu, 2014; Özaltın and Çağındı, 2018; Yildiz, 2013). However, grapes are the most widely used fruit in the production of pestil (Batu *et al*., 2007). White sugar, edible starch, seasoning, and additives may also be added during the production of pestil (Kara and Küçüköner, 2019; Nakilcioğlu-Taş *et al*., 2018). The composition and the production steps of pestil vary with the geographical region. In the Gümüşhane province of Turkey, pestil production uses milk, honey and wheat flour, unlike pestil production in the other regions. In addition, Gümüşhane pestil has

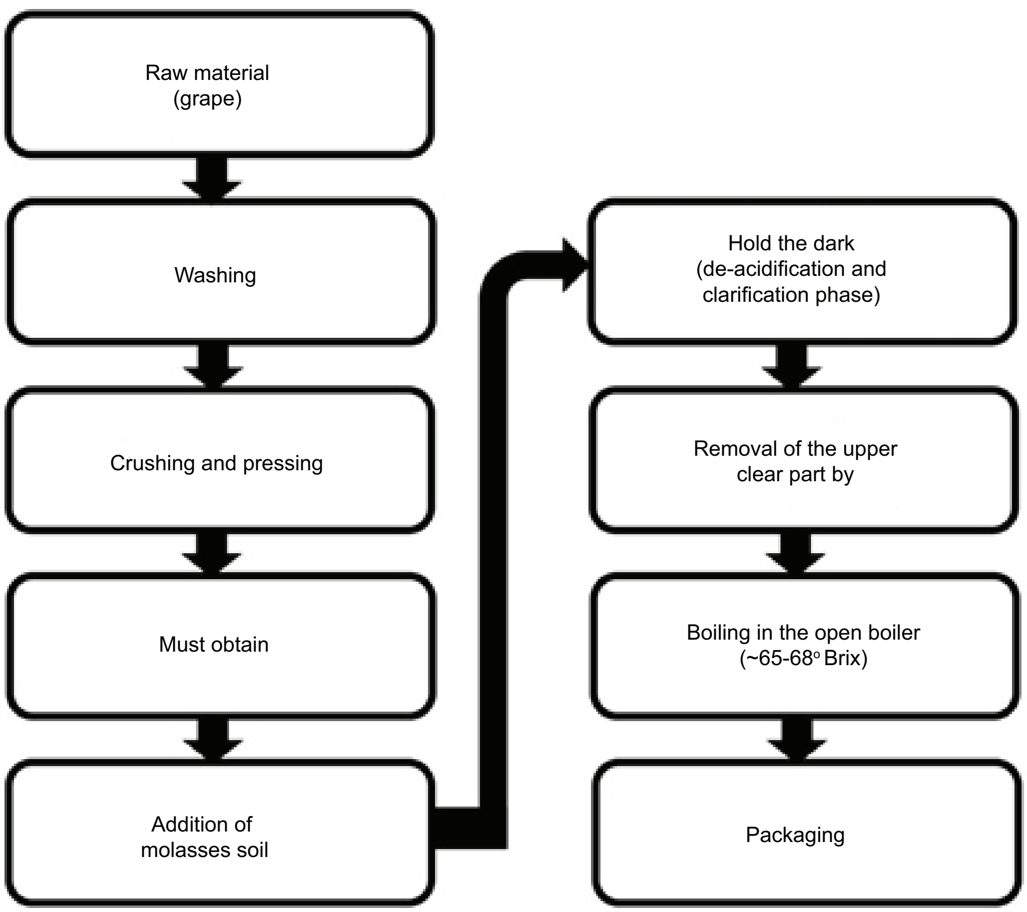

Figure 5. The flow chart for the production of liquid molasses using the traditional method (Türkben and Uylaşer, 2018).

a soft and shiny texture. Owing to these unique features, Gümüşhane pestil has received the "Geographical Registration Certificate (GRC)" from the Turkish Patent Institute (Kaya and Kahyaoglu, 2005; Yildiz and Boyraci, 2020).

The dry matter ratio in pestil is generally above 85%, and sugars constitute a significant proportion of this dry matter. In addition, pestil contains minerals and vitamins that play important roles in several metabolic processes in the human body. Therefore, pestil is considered a high-energy food (Batu *et al.*, 2007; Kara and Küçüköner, 2019). It is reported that 100 g of grape pestil provides 321.5–356.4 kcal of energy to the human body (Cagindi and Otles, 2005).

The minerals present in pestil include calcium, iron, potassium, magnesium, and phosphorus, while vitamins such as niacin, riboflavin, and thiamine have been reported (Batu *et al.*, 2007; Nakilcioğlu-Taş *et al.*, 2018). Since the iron present in pestil is easily absorbed in the human body, a certain portion of the daily iron requirement may be met by consuming pestil. According to a study, the mineral concentrations in pestil were: iron, 0.3–2.8 mg/100 g; calcium, 25.2–36.0 mg/100 g; potassium, 62.0–553.6 mg/100 g (Cagindi and Otles, 2005). The Ca/P ratio is important in child nutrition, and the recommended value is 1.2–2. The Ca/P ratio reported for grapes, which are used as raw materials for pestil production, varies between 2 and 2.7 (Batu *et al.*, 2007). Pestil is also a good source of dietary fiber as it is produced from fruits with high fiber content. In addition, pestil is a good source of carbohydrates and energy due to the presence of starch in it (Kara and Küçüköner, 2019; Özaltın and Çağındı, 2018; Yildiz and Boyraci, 2020). Consequently, pestil is preferred by individuals who require energy. On the other hand, those with diabetes and obesity are advised to limit their consumption of pestil. Furthermore, the glucose present in pestil exerts positive effects on the physical and mental performance of humans. The brain uses glucose as an energy source. Since glucose increases insulin secretion, the former is involved in the crossing of tryptophan across the blood–brain barrier as well as in the synthesis of serotonin. Moreover, glucose decreases the consumption rate of glycogen, which is important for athletes as it increases their endurance time (Batu *et al.*, 2007).

Currently, small businesses produce pestil using the traditional method, while modern methods are also used for pestil production. In Turkey, pestil is generally produced using traditional methods, the production stages of which are described ahead. First, the grapes are washed, selected, and pressed using a press. The grape juice produced is filtered using a cloth. Next, the molasses soil (containing 70% calcium carbonate) is added to the must, the seeds of which have been removed, to remove the acidity of the must. After another round of filtration, a portion of the filtered must is turned into a slurry by adding starch or flour. The remaining must is boiled for 30 min, following which the starch and flour slurry is added to this boiled must. The mixture is then allowed to boil further until the desired consistency is reached. This hot mixture is referred to as "herle." Finally, this herle is poured onto cloths in a thin layer and allowed to dry under the sun. If desired, the pestil is cut into different sizes and packed after sprinkling starch between the cut pieces (Batu *et al.*, 2007; Özaltın and Çağındı, 2018; Yildiz and Boyraci, 2020). The flow chart for the production of pestil is presented in Figure 6.

While the sun-drying method is a simple and low-cost method, it has certain disadvantages, such as greater time consumption compared to the industrial drying methods. Another disadvantage of the sun-drying method is that the pestil remains uncovered during drying in the sun, which increases the chances of contamination (Kara and Küçüköner, 2019; Köprüalan *et al.*, 2019).

In the production of pestil, a non-enzymatic browning reaction may be observed during the drying process and storage. Factors such as pH, drying temperature, drying duration, product composition, and water activity affect this non-enzymatic browning (Kaymul, 2021). In order to prevent this browning reaction, citric acid and ascorbic acid may be added to the pestil. The reaction may also be prevented by adding lemon juice to the pestil (Kara and Küçüköner, 2019).

In the drying process, the humidity of the environment and the air circulation affect the quality of the pestil (Yildiz and Boyraci, 2020). In the cases where the temperature is low and the ambient humidity is high, the drying rate decreases, which supports the growth of unwanted microorganisms in the pestil. Therefore, convective hot air dryers, which provide rapid drying and microbiological quality, are often preferred in pestil production (Kara and Küçüköner, 2019; Kıralan and Gündoğdu, 2021).

Raisin

Turkey is the world's largest producer and exporter of seedless raisins, accounting for approximately 40–45% of the world's raisin exports. Approximately two-thirds of the grapes produced in Turkey have seeds, while one-third of the grapes is seedless (MTRT, 2019). The production of seedless raisins in Turkey is concentrated in the Aegean Region, particularly in Manisa, Akhisar, Salihli, Turgutlu, Çal, Kemalpaşa, Menemen and Çivril (Şüyün, 2020). In terms of the vineyard area and the yield, the

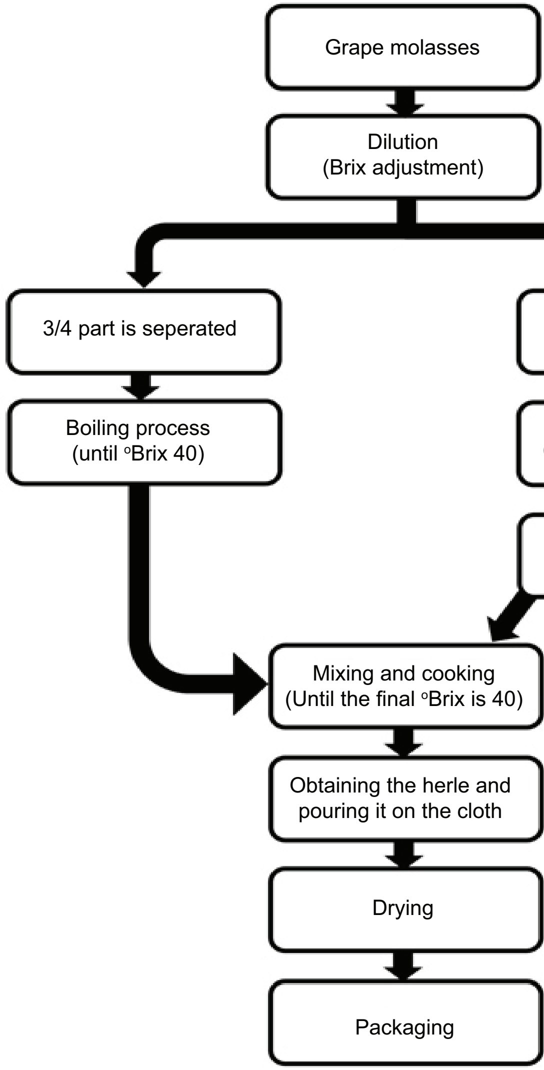

Figure 6. Flow Chart for Pestil Production (Nakilcioğlu-Taş *et al*., 2018).

most important production regions in Turkey after the Aegean Region are the Mediterranean region and south-eastern Anatolia. Sultani, Besni, and Corinth (currants) are considered dried grapes (KOP, 2021; MTRT, 2019).

The principle underlying the drying method is to evaporate the water content present in the food, followed by the removal of the produced steam away from the product surface (Alçay *et al*., 2015). This causes the water activity (a_w) to fall below the levels at which microorganisms grow, which ensures that the food is preserved for a longer duration without spoiling (Uysal-Seçkin and Taşeri, 2015). In addition, since the volume of the product is reduced due to water loss, transportation and storage also become easier (Alçay *et al*., 2015).

However, certain risks are associated with the drying of grapes. For instance, when the grapes have longer harvested and drying durations, the risk of rains in late August is encountered. In addition, the higher relative humidity around September is a risk factor encountered in the drying process conducted in the Aegean region. This higher humidity reduces the drying rate of the grapes and causes the grapes to remain in the exhibition for a longer duration (Akdeniz, 2011).

Raisin is considered an important dried fruit due to its high nutritional value. Raisin is a good source of minerals, such as iron, potassium and calcium, in addition to containing B group vitamins and 70% digestible fructose. Raisin also serves as a high-fibre food and is rich in antioxidants, and these properties allow the use of raisins in the treatment of cancer and prevention of other diseases such as constipation (Çağlayan, 2018).

At the beginning of the drying process, the sugar content in the grapes is approximately 20%. However, by the end of the drying process, the sugar content increases to approximately 85% (İşçi and Altındişli, 2016). Because the relative humidity is high under adverse meteorological conditions, the water mobility in grapes is reversible. Therefore, in an environment with high relative humidity, raisins do not lose water, and rather the moisture from the atmosphere is transferred to raisins. This prolongs the drying duration for grapes and renders the grapes unprotected against microorganisms. In addition, the browning reaction may continue as the increase in the sugar content in raisins with increasing humidity decreases and the enzyme activity is prolonged (Akdeniz, 2011; Dumanoğlu, 2021). Polyphenol oxidase is the main enzyme responsible for the browning reactions in grapes (Çağlayan, 2018).

Among the various drying processes used in Turkey and other nations is the use of sodium hydroxide (NaOH) as a dipping solution. Another process allows to obtain green raisins by dipping grape berries before drying in various dipping solutions inside dark drying rooms (Akdeniz, 2011). Contrary to these applications, another process allows to obtain brown raisins through direct laying and drying without the use of any dipping solution. In order to obtain visually appreciated brown raisins, bleaching processes with sulfur may be applied additionally (İnan, 2012).

In the dipping process applied to raisins, the aim is to remove the wax layer on the grape to allow for the raisin to appear brighter and increase the drying speed by approximately 2–3 times (İşçi and Altındişli, 2016). An example of this situation is as follows: under normal conditions, the grapes dry in nearly 14 days without dipping, while the dipped grapes dry in just 7–8 days (Akdeniz, 2011; Otağ, 2015).

After the dipping process, the bunches of grapes are brought to floor-type exhibitions or high-system wire exhibitions (Şen, 2014). The most suitable conditions for the drying of grapes would be available when there is sunny, cloudless and breezy weather. In floor-type exhibitions, the drying process requires nearly 10 days, depending on the air temperature. In high-system wire exhibitions, the drying process is completed in 15–20 days (Otağ, 2015). On the other hand, under less sunny, cloudy, and no-breeze conditions, the duration required for the drying of grapes is longer. The raisin obtained from the exhibitions is separated from their bunches and large garbage. Finally, the raisins are passed through the scattering machines and filled into sacks or plastic crates for storage (Akdeniz, 2011). The raisin is stored in a moisture-free, cool and dark environment. According to the Turkish Seedless Raisins Standards (TS 3411), the maximum final moisture content allowed for the raisin is 16% (TSI, 2011).

Walnut sausage (Köme)

Walnut sausage is a grape-based traditional food produced in almost every region in Turkey. Walnut sausage production is a culture belonging to Anatolia, and while it remains unknown when this production began, it is estimated to date back several years. According to historical records, walnut sausages were produced during the Ottoman Empire, although it was not traded. Walnut sausage is rich in minerals and vitamins and is also a good source of energy. In Turkey, walnut sausage is recognized by different names in different regions, such as köme, molasses sausage, bandırma, and orcik (Erdoğan *et al*., 2003).

The production of walnut sausage involves different steps, which are described ahead. First, the dried walnuts are broken and separated from their shells, following which they are strung on a rope using a needle. Next, the walnuts hung on the rope are dipped into the pre-prepared herle in groups. The walnuts dipped in herle are placed in a large and wide pot for a certain period, after which the walnuts with herle are arranged on sticks and these sticks are placed on a wheeled bench. Afterward, the walnuts with herle are dried in a greenhouse or in rooms with a drying system. The duration of this step is not constant but depends on the ambient conditions. Traditionally, the first drying process is terminated if a cracking sound is heard when the walnut sausage is twisted. After these stages, another dipping process is performed, following which all the remaining processes are repeated. This cycle is repeated four times (Bayram, 2018; Kalkışım and Özdemir, 2012). Figure 7 presents the flow chart for the production of walnut sausage (köme).

Several factors affect the walnut sausage production process, and the process usually completes in nearly 9 days. Accordingly, the drying process is an important step in the entire process. Herle thickness, air temperature, air flow, humidity, and the laying shape are important in the drying process. If the drying process is not performed properly, the deterioration of walnut sausage starts earlier. On the other hand, a higher quality product is obtained because of the desired-level drying of walnut sausages of appropriate thickness. The cracking of walnut sausages is a quality problem. A few reasons for this problem are the excessive thickness of the herle, the addition of excessive flour, and insufficient drying (Kalkışım and Özdemir, 2012). Finally, molding can also be seen

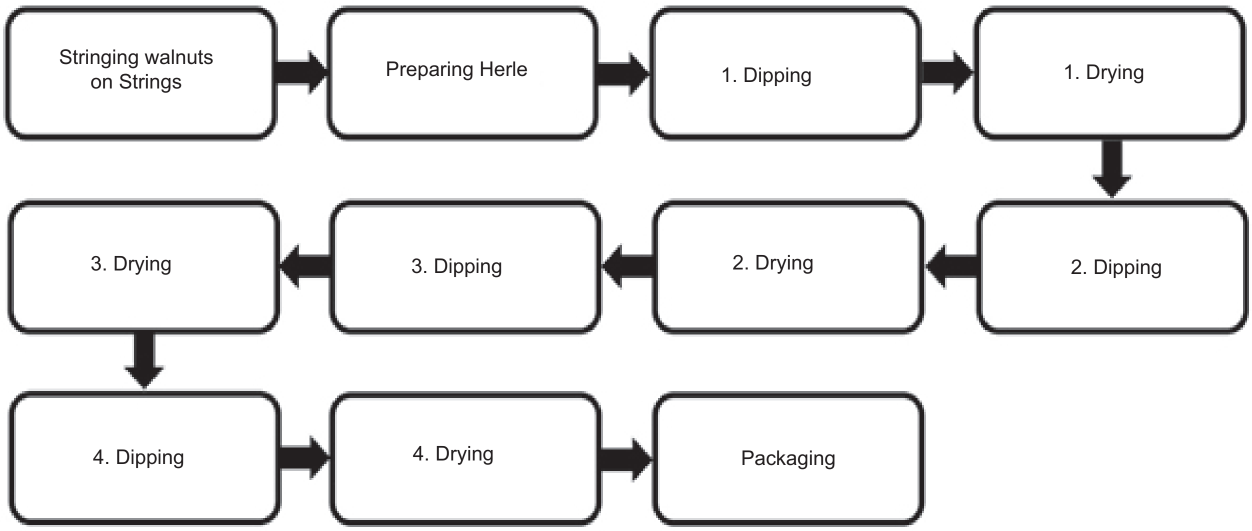

Figure 7. **The flow chart for the production of walnut sausage (köme) (Kalkışım and Özdemir, 2012).**

in walnut sausage because of using of moldy walnuts (Erdoğan *et al.*, 2003).

Köfter

Köfter is a grape-based traditional food prepared using water, molasses, and starch in Turkey (Yildiz *et al.*, 2015). Köfter is a food with high nutritional value, due to which it is consumed widely in Turkey, particularly in the Central Anatolia Region and in the winter season. Nevşehir is a prominent province for köfter production in Turkey. Köfter production is usually conducted in September-October when the grapes ripen. The commercial production of köfter, which is usually produced at home using traditional methods, is also prevalent (Becerikli and Başoğlu, 2018; Goksel *et al.*, 2013).

In addition to molasses, flour and starch, egg and molasses soil may be used in köfter production. The use of molasses soil in köfter production removes the acidity of the grape juice. Molasses soil contains a high amount of calcium carbonate, which ensures the collapse of colloids that reach the isoelectric point (Bilişli, 2013).

In general, Type 550 bread wheat flour and wheat starch are preferred in the production of köfter. It is reported that köfter prepared using flour is harder compared to the one prepared with starch (Becerikli and Başoğlu, 2018). Another ingredient used in the production of köfter is egg (Yolcu, 2018). The flow chart for traditional köfter production is presented in Figure 8.

Since köfter is a grape-based product, it is rich in both minerals and phenolic compounds. Köfter is a good

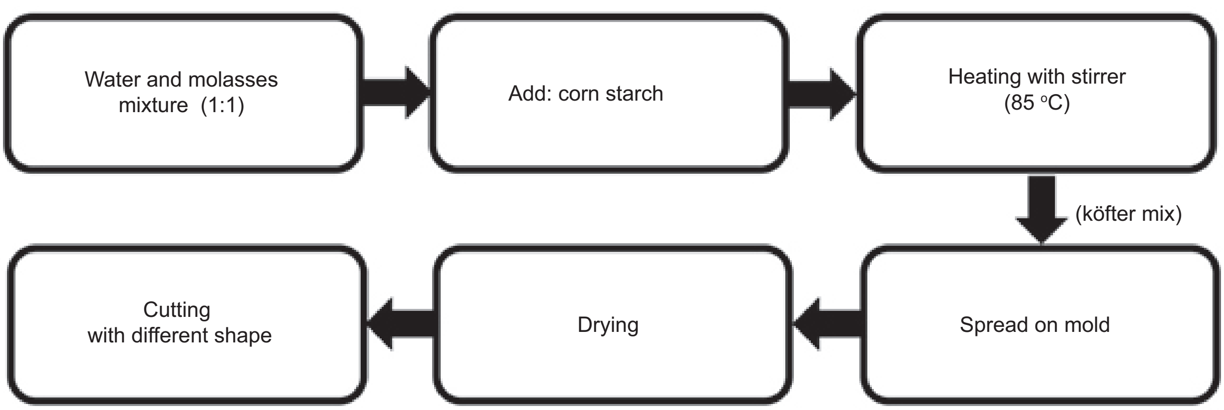

Figure 8. **The flow chart for traditional köfter production (Goksel *et al.*, 2013).**

source of minerals such as calcium, potassium, iron, magnesium, phosphorus and sodium. According to a study, the mineral contents in köfter samples were as follows: potassium, 7037.00–10247.67 mg/kg; calcium, 1116.00–1480.00 mg/kg; iron, 6.02–9.47 mg/kg (Becerikli and Başoğlu, 2018).

No standard for köfter is used in Turkey. However, according to the Turkish Food Codex Communiqué on Grape Molasses (Communiqué No: 2017/8), molasses with a pH of 5.0–6.0 is considered sweet molasses (TFC, 2017b). According to a study, the dry matter content in köfter samples was 79.17–82.17 g/100 g, while the pH value was 5.44–5.73 (Becerikli and Başoğlu, 2018). Accordingly, köfter is also considered a sweet grape-based food.

Several factors affect the quality of köfter. Molasses composition, starch type and concentration, and the concentration of other components are a few such factors. In addition, the drying temperature and duration used during the production of köfter may affect the quality of köfter (Goksel *et al.*, 2013; Yildiz *et al.*, 2015).

Non-enzymatic browning may occur during food processing, producing compounds with toxic effects, such as melanoidins and 5-hydroxymethylfurfural (HMF). HMF may be produced due to the drying temperature applied during the production of köfter and because of the sugar content in köfter. Therefore, HMF concentration could be used as a quality criterion for köfter (Goksel *et al.*, 2013).

Grape tarhana

Tarhana is a traditional Turkish food prepared by kneading wheat flour with yogurt, salt, pepper, and onion, followed by leaving the dough for fermentation, drying, and grinding (Aytunç and Özsisli, 2020). Different varieties of tarhana have emerged due to variations in tarhana production and different raw materials used in different regions of Turkey. A few of these varieties are Cranberry tarhana (Bolu), Uşak tarhana (Uşak), Maraş tarhana (Kahramanmaraş), Thrace-style fresh tarhana (Tekirdağ-Kırklareli-Edirne), Beyşehir tarhana (Konya) and Göce (Top) tarhana (Isparta) (Altundağ *et al.*, 2020; Sormaz *et al.*, 2019). In regard to the tarhana variety which uses grape (Tokat), while the production process used is similar to the production of traditional tarhana, the obtained product differs in several aspects from the other tarhana varieties. While the other tarhana varieties are generally consumed as soup, grape tarhana is consumed as dessert. In addition, no fermentation step is performed in the production process of grape tarhana as in the production of other tarhana varieties (Altundağ *et al.*, 2020; Coşkun, 2014; Sormaz *et al.*, 2019).

Grape tarhana is a sweet and Turkish delight-like traditional food, and its production has been prevalent in Tokat for several years (Köse and Çelik, 2017). Grape tarhana is consumed with walnuts, particularly in winter. Grape tarhana has a cumbersome production process and is prepared traditionally at home (Cangi *et al.*, 2011; Kaya *et al.*, 2009).

In the preparation of grape tarhana, grape must and molasses soil are used. First, the grape must is clarified and boiled for a while (Coşkun, 2014). Next, fine bulgur (cracked) wheat (1/8 or 1/9) is added to the must and boiled, until the mixture reaches the desired consistency (Kaya *et al.*, 2009; Köse and Çelik, 2017). Afterward, the mixture is poured into trays and allowed to cool and solidify (Coşkun, 2014). The cooled mixture attains the form of the molds on the trays, following which the drying process is applied (Cangi *et al.*, 2011; Sormaz *et al.*, 2019). The drying process is completed in 6–10 days in cool weather and 2–5 days in hot weather (Coşkun, 2014).

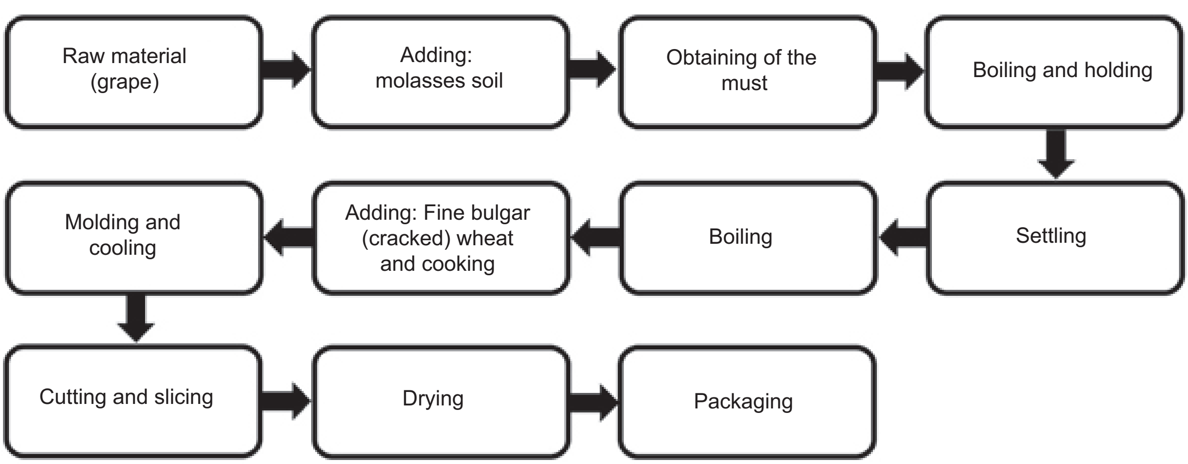

Figure 9. The flow chart for the production of grape tarhana (Cangi *et al.*, 2011).

The flow chart for the production of grape tarhana is presented in Figure 9.

According to a study, the dry matter content in grape tarhana samples ranged between 69.74% and 78.11% (Yıldız *et al.,* 2010). According to another study, the samples of grape tarhana had pH values varying between 4.45 and 6.01 (Kaya *et al.*, 2009). Grape tarhana is considered a healthy dessert as it is a grape-based product and has a high-calorie and nutritional content (Altundağ *et al.*, 2020). Therefore, this traditional food is preferred by people who require energy.

The tarhana produced in Gaziantep is quite similar to the Tokat grape tarhana. The production stages of the tarhana produced in Gaziantep are described ahead. The grape juice obtained by pressing the grapes is boiled in cauldrons referred to as "mahsere." Next, fine bulgur (cracked) wheat is added to the grape juice in a ratio of 1/10, followed by boiling. The mixture is then poured into containers and allowed to cool and solidify, followed by cutting into pieces. Finally, the cut pieces of the product are dried under the sun (Cangi *et al.*, 2011; Kaya *et al.*, 2009).

Verjuice

Koruk (*Vitis vinifera* L.) is the name assigned to the immature grape. Verjuice is a traditional sour-tasting beverage obtained by squeezing koruk (unripe grapes). The beverage is consumed directly in Turkey and is also used as a flavouring in salads, meals, and appetizers across the world, particularly in the Mediterranean nations (Ergezer *et al.*, 2018; Öztürk, 2020).

No standard exists for the production of verjuice, due to which the verjuice produced in each region is different. Moreover, the shelf life of verjuice is also limited. The pasteurization process may be applied to extend the shelf life of verjuice. In addition, antimicrobial additives may be added to verjuice to the extent permitted by the relevant legislation. The addition of potassium sorbate as an antimicrobial agent to verjuice is permitted by country legislation (Hayoglu *et al.*, 2009).

Verjuice is a beverage with a low pH value. According to a study, the pH values of verjuice varied between 2.74 and 2.94 (Ergezer *et al.*, 2018). In addition, because the raw material of verjuice is unripe grapes, it is rich in phenolic content. The consumption of verjuice as food provides several health benefits, such as positive effects on the digestive system (due to which it is used in the treatment of ulcers), cholesterol and blood pressure lowering effects, etc. (De Matos *et al.*, 2017; Shojaee-Aliabadi *et al.*, 2013).

In Turkey the production of verjuice is generally performed using traditional methods and commercial production is not common. However, the production of verjuice with traditional methods does not involve the use of aseptic conditions. This renders the traditionally prepared verjuice vulnerable to microbial contaminants, causing this verjuice to have a short shelf life. In addition, a rapid fermentation event occurs in the verjuice contaminated by wild yeast and molds, which renders it difficult to consume (Ergezer *et al.*, 2018).

In the production of verjuice, the Yediveren variety of unripe grapes is particularly preferred (Öztürk, 2020). The different steps followed during the production of verjuice using traditional methods are described ahead. Koruk bunches are placed in a plastic tub and crushed using a mallet. Sugar is then added to the crushed koruk in a ratio of 1:2, and the mixture is left undisturbed for 1 h. Afterward, boiled water is added to the mixture, followed by filtration of the mixture using a filter. The resulting filtrate is collected in a container, warm water is added to it, and the solution in filtered. This process is continued until the desired verjuice concentration is reached. The resulting filtrate is referred to as natural verjuice (Ergezer *et al.*, 2018).

Bulama

Bulama is a kind of solid molasses produced in the Thrace Region of Turkey and cities such as Bursa, Balıkesir, Gaziantep and Ankara. The Thrace Region has an important potential in terms of both vineyard area width and grape yield. Since approximately 69% of the vineyards in the region are in Tekirdağ, Tekirdağ bulama is particularly prominent among the breakfast products (Gülcü, 2010; Gülcü and Demirci, 2009).

Monosaccharides constitute 80% of the sugar content in bulama. Therefore, due to the easy movement of these monosaccharides in bulama through the digestive system, bulama consumption provides a rapid energy supply to the body. In addition, bulama is a good source of minerals such as iron, potassium, calcium, and magnesium (Gülcü and Demirci, 2009; Yıldırım, 2008).

Bulama is usually produced using traditional methods, although the content and the preparation steps of bulama vary with the region. The molasses produced in Turkey has several names, such as Bulama, Ağda, Zile, Çalma and Masara (Keleş *et al.*, 2019). Currently, bulama is being produced under home conditions, only by families interested in viticulture, and is sold and traded in the local markets established by the local producers in the region. Bulama is mostly produced in the center of Tekirdağ and in Şarköy and Malkara regions where viticulture is intense (Gülcü and Demirci, 2009). The steps of the traditional preparation of bulama in Tekirdağ are described ahead. Grape must is obtained by pressing the grapes, and molasses soil is added to the must (Batu, 2006). The mixture is then heated to 70–80 °C to allow for coagulation. In another boiler, water and *Gypsophila* L. root are boiled for 10–15 min, and the bitter juice of the plant is discarded. Water is added to the remaining *Gypsophila* L. in the boiler, followed by boiling until half of the water evaporates. The remaining *Gypsophila* L. juice is collected in a container. This process is repeated 3 times in total. Afterwards, the grape must and the *Gypsophila* L. juice are mixed and boiled after adding sugar. This process is continued until the mixture reaches the consistency of molasses. In a separate bowl, *Gypsophila* L. foam is prepared through whisking. The foam is then added to the molasses and the whisking is continued, allowing the molasses to harden and become lighter in colour. When the desired colour and consistency are achieved, the heating process is terminated, and the bulama is obtained (Gülcü and Demirci, 2009).

According to a study conducted by Gülcü and Demirci (2009), the water-soluble dry matter content in the bulama samples was approximately 80.06% and the average pH value of the bulama samples was 4.22. Accordingly, these samples were classified as sour molasses. According to the Turkish Food Codex Communiqué on Grape Molasses (Communiqué No: 2017/8), molasses with pH values of 3.5–5.0 are classified as sour molasses (TFC, 2017b). Bulama is a good source of minerals as the raw material used in bulama production is grape. According to a study, the average mineral contents in the bulama samples were as follows: calcium, 561 mg/kg; sodium, 498.4 mg/kg; magnesium, 190.4 mg/kg; iron, 20.8 mg/kg (Gülcü and Demirci, 2009).

Must

Must is a traditional beverage obtained by boiling grape juice. Must is also used in the production of other grape-based foods, such as pestil, walnut sausage, and molasses (Batu *et al*., 2007).

Several factors may directly affect the must quality, such as the soil features of the vineyard, geographical structure, climatic conditions, soil-water relationship, and sunshine duration (Bahar *et al*., 2018). All these factors, which are directly related to the quality of the must or wine, are evaluated within the term “terroir” (Bekar, 2016). In addition, it is important to select a quality raw material during the production of must. In the grape ripening period, the sugar content increases, while the acidity decreases. It is reported that the Brix value of the grapes to be processed for the must during harvest should be 22–24, and the titration acidity value in terms of tartaric acid should be 5–6 g/L (Gucer *et al*., 2021). LAB is usually isolated from grape must. The different LAB species isolated from the must include *L. brevis, L. plantarum, Oenococcus oeni, L. hilgardii* and *Leuconostoc mesenteroides* (Tokatlı *et al*., 2012).

The different must production stages are described ahead. The grapes are harvested in September or October and washed to remove foreign materials such as straw, garbage, dust, and soil. Afterward, the grapes are passed through a suitable press and crushed to extract their juices. The extracted grape juice is filtered through a filter, and molasses soil (white soil containing 70% $CaCO_3$) is added to the filtrate. The purpose of using molasses soil at this stage is to reduce acidity and clarify the must (Batu and Gök, 2006; Batu *et al*., 2007). In the next step, the must is boiled for 3–5 min. When foaming begins in the must, the boiling process is terminated, and the foam on the surface is removed. Finally, the must is removed from the boiler and separated from the sediment (molasses soil) settled at the bottom. When all processes are completed, the must is allowed to rest until it acquires its unique colour. The desired pH value of the final product is 7.6, and the desired dry matter ratio is 30–35%. The Brix value in must should be 20. The must may be produced from fresh grapes as well as from raisins. This ensures that must production continues regardless of the season (Batu *et al*., 2007).

Conclusions

Grape fruit has been cultivated and processed into various products since ancient times. Owing to its high nutritional value and chemical composition, grape fruit serves as a good source of energy and may be used in the treatment of various diseases. Turkey is one of the world’s leading nations in terms of grape cultivation. The grapes produced in Turkey are consumed as fresh fruit or processed into grape-based foods. Hardaliye, molasses, pestil, grape tarhana, wine, Turkish Rakı, raisins, must, brined vine leaf, verjuice, unripe grape pickle, bulama, köfter and walnut sausage are a few examples of the grape-based foods produced and consumed in Turkey. These foods are produced using different methods, such as fermentation, cooking, and distillation. In general, the traditional grape-based foods produced in Turkey are meant for domestic consumption and are prepared using traditional methods. However, considering the export potential of foods, such as wine and raisins, it is possible to increase the economic value of these products to higher levels through R&D (Research-Development) and marketing activities.

Conflicts of interest

The authors express no conflicts of interest associated with this work.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Data availability statement

All data were included in the manuscript.

References

Ademoğlu, A. and Özkaya, F.D., 2021. Özel gün ve tören yemekleri: ethnic foods dergisi üzerine bir inceleme. Journal of Gastronomy, Hospitality and Travel 4(2): 248–257. https://doi.org/10.33083/joghat.2021.72

Adınır, M., 2011. Utilization as pickle of unripe grapes (*V. vinifera*) on grapevine picked brined-vine leaves. MSc Thesis, Gaziosmanpaşa University, Graduate School of Natural and Applied Sciences.

Akdeniz, B., 2011. Geleneksel usullerde sultani çekirdeksiz üzüm çeşidinin kurutulması. Gıda Teknolojileri Elektronik Dergisi 6(1): 13–22.

Aktaç, Ş., Hasköylü, A. and Güneş, F.E., 2015. Nutritional properties of hardaliye. In: 3rd International Symposium on "Traditional Foods from Adriatic to Caucasus", Sarajevo, Bosnia and Herzegovina, 1–4 October 2015.

Alçay, A.Ü., Yalçin, S., Bostan, K. and Dinçel, E., 2015. Orta Asya'dan Anadolu'ya kurutulmuş gıdalar. Anadolu Bil. MYO Dergisi 37: 83–93.

Altay, F., Karbancıoglu-Güler, F., Daskaya-Dikmen, C. and Heperkan, D., 2013. A review on traditional Turkish fermented non-alcoholic beverages: microbiota, fermentation process and quality characteristics. International Journal of Food Microbiology 167(1): 44–56. https://doi.org/10.1016/j.ijfoodmicro.2013.06.016

Altundağ, Ö.Ö., Kenger, E.B. and Ulu, E.K., 2020. Farklı Tarhana Türlerinin Sağlık Yönünden Değerlendirilmesine Yönelik Bir Çalışma. Sağlık Akademisi Kastamonu 5(2): 143–157. https://doi.org/10.25279/sak.458051

Amoutzopoulos, B., Löker, G.B., Samur, G., Çevikkalp, S.A., Yaman, M., Köse, T., *et al.*, 2013. Effects of a traditional fermented grape-based drink 'hardaliye' on antioxidant status of healthy adults: a randomized controlled clinical trial. Journal of the Science of Food and Agriculture 93(14): 3604–3610. https://doi.org/10.1002/jsfa.6158

Anlı, R.E., 2022. Şarap Üretimi. Fermantasyon Teknolojisi. Available at: https://acikders.ankara.edu.tr/pluginfile.php/7323/mod_resource/content/0/FERM.F.REA.8.%20hafta.pdf (accessed 4 September 2022).

Anli, R.E. and Bayram, M., 2010. Traditional aniseed-flavored spirit drinks. Food Reviews International 26(3): 246–269. https://doi.org/10.1080/87559129.2010.484115

Anli, R.E., Vural, N. and Gucer, Y., 2007. Determination of the principal volatile compounds of Turkish Raki. Journal of the Institute of Brewing 113(3): 302–309. https://doi.org/10.1002/j.2050-0416.2007.tb00290.x

Anonymous, 2021. English map of Turkey regions. Available at: https://upload.wikimedia.org/wikipedia/commons/c/c8/Turkey_Regions_map-en.svg (accessed 4 September 2021).

Arici, M. and Coskun, F., 2001. Hardaliye: fermented grape juice as a traditional Turkish beverage. Food Microbiology 18: 417–421. https://doi.org/10.1006/fmic.2001.0413

Aşkın, B., 2018. Farklı sıcaklıkların hardaliyenin depolama stabilitesi üzerine etkisi. Harran Journal of Agricultural Food Science 23(1): 13–21. https://doi.org/10.29050/harranziraat.409434

Aydoğdu, H., Yıldırım, Ş., Halkman, A.K. and Durgun, T., 2014. A study on production and quality criteria of hardaliye; a traditional drink from thrace region of Turkey. Gıda 39 (3):139–145.

Aytunç, R. and Özsisli, B., 2020. Determination of some properties of the traditional Maras tarhana produced by tempered corn addition. Turkish Journal of Food and Agricultural Science 8(5): 1067–1073. https://doi.org/10.24925/turjaf.v8i5.1067-1073.3273

Bahar, E., Korkutal, İ. and Hüseyin, Ö., 2018. Bağcılıkta terroir unsurları. Bahçe 47(2): 57–70.

Barbaros, B. and Kabaran, S., 2014. Akdeniz diyeti ve sağlığı koruyucu etkileri. Beslenme ve Diyet Dergisi 42(2): 140–147.

Batu, A., 2006. Klasik ve Modern Yönteme Göre Sıvı ve Beyaz Katı Üzüm Pekmezi (Zile Pekmezi) Üretimi. Gıda Teknolojileri Elektronik Dergisi 2006(2): 9–26.

Batu, A., 2020. Gastronomi ve Moleküler Gastronomi Açısından Üzüm Pekmezi. Aydın Gastronomy 4(1): 35–44.

Batu, A. and Gök, V., 2006. Pekmez üretiminde HACCP uygulaması. Gıda Teknolojileri Elektronik Dergisi 3(7): 1–18.

Batu, A., Kaya, C., Çatak, J. and Şahin, C., 2007. Pestil üretim tekniği. Gıda Teknolojileri Elektronik Dergisi 1: 71–81.

Bayındır, M.S. and Önçel, S., 2019. Gastronomide kültürel miras bakış açısıyla Kırklareli hardaliyesi'nin geleneksel üretiminin değerlendirilmesi. Journal of Tourism and Gastronomy Studies 7(3): 1867–1886. https://doi.org/10.21325/jotags.2019.453

Bayram, H.U., 2018. Determine production methods and quality parameters of Gumushane Pestil and Kome. MSc Thesis, Karadeniz Technical University, Graduate School of Natural and Applied Sciences.

Bayram, M., Esin, Y., Kaya, C., İlhan, M., Akın, G. and Etdöğer, R., 2015. Geleneksel Yöntemle Müşküle Üzümünden Üretilen Hardaliyenin Bazı Özelliklerinin Belirlenmesi. Academic Food Journal 13(2): 119–126.

Becerikli, F., 2015. Determination of physical, chemical and microbiologic properties of koftur is a traditional food in Turkey. MSc Thesis, Uludag University, Graduate School of Natural and Applied Sciences.

Becerikli, F. and Başoğlu, F., 2018. Geleneksel Ürünlerimizden Olan Köftürün Bazı Biyoaktif, Fizikokimyasal ve Kimyasal Özellikleri. Gıda 43(2): 356–363. https://doi.org/10.15237/gida.GD17085

Bekar, T., 2016. Şaraplık üzüm kalitesi üzerine yetiştiriciliğin etkileri. Türk Tarım ve Doğa Bilimleri Dergisi 3(4): 255–264.

Bergama, D., 2017. Effect of fractionation and triple pot still distillation on the aroma compounds of distillates during raki production. MSc Thesis, Cukurova University, Institute of Natural and Applied Sciences.

Bilişli, A., 2013. Üzüm pekmezi. In: Özel Gıdalar, Bilişli, A (eds.) Sidas Medya, İzmir, Turkey. ISBN: 978–605–5267–13–1.

Bulut-Solak, B., 2021. Food, nutrition, and health in Turkey, the European part. In: Gostin, A.I., Bogueva, D. and Kakurinov, V. (eds.) In: Nutritional and health aspects of food in the Balkans. Academic Press, Elsevier Publishing, pp. 263–278. https://doi.org/10.1016/B978-0-12-820782-6.00008-6

Cabaroglu, T. and Yilmaztekin, M., 2011. Methanol and major volatile compounds of Turkish Raki and effect of distillate source. Journal of the Institute of Brewing. 117(1): 98–105. https://doi.org/10.1002/j.2050-0416.2011.tb00449.x

Cagindi, O. and Otles, S., 2005. Comparison of some properties on different types of pestil: a traditional product in Turkey. International Journal of Food Science and Technology 40: 897–901. https://doi.org/10.1111/j.1365-2621.2005.00962.x

Cangi, R. and Yağcı, A., 2012. Iğdır yöresinde salamuralık asma yaprağı üretim imkanları. Journal of the Institute of Science and Technology 2(2 Sp:A): 9–14.

Cangi, R., Yanar, Y. and Dülgeroğlu, Y., 2012. The effect of harvest period and brining methods on fungicide residue levels in brined vine leaves production. Final Reports, Gaziosmanpaşa University, Scientific Research Projects Commission.

Cangi, R., Yıldız, M., Yağcı, A. and Kaya, C., 2011. Tokat'tan Geleneksel Bir Lezzet Üzüm Tarhanası. In: 6th Ulusal Bahçe Bitkileri Kongresi, Şanlıurfa, Turkey, 4–8 October 2011, pp. 100–103.

Ciani, M., Beco, L. and Comitini, F., 2006. Fermentation behaviour and metabolic interactions of multistarter wine yeast fermentations. International Journal of Food Microbiology 108(2): 239–245. https://doi.org/10.1016/j.ijfoodmicro.2005.11.012

Coskun, F., 2017. A traditional Turkish fermented non-alcoholic grape-based beverage, "Hardaliye". Beverages 3(1): 2. https://doi.org/10.3390/beverages3010002

Coşkun, F., 2014. Tarhananın tarihi ve Türkiye'de tarhana çeşitleri. Gıda Teknolojileri Elektronik Dergisi. 9 (3):69–79.

Çağlayan, H., 2018. Effect of pumpkin and raisin addition on some quality characteristics of probiotic yoghurts. MSc Thesis, Hitit University, Graduate School of Natural and Applied Sciences.

Çam, T. and Yıldırım, H.K., 2018. Üzümsü meyvelerdeki fenolik bileşiklerin fermantasyon ile değişimi. Akademik Gıda 16(1): 101–108. https://doi.org/10.24323/akademik-gida.417902

De Matos, A.D., Curioni, A., Bakalinsky, A.T., Marangon, M., Pasini, G. and Vincenzi, S., 2017. Chemical and sensory analysis of verjuice: an acidic food ingredient obtained from unripe grape berries. Innovative Food Science and Emerging Technologies 44: 9–14. https://doi.org/10.1016/j.ifset.2017.09.014

Dolgun, E.C., Karaca, G. and Aktaş, M., 2020. Performance analysis of infrared film drying of grape pomace using energy and exergy methodology. International Communications in Heat and Mass Transfer 118: 104827. https://doi.org/10.1016/j.icheatmasstransfer.2020.104827

Dumanoğlu, B., 2021. Moisture sorption isotherm, thermodynamic properties and kinetic stability of encapsulated propolis powder. MSc Thesis, Aydın Adnan Menderes University, Graduate School of Natural and Applied Sciences.

Ellison, R.C., 2011. The French paradox: 20 years later. Journal of Wine Research 22(2): 105–108, https://doi.org/10.1080/09571264.2011.603214

Erdoğan, A., Gürses, M. and Sert, S., 2003. Erzurum'da Satışa Sunulan Köme (Cevizli Pestil Sucuğu) ve Kuru İncirlerin Aflatoksin İçeriklerinin Saptanması. Atatürk Üniversitesi Ziraat Fakültesi Dergisi 34(1): 85–88.

Ergezer, H., Gökçe, R. and Akcan, T., 2018. Koruk Sularının Bazı Kalite Karakteristikleri Üzerine Pastörizasyon ve Potasyum Sorbat İlavesinin Etkisi. Akademik Gıda 16(3): 287–292. https://doi.org/10.24323/akademik-gida.475352

Ferrie`res, J., 2004. The French paradox: lessons for other countries. Heart, 90(1): 107–111. https://doi.org/heart.90.1.107

Ghahremani, H. and Salami, S., 2021. French paradox, alcohol, and health related concerns. International Journal of Cancer Management 14(7): e105006. https://doi.org/10.5812/ijcm.105006

Goksel, M., Dogan, M., Toker, O.S., Ozgen, S., Sarioglu, K. and Oral, R.A., 2013. The effect of starch concentration and temperature on grape molasses: rheological and textural properties. Food and Bioprocess Technology 6(1): 259–271. https://doi.org/10.1007/s11947-011-0705-5

Gucer, Y., Aydogdu, H. and Durgun, T., 2009. A traditional Thracian beverage; "Hardaliye". Trakia Journal of Sciences 7: 208–210.

Gucer, Y., Poyrazoglu, E.S. and Artik, N., 2021. GC/MS determination of volatile aromatic compounds of Kalecik Karasi must produce by cold maceration. Journal of the Faculty of Engineering and Architecture of Gazi University 36(3): 1532–1538. https://doi.org/10.17341/gazimmfd.719047

Gülcü, M., 2010. Traditional grape products of Thracian region and local production form in Turkey. In: 33 rd World Congress of vine and wine, Tbilisi, Georgia, 20–27 June 2010.

Gülcü, M. and Demirci, A.Ş., 2009. Tekirdağ Yöresinde Üretilen Katı Pekmez "Bulama" Üzerine Bir Araştırma. In: II. Geleneksel Gıdalar Sempozyumu, Van, Turkey, 27–29 May 2009, pp. 86–91.

Gülcü, M., Demirci, A.Ş., Arıcı, M. and Aydın, S., 2009. Yemeklik asma yaprağı üretimi. In: II. Geleneksel Gıdalar Sempozyumu, Van, Turkey, 27–29 May 2009.

Gülcü, M. and Torçuk, A.İ., 2016. Yemeklik asma yaprağı üretimi ve pazarlamasında kalite parametreleri. Meyve Bilimi 1: 75–79.

Gülgör, G. and Korukluoğlu, M., 2015Şarap Kalitesinin Geliştirilmesinde Brettanomyces Türlerinin Killer Toksinler ile Engellenmesi. Bursa Uludağ Üniversitesi Ziraat Fakültesi Dergisi 29(2): 183–192.

Hayoglu, I., Kola, O., Kaya, C., Özer, S. and Turkoglu, H., 2009. Chemical and sensory properties of verjuice, a traditional Turkish non-fermented beverage from Kabarcik and Yediveren grapes. Journal of Food Processing and Preservation 33: 252–263. https://doi.org/10.1111/j.1745-4549.2008.00339.x

Heshmati, A., Ghadimi, S., Ranjbar, A. and Khaneghah, A.M., 2019. Changes in aflatoxins content during processing of pekmez as a traditional product of grape. LWT-Food Science and Technology 103: 178–185. https://doi.org/10.1016/j.lwt.2019.01.001

İnan, M.S., 2012. The effects of potassium bicarbonate application by spraying method on drying characteristics of Sultani grape variety. MSc Thesis, Gaziosmanpaşa University, Graduate School of Natural and Applied Sciences.

İşçi, B. and Altındişli, A., 2016. *V. vinifera* L.cv. "Sultaniye"nin Polietilen Tünel Tipi Kurutucu ve Geleneksel Yöntemle Kurutulması. Ege Üniversitesi Ziraat Fakültesi Dergisi 53(4): 469–479.

Jouhten, P., Ponomarova, O., Gonzalez, R. and Patil, K.R., 2016. *Saccharomyces cerevisiae* metabolism in ecological context. FEMS Yeast Resources 16(7): fow080. https://doi.org/10.1093/femsyr/fow080

Kalkışım, Ö. and Özdemir, M., 2012. Pestil ve Köme Teknolojisi. Available at: https://kutuphane.gumushane.edu.tr/media/uploads/kutuphane/files/pestil_kome.pdf (accessed 30 May 2021).

Kamiloglu, S. and Capanoglu, E., 2014. In vitro gastrointestinal digestion of polyphenols from different molasses (pekmez) and leather (pestil) varieties. International Journal of Food Science 49(4): 1027–1039. https://doi.org/10.1111/ijfs.12396

Karagöz, Ş. and Güllü, M., 2017. Türk Kültüründe Kış Hazırlıkları; Turşu Türlerinin ve Üretim Metotlarının Değerlendirilmesi. Al-Farabi International Journal of Social Sciences 2: 95–105.

Kara, O.O. and Küçüköner, E., 2019. Geleneksel bir meyve çerezi: Pestil. Akademik Gıda 17(2): 260–268. https://doi.org/10.24323/akademik-gida.613621

Kaya, C., Cangi, R., Yıldız, M. and Saraçoğlu, O., 2009. Tokat Üzüm Tarhanası. In: II. Geleneksel Gıdalar Sempozyumu, Van, Turkey, 27–29 May 2009, pp.72–75.

Kaya, S. and Kahyaoglu, T., 2005. Thermodynamic properties and sorption equilibrium of pestil (grape leather). Journal of Food Engineering 71(2): 200–207. https://doi.org/10.1016/j.jfoodeng.2004.10.034

Kaya, Z., 2017. Şarap üretimi ve kalite. Aydın Gastronomy 1(2): 17–30.

Kayikcioglu, S. and Arikan, U., 2020. An overlook to world wine industry. Press Academia Procedia 11(1): 219–223. https://doi.org/10.17261/Pressacademia.2020.1271

Kaymul, M., 2021. Processing some fruits with pestil and determination of some physiochemical properties. MSc Thesis, Pamukkale University, Graduate School of Natural and Applied Sciences.

Keleş, P.Ş., Gürses, M. and Erdoğan, A., 2019. Geleneksel şeker kamışı pekmezi. Türk Doğa ve Fen Dergisi 8(1): 43–46.

Kesmez, M. and Aydın, M.S., 2014. Rakı Cep Kitabı. İstanbul: Overteam Yayınları. ISBN: 978–605–5058–01–2.

Kıralan, M. and Gündoğdu, M., 2021. Dut Türlerine Ait Meyvelerin Organik Asit ve C vitamini İçerikleri Üzerine Farklı Kurutma Tekniklerinin Etkisi. IJAWS 7(3): 404–411. https://doi.org/10.24180/ijaws.990049

Kocaadam, B. and Acar-Tek, N., 2016. Ekmek, bira, şarap ve yoğurdun orijinleri ve tarihsel süreçleri. Beslenme ve Diyet Dergisi 44(3): 272–279.

Koçarslan, B., 2002. Determination of numbers and activities of dominant species in anaerobic reactors treating alcohol distillery effluents. MSc Thesis, Istanbul Technical University, Institute of Science and Technology.

KOP (Konya Ovası Projesi), 2021. Üretici Rehberi-Üzüm. Available at: http://www.kop.gov.tr/upload/dokumanlar/229.pdf (accessed 29 May 2021).

Köprüalan, Ö., Bodruk, A. and Ertekin, F., 2019. Meyve ve sebzelerin patlatmalı puf kurutma yöntemi ile kurutulması. Akademik Gıda 17(1): 81–88. https://doi.org/10.24323/akademik-gida.544726

Köse, B. and Çelik, S.A., 2017. Dünyada ve Türkiye'de bağcılık turizmi. IRTAD 1(2): 29–34.

Lippi, G., Franchini, M. and Guidi, G.C., 2010. Red wine and cardiovascular health: the "French Paradox" revisited. International Journal of Wine Research, 2; 1–7. https://doi.org/10.2147/IJWR.S8159

MTech, R.J. and Venkatasubramanian, P., 2017 Sugarcane molasses—a potential dietary supplement in the management of iron deficiency anemia. Journal of Dietary Supplements 14(5): 589–598. https://doi.org/10.1080/19390211.2016.1269145

MTRT (The Ministry of Trade: Republic of Türkiye), 2019. 2018 Yılı Çekirdeksiz Kuru Üzüm Raporu. Available at: https://ticaret.gov.tr/data/5d41e59913b87639ac9e02e8/3b2ba45225a22c82570042d14b4de7ef.pdf (accessed 29 May 2021).

Nakilcioğlu-Taş, E., Çakaloğlu, B. and Ötleş, S., 2018. Farklı oranlarda keçiboynuzu unu içeren pestillerin bazı fiziksel, kimyasal ve duyusal özelliklerinin belirlenmesi. Turkish Journal of Food and Agriculture Sciences 6(8): 945–952. https://doi.org/10.24925/turjaf.v6i8.945-952.1445

Otağ, M.R., 2015Determination of some properties and resveratrol content of some grape varieties grown in Denizli Çal region during different ripening period and after drying process. PhD Thesis, Pamukkale University, Graduate School of Natural and Applied Sciences.

Otles, S. and Ozyurt, V.H., 2019. Probiotic and prebiotic beverages. Grumezescu, A.M. and Holban, A.M. (eds.) In: Functional and medicinal beverages. Academic Press, Massachusetts, pp. 447–458.

Özaltın, K.E. and Çağındı, Ö., 2018. Üzüm Pestili Üretiminde Üzüm Posasının Kullanım. Bahçe 47(Özel Sayı 1): 321–326.

Özden, S.Y., 2015. Alkolizm sebep ve sonuçları. Nobel Akademik Yayıncılık, Ankara, Turkey. ISBN: 978–605–320–161–8.

Öztürk, F., 2020. Midye Örneklerinde Vibrio parahaemolyticus'a Karşı Koruk, Limon ve Nar Suyunun Antibakteriyel Etkisi. Gıda 45(3): 506–516. https://doi.org/10.15237/gida.GD20024

Piergiovanni, L., 2012. Packaging and shelf life of fermented foods. Italian Journal of Food Science 24(4): 9–15.

Semerci, G. and Cangi, R., 2020. Determination of yield and leaf characteristics of edible leaves collected from grapevine nursery parcel. Turkish Journal of Food and Agriculture Science 8(3): 538–546. https://doi.org/10.24925/turjaf.v8i3.538-546.2866

Shojaee-Aliabadi, S., Hosseini, S.M., Tiwari, B., Hashemi, M., Fadavi, G. and Khaksar, R., 2013. Polyphenols content and antioxidant activity of Ghure (unripe grape) marc extract: influence of extraction time, temperature and solvent type. International Journal of Food Science and Technology 48(2): 412–418. https://doi.org/10.1111/j.1365-2621.2012.03203.x

Sormaz, Ü., Onur, N., Güneş, E. and Nizamlıoğlu, H.F., 2019. Türk mutfağı geleneksel ürünlerinde yöresel farklılıklar: Tarhana örneği. Aydın Gastronomy 3(1): 1–9.

Sun, Y., Li, E., Qi, X. and Liu, Y., 2015. Changes of diversity and population of yeasts during the fermentations by pure and mixed inoculation of *Saccharomyces cerevisiae* strains. Annals of Microbiology 65(2): 911–919. https://doi.org/10.1007/s13213-014-0934-8

Süren, T. and Kızıleli, M., 2021. Geleneksel Türk İçecekleri. AHBVTF Dergisi 24(1): 46–71. https://doi.org/10.34189/tfd.24.01.003

Şen, L., 2014. Occurance of ochratoxin A in raisins and effect of storage condition on ochratoxin A level. PhD Thesis, Pamukkale University, Graduate School of Natural and Applied Sciences.

Şenuyar, C., Demirbaş, N. and Saygın, Ö., 2014. Türk şarap sektörünün mevcut durumu ve sektörün gelişimini sınırlayan faktörlerin değerlendirilmesi. Bursa Uludağ Üniversitesi Ziraat Fakültesi Dergisi 28(2): 1–12.

Şüyün, F., 2020. Zahmetli ve değerli: Kuru üzüm. Available at: https://www.dunya.com/saglik/zahmetli-ve-degerli-kuru-uzum-ozel-haberi-435086 (accessed 4 September 2022).

Tamer, C.E., Ömeroğlu, P.Y. and Çopur, Ö.U., 2019. Functional and traditional nonalcoholic beverages in Turkey. Grumezescu, A.M. and Holban, A.M. (eds.) In: Non-alcoholic beverages. Woodhead Publishing, USA. pp. 483–521. https://doi.org/10.1016/B978-0-12-815270-6.00015-3

TFC (Turkish Food Codex), 2017a. Turkish food codex communiqué on distilled alcoholic beverages (Communiqué No: 2016/55). Official Gazette, March 21, 30014. Available at: https://www.resmigazete.gov.tr/eskiler/2017/03/20170321-11.htm (accessed 5 September 2022).

TFC (Turkish Food Codex), 2017b. Turkish food codex communiqué on grape molasses (Communiqué No: 2017/8). Official Gazette, June 30, 30110. Available at: https://www.resmigazete.gov.tr/eskiler/2017/06/20170930-24.htm (accessed 5 September 2022).

Tokatlı, M., Dursun, D., Arslankoz, N., Şanlıbaba, P. and Özçelik, F., 2012. Turşu üretiminde laktik asit bakterilerinin önemi. Akademik Gıda 10(1): 70–76.

Tosun, H., Yıldız, H., Obuz, E. and Seçkin, A.K., 2014. Ochratoxin A in grape pekmez (grape molasses) consumed in Turkey. Food Additives and Contaminants: Part B 7(1): 37–39. https://doi.org/10.1080/19393210.2013.833298

TSI (Turkish Standards Institution), 2011. Turkish Seedless Raisins Standards (TS 3411). Available at: https://intweb.tse.org.tr/Standard/Standard/StandardAra.aspx (accessed 5 September 2022).

Türkben, C., Suna, S., İzli, G., Uylaşer, V. and Demir, C., 2016. Physical and chemical properties of pekmez molasses produced with different grape cultivars. Journal of Agriculture Science 22(3): 339–348. https://doi.org/10.1501/Tarimbil_0000001392

Türkben, C. and Uylaşer, V., 2018. Türkiye'de Farklı Lokasyonlarda Üretilen Pekmezin (Üzüm Pekmezi) Fiziksel ve Kimyasal Özellikleri. Bahçe 47(Özel Sayı 1): 131–139.

Uçar, A., 2015. Geleneksel Türk Tadı: Pekmez. Available at: https://ayk.gov.tr/wp-content/uploads/2015/01/U%C3%87AR-Asl%C4%B1-GELENEKSEL-T%C3%9CRK-TADI-PEKMEZ.pdf (accessed 29 May 2021).

Uysal-Seçkin, G. and Taşeri, L., 2015. Yarı-Kurutulmuş Meyve ve Sebzeler. Pamukkale Üniversitesi Mühendislik Bilimleri Dergisi 21(9): 414–420. https://doi.org/10.5505/pajes. 2015.47560

Yakar, Y., 2018. Çekirdeksiz sofralık üzümlerde pestisit kalıntılarının belirlenmesi. Yüzüncü Yıl Üniv. Tarım Bilimleri Dergisi 28(4): 444–447. https://doi.org/10.29133/yyutbd.453960

Yıldırım, A., 2008. A Research on some of the chemical properties of beet molasses produced traditionally in Kirklareli City. MSc Thesis, Namık Kemal University, Graduate School of Natural and Applied Sciences.

Yıldız, M, Kaya, C, Cangi, R, Özgen, M, Saraçoğlu, O, Tokbaş, H., et al., 2010. Beyaz ve Siyah Üzümden Üretilen Tokat Tarhanasının Bazı Özellikleri. In: 1st International Symposium on "Traditional foods from Adriatic to Caucasus," Tekirdağ-Turkey, 15–17 April 2010, pp. 524–526.

Yildiz, O., 2013. Physicochemical and sensory properties of mulberry products: Gümüşhane pestil and köme. Turkish Journal of Agriculture and Forestry 37(6): Article 11. https://doi.org/10.3906/tar-1301-41

Yildiz, O. and Boyraci, G.M., 2020. Production and some quality parameters of sugar beet sweets (Pestil and Köme). Sugar Technology 22(5): 842–852. https://doi.org/10.1007/s12355-020-00832-z

Yildiz, O., Kara, M. and Dinç, S., 2015. Production and some properties of traditional sugar beet pekmez from Turkey. International Sugar Journal 117(1394): 46–53.

Yildiz, O., Yurt, B., Toker, O.S., Ceylan, M.M., Yilmaz, M.T. and Bastürk, A., 2015. Pasting, textural and sensory characteristics of the kofter, a fruit-based dessert: effect of molasses and water concentration. International Journal of Food Engineering 11(3): 349–358. https://doi.org/10.1515/ijfe-2014-0313

Yılmaz, D.M., 2022. Determination of tryptophan pathway metabolites in some fermented products. MSc Thesis, Trakya University, Institute of Natural and Applied Sciences.

Yılmaz, İ. and Akay, E., 2020. Özel ilgi turizminde şarap turizmi. Turkish Journal of Scientific Reviews 13(2): 83–94.

Yolcu, M.A., 2018. Nevşehir Yöresinde Ailelerin Geleneksel Kış Hazırlıkları. Kültür Araştırmaları Dergisi 1(1): 7–22.

Zhang, Y., 2010. Allyl isothiocyanate as a cancer chemopreventive phytochemical. Molecular Nutrition and Food Research 54(1): 127–135. https://doi.org/10.1002/mnfr.200900323