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ESTIMATION OF SOME CHEMICAL AND NUTRITIONAL CHARACTERISTICS OF *PISTACIA TEREBINTHUS* L. FRUITS

MEHMET KÖTEN[*] AND MERYEM KUZUCU[1]

Department of Nutirition and Dietetics, Kilis 7 Aralık University, Kilis, Turkey

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Abstract

In this study; some quality characteristics of menengic (*Pistacia terebinthus* L.) fruit, which has a high potential to be a functional product in terms of its components, were investigated. For this purpose, moisture, ash, protein, fat, energy, total dietary fiber, total phenolic content, antioxidant activity and color (L*, a*, b*) of menengic fruits were analyzed. The moisture, ash, protein and fat contents of menengic fruit were 5.89, 3.02, 10.08 and 40.27%, respectively. As a result of the analyses, the total dietary fiber content was determined as 4.98%, the total phenolic content was 652.82 mgGAE/100g, antioxidant activity value was 92.38% and the phytic acid content was found to be 4.02 mg/g. The results showed that menengic fruit can be a valuable source for food uses, especially regarding the phytochemical components, protein, fat and fiber.

Pistacia terebinthus L. (Menengic, known in Turkey) is a member of the Anacardiaceae family, native to Asia and the Mediterranean, and is a slow-growing fruit species that grows wild in the south and southeast parts of Turkey. It is also seen to be grown in the Canary Islands, Morocco, Portugal, Greece, North Africa, the Arabian Peninsula and Western Asia (Uyar and Abdulrahman 2020). Different species of *Pistacia* are used as food, medicine and ornamental plants (Kallis *et al.* 2022). *Pistacia terebinthus* is among the 20 *Pistacia* species commonly found in Turkey and other Mediterranean countries. It has attracted the attention of researchers due to its antioxidant, phenolic content, anti-inflammatory, antipyretic and antiseptic properties, and fat content of its seeds. There are many studies on the volatile components obtained from whole fruits, flowers or leaves and branches of *P. terebinthus* (Gogus *et al.* 2011). Menengic has been used in traditional medicine since Antiquity, and its leaves and resin have stimulating, diuretic and astringent properties (Bellifa *et al.* 2021). It has been shown that dried fruit extracts of *P. terebinthus* have some hypolipidemic effects without toxic effects (Bakirel *et al.* 2003). The fruits of *P. terebinthus* improved the lipid profile and caused reduction in atherosclerosis (Edwards *et al.* 1999). Epilupeol and epilupeol acetate in the resin of *Pistacia* species had antiviral activity (Özçelik *et al.* 2005).

In the literature review, studies on the chemical composition and nutritional content of *P. terebinthus* fruits are very limited, and these studies are generally the post-harvest products of *P. terebinthus*; coffee, fat, resin, bark and leaves were focused on. Therefore, in this study nutritional and color properties of *P. trebinthus* fruit grown in Siirt, Turkey were investigated.

Pistacia terebinthus fruits were collected from a local spice shop in Siirt, Turkey. Fruits were kept at room temperature in polypropylene bags at the laboratory. The healthy and mature grains were ground into a puree in a crushing mill (Bastak brand, model no: 1600, Turkey). The ground samples were stored in refrigeration conditions (+4 °C).

AACC methods were used to determine moisture (method 44-19), ash (method 08-01), and protein (method 46-12) and fat (method 30-25) contents (AACC 2010).

*Author for correspondence: <mehmetkoten@kilis.edu.tr>. [1]Department of Horticulture, Kilis 7 Aralık University, Kilis, Turkey.

Total dietary fiber (TDF) was assayed following the method of Köten (2021) and a test kit (Megazyme International Ireland Ltd., Bray Business Park, Bray, Co. Wicklow, IRELAND) was used in this experiment. The results are calculated on dry matter (%). Total phenolic content (TPC) was determined using the Folin-Ciocalteu reagent according to the method of Köten (2021). The results were expressed as mg gallic acid equivalent (GAE) amount per 100 grams of sample.

Antioxidant activity method was based on the spectrophotometric measurement of the reduction in color as a result of the destruction of the DPPH (2,2-diphenyl-1-picrylhdrazyl) radical, a stable pink compound (Köten 2021). The results were calculated using the following equation.

Inhibition rate of DPPH radical (%) = $[(A_{Blank}-A_{Sample})/A_{Blank}] \times 100$

Here; A_{Blank} = Absorbance of the blank, A_{Sample} = Absorbance of the sample.

Phytic acid method based on the spectrophotometric measurement of the color formed due to bipyridine by the amount of Fe^{+3}, precipitated in the form of phytic acid. The phytic acid concentration was calculated by taking into account the amount of Fe^{+3} that bound to the phytic acid and precipitates (Köten 2021). The energy value was analyzed following the method of Elsebaie and Mostafa (2018).

Where, Carbohydrate (%) = [100-(moisture + fat + protein + ash + fiber)]

Energy (kcal) = (fat×9)+(protein×4)+(carbohydrate×4)

Color measurements were made with Hunterlab MiniScan EZ (Reston, Virginia, USA) model color measuring device and values were expressed according to CIALAB measurement system in this device. On the HunterLab color scale, L*=0 (black), L*=100 (white); -a* (green), +a* (redness); -b* (blueness) and +b* (yellowness) values were read at daylight (D65/10°) setting. 1000 grain weight and width/length ratio was made according to the method reported by Özcan (2004).

The results showed that the moisture, ash, protein and fat contents of menengic fruit were 5.89, 3.02, 10.08 and 40.27%, respectively (Table 1). The weight of a thousand fruits and the width/length ratio of the fruit were determined as 80.86 g and 0.92, respectively. The moisture, protein, ash, and width/length ratio were observed to be higher than those reported by Kizil and Turk (2010), while the values for fat content and weight of 1000 fruits were found to be lower. The ash content and the width/length ratio were found to be similar to those reported by Özcan (2004) for terebinth fruits, while the moisture and energy values were found to be lower. These variations in the contents are thought to be caused by the region in which the terebinth fruits are cultivated and the climatic conditions of that region. Looking at the color values of menengic fruits from Table 1, it was seen that the L*, a* and b* values were 15.44, 3.60, and 11.92, respectively. The lower a* redness values of the fruits suggest that their color is primarily green or close to green. The decrease in L* lightness values from 100 towards zero indicates that the fruit is dark in color. The color values observed in this study were found to be different from those reported by Altuntaş *et al.* (2020). These differences are believed to be due to the region where the fruit was grown and the climatic conditions of that area.

As a result of the analysis, the total dietary fiber content of menengic fruit was determined as 4.98% (Table 2). Dietary fiber is one of the food components resistant to digestive enzymes and is mainly found in grains, fruits and vegetables. Due to its functional properties, dietary fiber has many positive effects on health. The quality of the consumed part of the plant, its maturity level and storage conditions are among the factors affecting the nutritional fiber composition of plant foods (Dülger and Gahan 2011). There are very few studies in the literature regarding the total dietary fiber content of *P. terebinthus*. In their study, Köten and Ünsal (2022) found the dietary fiber content of terebinth fruits to be 4.28%.

Many plant-derived foods not only contain phenolic substances, which are the strongest antioxidants, but also contribute to the body's defense against oxidative damage. These compounds not only protect food against spoilage, but also provide antioxidant substances to human body as a result of consumption (Güleşci and Aygül 2016). Total phenolic substance and antioxidant activity values, which are very important for health, were determined as 652.82 and

Table 1. Physical and chemical characteristics of terebinth fruits.

Characteristics	Value
Moisture (%)	5.89 ± 0.68
Ash (%)	3.02 ± 0.04
Protein (%)	10.08 ± 0.08
Fat (%)	40.27 ± 0.66
L*	15.44 ± 0.24
a*	3.60 ± 0.16
b*	11.92 ± 0.56
Weight of 1000 fruits (g)	80.86 ± 0.82
Width/length ratio	0.92 ± 0.05

Values are mean ± standard deviation (n = 3).

92.38 mg/100 g, respectively (Table 2). The results obtained are similar to the findings reported by Köten and Ünsal (2022). Phytic acid is considered an antinutrient because it has a strong chelating capacity and prevents their absorption by binding minerals. However, studies conducted in recent years have also shown that phytic acid has anticarcinogenic and antimutagenic properties (Şenlik and Alkan 2021). The phytic acid content of menengic fruit was determined as 4.02 mg/g. There is very limited data available in the literature regarding the phytic acid content of pistachio fruits. The phytic acid content observed in this study (4.02 mg/g) was higher than the value of 2.48 mg/g reported by Köten (2021). In addition, in the energy calculation made, it was seen that the fruit of menengic had an energy value of 547.49 kcal (Table 2). This value was found to be lower than the value (618.90 kcal) reported by Özcan (2004).

Table 2. Nutritional characteristics of terebinth fruits.

Characteristics	Value
TDF (%)	4.98 ± 1.02
TPC (mgGAE/100g)	652.82 ± 2.75
Antioxidant activity (%)	92.38 ± 0.96
Phytic acid (mg/g)	4.02 ± 0.44
Energy (kcal)	547.49 ± 12.46

Values are mean ± standard deviation (n = 3).

As a result, it is thought that menengic fruit can be a valuable source for food uses, especially in terms of phytochemical components, protein, fat and fiber. However, more studies are needed to determine in detail the other chemical, physical and mechanical properties of menengic fruits to be harvested from different locations. These studies will contribute significantly to both the use of menengic fruit as food in various ways in terms of human health and the more efficient use of machines and systems used in post-harvest production technologies.

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