Antioxidants, polyphenols, and health benefits of cherry laurel: a review

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Abstract

Cherry laurel (dark purple or black when mature) is a popular summer fruit in the Black Sea region of Turkey. It has been gaining popularity as a valuable source of healthy fruit over the last two decades and is a good source of nutrients and polyphenols together with high antioxidant activity. This contribution discusses nutritional characteristics, antioxidants, polyphenols, and health benefits of cherry laurel. Where available, comparisons are made with other cherry fruits (Cornelian, sweat, and sour) and blueberry. Although several health benefits of this fruit and its seeds have been known as home-made and traditional medicine, in vivo and well-designed human clinical trials are scarce. Therefore, additional carefully-designed human clinical trials are needed to validate the health benefits of this fruit.

Keywords: Cherry laurel; Nutrients; Antioxidants; Polyphenols; Health benefits.

1. Introduction

Cherry laurel (*Laurocerasus officinalis* Roem.) belongs to the Rosacea family and is a popular fruit (dark purple or black when mature), mainly distributed and cultivated in the coasts of the Black Sea region of Turkey and is locally called “Taflan” or “Karayemis” (Alasalvar et al., 2005; Liyana-Pathirana et al., 2006; Alasalvar, 2016). It is native to some Asian countries, the Caucasus, Iran, some Mediterranean countries, Bulgaria, Serbia, and Western Europe (Kolayli et al., 2003; Sahan et al., 2012). Cherry laurel is mostly consumed as fresh fruit in local markets but may also be dried, pickled, and processed into syrup (known as pekmez), jam, and marmalade. Besides its use for food, both fruit and seeds of cherry laurel are well-known as traditional medicine in Turkey and have been used for many years for the treatment of stomach ulcer, digestive system complaints, bronchitis, eczemas, hemorrhoids, diuretic agent, wound healing, and hyperglycemia, among others (Baytop, 1984; Yeşilada et al., 1999; Kolayli et al., 2003; Colak et al., 2005; Halilova and Ercisli, 2010; Turan et al., 2013; Alasalvar, 2016; Ayla et al., 2019).

This review article highlights nutritional characteristics, antioxidants, polyphenols, and health benefits of cherry laurel.

2. Nutritional characteristics of cherry laurel

The proximate compositions of cherry laurel are summarized in Table 1 (Kolayli et al., 2003; Alasalvar et al., 2005; Ozturk et al., 2017; Turkish Food Composition Database, 2020). Cherry laurel is a nutrient-dense fruit. Carbohydrate (13.96–20.23 g/100 g) is the predominant component, followed by small amounts of protein and lipid. It contains 1.61–4.02 g/100 g dietary fibre and 11.38–11.51 g/100 g sugar. Glucose is the predominant sugar, followed with fructose, in cherry laurel. With respect to minerals, cherry laurel is an excellent source of manganese (2.27–2.42 mg/100 g). The recommended dietary allowance (RDA) of manganese is 2.3 and...
Table 1. Nutritional characteristics of cherry laurel (per 100 g)

| Nutrient            | Unit | Cherry laurel fruit | References                                                                                   |
|---------------------|------|---------------------|---------------------------------------------------------------------------------------------|
| **Proximate composition** |      |                     |                                                                                             |
| Water               | g    | 77.28–81.21         | Alasalvar et al. (2005); Turkish Food Composition Database (2020)                          |
| Energy              | kcal | 74–76               |                                                                                             |
| Protein             | g    | 0.54–1.59           |                                                                                             |
| Lipid (fat)         | g    | 0.10–0.56           |                                                                                             |
| Ash                 | g    | 0.43–0.79           |                                                                                             |
| Carbohydrate        | g    | 13.96–20.23         |                                                                                             |
| Dietary fiber       | g    | 1.61–4.02           |                                                                                             |
| **Sugars**          | g    | 11.38–11.51         |                                                                                             |
| Xylose              | g    | 0.19–0.23           |                                                                                             |
| Arabinose           | g    | 0.07–0.08           |                                                                                             |
| Fructose            | g    | 4.84–5.16           |                                                                                             |
| Glucose             | g    | 5.43–5.88           |                                                                                             |
| Sorbitol            | g    | 1.51–4.80           |                                                                                             |
| Sucrose             | g    | tr                  |                                                                                             |
| **Minerals**        |      |                     |                                                                                             |
| Calcium             | mg   | 14.8–53             | Kolayli et al. (2003); Turkish Food Composition Database (2020)                             |
| Copper              | mg   | 0.08–0.09           |                                                                                             |
| Iron                | mg   | 0.44–0.83           |                                                                                             |
| Magnesium           | mg   | 17.9–27.0           |                                                                                             |
| Manganese           | mg   | 2.27–2.42           |                                                                                             |
| Phosphorus          | mg   | 21–22               |                                                                                             |
| Potassium           | mg   | 157–222             |                                                                                             |
| Selenium            | µg   | –                   |                                                                                             |
| Sodium              | mg   | 1.0–5.5             |                                                                                             |
| Zinc                | mg   | 0.16–0.37           |                                                                                             |
| **Vitamins**        |      |                     |                                                                                             |
| Folate (DFE)        | µg   | –                   | Ozturk et al. (2017); Turkish Food Composition Database (2020)                               |
| Niacin              | mg   | 0.20–0.35           |                                                                                             |
| Pantothenic acid    | mg   | –                   |                                                                                             |
| Pyridoxine (B-6)    | mg   | 0.06–0.07           |                                                                                             |
| Riboflavin          | mg   | 0.02–0.03           |                                                                                             |
| Thiamin             | mg   | –                   |                                                                                             |
| Vitamin A (RAE)     | µg   | tr-3.0              |                                                                                             |
| Vitamin C           | mg   | 2.00–204            |                                                                                             |
| Vitamin E (ATE)     | mg   | –                   |                                                                                             |
| Vitamin K           | µg   | –                   |                                                                                             |
| **Carotenoids**     |      |                     |                                                                                             |
| Beta-carotene       | µg   | tr-38               | Turkish Food Composition Database (2020)                                                    |
| Lutein              | µg   | 23–35               |                                                                                             |

Abbreviations: ATE, alpha-tocopherol equivalents; DFE, dietary folate equivalents; RAE, retinol activity equivalents; tr, trace.
It is also interesting to note that cherry laurel is rich in ascorbic acid (2.0–20.4 mg/100 g). Considering RDA values, consuming approximately 100 g fresh cherry laurel supplies 100% of manganese and vitamin C daily.

### 3. Antioxidants in cherry laurel

Antioxidant activities of cherry laurel have been reported using various assays. These include 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), beta-carotene bleaching (BCB), copper reducing antioxidant capacity (CUPRAC), 2,2-diphenyl-1-picrylhydrazyl (DPPH), ferric reducing antioxidant power (FRAP), hydrogen peroxide scavenging, low-density lipoprotein (LDL) oxidation, oxygen radical absorbance capacity (ORAC), and superoxide radical inhibitory assays (Table 2).

The antioxidant activities of cherry laurel vary according to the type of antioxidant assay used (Table 2). The antioxidant capacities of cherry laurel, determined using ABTS, DPPH, FRAP, and ORAC assays, were 23.21, 43.54, 14.74, and 3,633–7,996 μmol TE/g, respectively (Alasalvar et al., 2005; Celep et al., 2012; Ozturk et al., 2017). Cherry laurel contains much higher contents of total anthocyanins (40.62–378 mg C3GE/100 g fw) and higher amount of total phenolics (275–695 mg GAE/100 g fw) than that of blueberry cultivars (Rodrigues et al., 2010). In terms of total carotenoids, cherry laurel has 2-fold higher total carotenoids (254–261 μg/100 g) than that of sweet cherry (123 μg/100 g) and blueberry (112 μg/100 g).
μg/100 g) (USDA, 2019). Thus, cherry laurel may be considered as a rich source of polyphenols.

4. Polyphenols in cherry laurel

To the best of our knowledge, limited polyphenols (anthocyanins, flavan-3-ols, flavonols, phenolic acids, and procyanidins) have been reported in cherry laurel (Table 4). Phenolic acids (11 in total) are the main polyphenols reported in cherry laurel. Chlorogenic acid is the most abundant phenolic acid, followed by caffeic, p-coumaric, syringic, and gallic acids. Besides, o-coumaric, ferulic, p-hydroxybenzoic, protocatechuic, protocatechuic acid ethyl ester, and vanillin acids are also present (Alasalvar et al., 2005; Karahalil & Şahin, 2011; Karabegović et al., 2014; Ozturk et al., 2017; Bayrambaş et al., 2019). Ayaz et al. (1997) reported the presence of protocatechuic, p-hydroxybenzoic, vanillin, caffeic, and p-coumaric acids in several cultivated and wild cherry laurel varieties where vanillin acid was the most abundant phenolic acid.

Four anthocyanins have been reported in cherry laurel (Table 4). Keracyanin chloride was the most abundant anthocyanins, as reported in a a recent study (Bayrambaş et al., 2019). Besides, cyanidin-3-glucoside, cyanidin-3-rutinoside, and pelargonidin-3-glucoside were also detected in cherry laurel (Karahalil and Şahin, 2011). Capanoglu et al. (2011) reported the total flavan-3-ol content in cherry laurel was 1,089 mg/100 g dw where (-)-epigallocatechin gallate and (-)-epigallocatechin were the most abundant flavan-3-ols. Besides, kaempferol was the most abundant flavonols detected in cherry laurel, followed by quercetin-3-glucoside and rutin. Cherry laurel also contains procyanidin B2 (14.4–52.4 mg/100 g fw) (Bayrambaş et al., 2019). Figure 1 shows chemical structures of the phenols and polyphenols present in cherry laurel.

5. Health benefits of cherry laurel

Since cherry laurel has high contents of phenolic acids, anthocyanins, and flavan-3-ols, it is able to provide health benefits beyond basic nutrition (Karahalil and Şahin, 2011; Bayrambaş et al., 2019). Cherry laurel renders beneficial effects on human health such as...
neuroprotective, anti-diabetic, dimethoate-induced liver damage, antioxidative stress, anti-microbial, wound healing, and cytotoxic activities (Orhan and Akkol, 2011; Orhan et al., 2015; Demir et al., 2017; Eken et al., 2017; Ayla et al., 2019; Bayrambaş et al., 2019). These health effects of cherry laurel are reviewed below.

Orhan and Akkol (2011) evaluated the neuroprotective potential of cherry laurel extract. Results demonstrated that dichloromethane extract of cherry laurel (100 and 200 µg/mL) showed 16.3 and 19% inhibitory activity on acetylcholinesterase, respectively, but had no effect on the activity of butyrylcholinesterase enzyme. These enzymes play important roles in the pathogenesis of Alzheimer’s disease (Orhan and Akkol, 2011). More research should be conducted to ascertain the neuroprotective potential of cherry laurel.

Orhan et al. (2015) determined the effect of ethanolic extract of pitted and non-pitted cherry laurel on blood glucose levels in healthy glycemic, glucose-loaded, and streptozotocin-induced diabetic rats. Results demonstrated that pitted extract of cherry laurel (500 and 1,000 mg/kg) showed a notable hypoglycemic effect in healthy male rats. However, pitted cherry laurel extract (1,000 and 2,000 mg/kg) had weak inhibitory effect on blood glucose levels in glucose-loaded rats. All cherry laurel extracts had no effect on blood glucose levels in streptozotocin-induced diabetic rats (Orhan et al., 2015).

More recently, Eken et al. (2017) evaluated the protective role of methanolic extract of cherry laurel on blood glucose levels in healthy glycemic, glucose-loaded, and streptozotocin-induced diabetic rats. Results demonstrated that pitted extract of cherry laurel (500 and 1,000 mg/kg) showed a notable hypoglycemic effect in healthy male rats. However, pitted cherry laurel extract (1,000 and 2,000 mg/kg) had weak inhibitory effect on blood glucose levels in glucose-loaded rats. All cherry laurel extracts had no effect on blood glucose levels in streptozotocin-induced diabetic rats (Orhan et al., 2015).

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The antimicrobial effects of methanolic extract of cherry laurel against five microbial strains including Gram-positive bacteria (Bacillus cereus and Staphylococcus aureus) and Gram-negative bacteria (Escherichia coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa) was determined by Ayla et al. (2019), using agar diffusion method. Cherry laurel extract exhibited potential inhibitory activities against growth of the five tested human pathogenic microbes where there were no significant differences between the antimicrobial effects between Gram-positive and Gram-negative bacteria. In addition, cherry laurel extract was also investigated for wound healing effects in excisional wound mice model for ten days. Results demonstrated that topical application of cherry laurel extract on wound area accelerated wound contraction rate and enhanced epithelialization and angiogenesis in the wound healing compared to the control group (Ayla et al., 2019). The authors postulated that the antioxidant and antimicrobial effects of cherry laurel contributed to the wound healing effects.

Finally, Bayrambaş et al. (2019) investigated the cytotoxic effect of methanolic extract of three cherry laurel varieties on HCT 116 human colon cancer cell line. Treatment with 61K04 variety prevented the growth of cancer cells (55% apoptosis), followed by 61K05 (27% apoptosis), and 55K06 (36.9% apoptosis) varie-
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ties. In another study, Demir et al. (2017) reported that dimethyl sulphoxide extract of cherry laurel exhibited potential cytotoxic effect on human colon cancer cells (WiDr) and human lung cancer cells (A549) in vitro. However, cherry laurel extract did not show any effect on the cell viability of human prostate cancer cells (PC-3), hepatocarcinoma cells (HepG2), cervix adenocarcinoma cells (HeLa), and breast adenocarcinoma cells (MCF-7). These findings should be validated in animal models to provide better indication of the use of cherry laurel extract in preventing severity of various types of cancer.

6. Conclusion

The available data to date reveal that cherry laurel is rich in antioxidant phenolics and possesses strong radical scavenging activity. It is a good source of nutrients and polyphenols (mainly phenolic acids, anthocyanins, and flavan-3-ols). Limited data exist in the literature on the detailed polyphenol profiles of cherry laurel. Further research is warranted to identify other polyphenols present in cherry laurel such as anthocyanins, ellagitannins, and proanthocyanidins as well as to addressing its health benefits using well-designed human clinical trials.

References

Alasalvar, C. (2016). Cherry laurel syrup (Pekmez). In: Shahidi, F., and Alasalvar, C. (Ed.). Handbook of functional beverages and human health. CRC Press, Taylor & Francis Group, Boca Raton, FL, pp. 187–192.

Alasalvar, C., Al-Farsi, M., and Shahidi, F. (2005). Compositional characteristics and antioxidant components of cherry laurel varieties and pekmez. J. Food Sci. 70: 547–552.

Ayaz, F.A., Kadioğlu, A., Reunanen, M., and Var, M. (1997). Phenolic acid and fatty acid composition in the fruits of Laurocerasus officinalis Roem. and its cultivars. J. Food Compos. Anal. 10: 350–357.

Ayla, S., Okur, M.E., Günsül, M.Y., Özdemir, E.M., Çiçek Polat, D., Yoltaş, A., Biperoğlu, Ö., and Karahüseyinoğlu, S. (2019). Wound healing effects of methanol extract of Laurocerasus officinalis Roem. Biotechn. Histochem. 94: 180–188.

Bayrambaş, K., Çakır, B., and Gülsener, I. (2019). Influence of phenolic profile on the RP-HPLC detection and anti-carcinogenic potential of cherry laurel extracts from Black Sea Region-Turkey. Microchem. J. 149: 103963.

Baytop, T. (1984). Therapy with medicinal plants in Turkey (past and present). Istanbul University Publication No. 3255, Istanbul, Turkey.

Capanoglu, E., Boyacıoglu, D., de Vos, R.C., Hall, R.D., and Beekwilder, J. (2011). Procyanidins in fruit from sour cherry (Prunus cerasus) differ strongly in chain length from those in laurel cherry (Prunus laurocerasus) and Cornelian cherry (Cornus mas). J. Berry Res. 1: 137–146.

Celep, E., Aydın, A., and Yesilada, E. (2012). A comparative study on the in vitro antioxidant potentials of three edible fruits: Cornelian cherry, Japanese persimmon and cherry laurel. Food Chem. Toxicol. 50: 3329–3335.

Chaovanakrit, A., and Wrolstad, R.E. (2004). Total anthocyanins and total phenolics of fresh and processed cherries and their antioxidant properties. J. Food Sci. 69: FCT67–FCT72.

Colak, A., Özen, A., Dincer, B., Güner, S., and Ayaz, F.A. (2005). Diphenolases from two cultivars of cherry laurel (Laurocerasus officinalis Roem.) fruits at an early stage of maturation. Food Chem. 90: 801–807.

Demir, S., Turan, I., Demir, F., Demir, E.A., and Aiyazicigil, Y. (2017). Cytotoxic effect of Laurocerasus officinalis extract on human cancer cell lines. Marmara Pharm. J. 21: 121–126.

DRTs. (2000). DRTs. Dietary reference intakes for vitamin C, vitamin E, selenium, and carotenoids. The National Academies Press, Washington, DC.

DRTs. (2001). DRTs. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. The National Academies Press, Washington, DC.

Eken, A., Endirlik, B.U., Bakir, E., Baldeadir, A., Yay, A.H., and Canturk, F. (2017). Effect of Laurocerasus officinalis Roem. (cherry laurel) fruit on dimethoate induced hepatotoxicity in rats. Kafkas Univ. Vet. Fak. Derg. 23: 779–787.

Hagerman, A.E., Riedl, K.M., Jones, G.A., Sovik, K.N., Ritchard, N.T., Hartzfeld, P.W., and Riechel, T.L. (1998). High molecular weight plant polyphenolics (tannins) as biological antioxidants. J. Agric. Food Chem. 46: 1887–1892.

Hallilova, H., and Erçislı, S. (2010). Several physic-chemical characteristics of cherry laurel (Laurocerasus officinalis Roem.) fruits. Biotechnol. Biotechnol. Eq. 24: 1970–1973.

Jerez, M., Selga, A., Sineiro, J., Torres, J.L., and Nunez, M.J. (2007). A comparison between dark extracts from Pinus pinaster and Pinus radiata: Antioxidant activity and procoenzymes composition. Food Chem. 100: 439–444.

Karabegović, I.T., Stojičević, S.S., Veličković, D.T., Todorović, Z.B., Nikolić, N.Č., and Lazić, M.L. (2014). The effect of different extraction techniques on the composition and antioxidant activity of cherry laurel (Prunus laurocerasus) leaf and fruit extracts. Ind. Crops Prod. 54: 142–148.

Karahil, F., and Şahin, H. (2011). Phenolic composition and antioxidant capacity of cherry laurel (Laurocerasus officinalis Roem.) sampled from Trabzon region, Turkey. Afr. J. Biotechnol. 10: 16293–16299.

Kolaylı, S., Küçük, M., Duran, C., Candan, F., and Dinçer, B. (2003). Chemical and antioxidant properties of Laurocerasus officinalis Roem. (Cherry laurel) fruit grown in the Black Sea region. J. Agric. Food Chem. 51: 7489–7494.

Liyanai-Pathirana, C.M., Shahidi, F., and Alasalvar, C. (2006). Antioxidant activity of cherry laurel (Laurocerasus officinalis Roem.) and its concentrated juice. Food Chem. 99: 121–128.

Orhan, I.E., and Akkol, E.K. (2011). Estimation of neuroprotective effects of Laurocerasus officinalis Roem. (cherry laurel) by in vitro methods. Food Res. Int. 44: 818–822.

Orhan, N., Damlaci, T., Baykal, T., Özek, T., and Aslan, M. (2015). Hypoglycaemic effect of seed and fruit extracts of laurel cherry in different experimental models and chemical characterization of the seed extract. Rec. Nat. Prod. 9: 379.

Oztürk, B., Celik, S.M., Karakaya, M., Karakaya, O., Islam, A., and Yanligac, T. (2017). Storage temperature affects phenolic content, antioxidant activity and fruit quality parameters of cherry laurel (Prunus laurocerasus L.). J. Food Process. Preserv. 41: e12774.

Rodrigues, E., Poerner, N., Rockenbach, I.I., Gonzaga, L.V., Mendes, C.R., and Fett, R. (2010). Phenolic compounds and antioxidant activity of blueberry cultivars grown in Brazil. Ciência. Tecnol. Aliment., Campinas 31: 911–917.

Sahan, Y., Cansev, A., Celik, G., and Cinar, A. (2012). Determination of various chemical properties, total phenolic contents, antioxidant capacity and organic acids in Laurocerasus officinalis fruits. Acta Hortic. 939: 359–366.

Turan, M.I., Turkoğlu, M., Dundar, C., Celik, N., and Suleyman, H. (2013). Investigating the effect of Laurocerasus officinalis fruit extract in type II diabetes induced rats. Int. J. Pharmacol. 9: 373–378.

Turkish Food Compositon Database. (2020). Turkish Food Composition Database. Cherry laurel. Published online at http://www.turkom.gov.tr/food-cherry-laurel-570 (accessed June 20, 2020).

USDA. (2019). USDA FoodData central for SR legacy. Published online at https://ndb.nal.usda.gov (accessed June 20, 2020).

Yesiltas, E., Sezik, E., Honda, G., Takaihi, Y., Takeda, Y., and Tanaka, T. (1999). Traditional medicine in Turkey IX: folk medicine in north-west Anatolia. J. Ethnopharmacol. 64: 195–210.