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Research article

A comparison of the oxidative stress/antioxidant status of pineapple, passion fruit, kiwi, avocado, and dragon fruits

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Abstract

For centuries, people have sought natural remedies for healing and well-being. Natural antioxidants found in medicinal aromatic plants provide a more cost-effective and healthier alternative to synthetic antioxidants. The present study aimed to determine the fruit with the highest antioxidant activity among those grown in our country's climate zone, especially due to the bioactive components of tropical and subtropical fruits. For each type of fruit, we purchased five fresh specimens from the Kahramanmaras and Mersin provinces: pineapple (*Ananas comosus*), passion fruit (*Passiflora ligularis*), kiwi (*Actinidia deliciosa*), dragon fruit (*Hylocereus undatus*), and avocado (*Persea americana*). The fruits were homogenized in a 1.15% KCl solution, and their levels of malondialdehyde (MDA), superoxide dismutase (SOD), and catalase (CAT) were determined using spectrophotometrically. The Lowry method was conducted to measure the protein content of the fruits and was expressed as U/mg protein. *H. undatus* exhibited the highest antioxidant enzyme capacity, followed by *P. ligularis, A. deliciosa, P. americana,* and *A. comosus* (p<0.05). The highest levels of MDA were observed among *A. comosus,* followed by *P. americana*, *A. deliciosa*, *P. ligularis*, and *H. undatus* (p<0.05). There is a growing scientific consensus that antioxidants, especially polyphenolic forms, can help reduce the incidence of certain diseases like cancer, cardiovascular diseases, neurodegenerative disorders, and DNA damage diseases, and may even have anti-aging properties. This study has shown that dragon fruit exhibits a significantly higher level of antioxidant content compared to the rest of the tropical fruits included in the study. Studies on these fruits, which are still very limited in number, can guide our future diet.

Keywords: *Antioxidant; oxidative stress; polyphenol; secondary metabolites; tropical fruits*

1. Introduction

Growing evidence suggests that oxidative stress significantly influences human health. Our bodies possess antioxidant systems that maintain a balance between oxidants and antioxidants. However, an imbalance caused by an excess of oxidants can lead to oxidative stress, resulting in cellular damage and various diseases (Kurutas, 2015). The medical and pharmaceutical communities are actively investigating ways to mitigate oxidative stress by promoting healthy lifestyles and developing novel treatments (Mazumder et al., 2025). Natural antioxidants have emerged as a primary focus of this research.

For centuries, humans have used medicinal plants and aromatics for medicinal purposes. These plants contain secondary metabolites, primarily phenolic and polyphenolic compounds, as well as flavonoids, alkaloids, terpenes, saponins, and steroids. These secondary metabolites possess antifungal, antimicrobial, antimalarial, antihistaminic, anticancer, antihypertensive, anti-inflammatory properties, and antioxidant activity (Celik and Ayran, 2011; Şar, 2011; Varli et al., 2020).

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Tropical fruits are notable for their rich antioxidant content.

Actinidia deliciosa (kiwi), grown in the Mediterranean region of Türkiye, is a member of the *Actinidiaceae* family. Renowned as a popular commercial fruit, kiwi is a nutritional powerhouse, rich in minerals like calcium (Ca), zinc (Zn), sodium (Na), magnesium (Mg), potassium (K), and phosphorous (P), vitamins like A, B, C, E, K, and phytochemicals. Beyond its major flavonoid content (gallic acid, syringic acid, caffeic acid, salicylic acid, ferulic acid, and protocatechuic acid), kiwi's secondary metabolites, particularly phenolic compounds, contribute to its antioxidant properties (Satpal et al., 2021; Kumar et al., 2024; Kim et al., 2025). Recognized for its role in insulin-glucose balance, weight management, and hemostatic pressure, kiwi fruit has drawn attention for its potential antidiabetic, antiulcer, and anti-inflammatory effects, leading to its use in traditional therapeutic applications (Satpal et al., 2021; Kim et al., 2025). Avocado (*Persea americana*) fruit, which has more than 100 subspecies worldwide, is grown in the coastal cities of the Mediterranean region of Türkiye. *P. americana*, one of the subtypes of the *Lauraceae* family, is classified as a functional food due to its rich fiber (6.80 g), tocopherol (2.35 mg), carotenoid (87 mg), sterol (83 mg), ascorbic acid (8.80 mg), K (507 mg), omega-3 and omega-1 (0.13 g and 1.67 g) contents. Avocado fruit can provide approximately 230 kcal of energy. The increasing consumption of avocados can be attributed to their high nutritional value and phytochemical content as well as their high contents of unsaturated fatty acids, vitamins B, C, D, E, and K, dietary fiber, potassium, magnesium, carotenoids, phytosterols, terpenoids, and phenolics (Genc et al., 2021; Fernandes Melo et al., 2025). Studies have shown that the phytosterols found in avocados, such as oleic acid, β-sitosterol, campestral, and stigmasterol, affect both cholesterol levels and cardiovascular disorders (Genc et al., 2021).

It has been observed that various preparations and extracts obtained from *Passiflora* species, which are tropical fruits, have a wide pharmacological spectrum on different biochemical processes, as well as blood, and several systems such as the cardiovascular and nervous systems. *Passiflora ligularis* (passion fruit) is used for human and animal health as an anti-inflammatory, antimicrobial, antitumor, analgesic, anxiolytic, antispasmodic, aphrodisiac, hypotensive, antidiuretic, and antioxidant due to its polyphenol content (Anusooriya et al., 2014; Echeverry González et al., 2025). The fruit serves as an excellent source of nutrients, such as protein, carbohydrates, amino acids, vitamins (primarily vitamin C, as well as B1, B2, B3, B5, B9, B12, and beta-carotene), fibers, and minerals (Na, iron (Fe), Mg, K, Zn, P, selenium (S), and Ca)[8]. With these features, this tropical fruit has garnered significant interest from the public and scientific communities due to its potential health benefits (Vilain, 2011; Echeverry González et al., 2025).

Pineapple (*Ananas comosus*) is a versatile tropical fruit known for its unique taste and aroma. Pineapple belongs to the Liliopsidae family, which is rich in nutrients such as Ca, P, vitamins C and A, as well as phenolic compounds including gallic acid, catechin, gentisic acid, syringic acid, vanillin, coumaric acid, sinapic acid, isoferulic acid, p-hydroxybenzoic acid, and cinnamic acid (Du et al., 2016). Due to this content, it has attracted attention for its antioxidant activity and anti-inflammatory effects, besides inhibiting hydrolytic and oxidative enzymes in human cells. In addition, its health benefits include reducing the risk of cerebrovascular disease and diabetes, as well as regulating the gastrointestinal system and mood. The fruit is effectively used as a diuretic, intestinal worm expeller, and birth control aid. Additionally, pineapple is commonly used to stimulate appetite for dietary nutrition and to increase oil secretion for topical debridement. As a source of bromelain, pineapple is used as a substitute for proteolytic proteins (Mohd et al., 2020). The fruit's accessibility, taste, and valuable bioactive compounds have made it a popular choice in both the food industry and medical applications (Sharma et al., 2024). Dragon fruit (*Hylocereus undatus*), also known as pitaya, is another tropical fruit that grows in the warm, humid climate of Türkiye's Mediterranean and Aegean regions. This cactus boasts a white interior and contains 35-50 kcal of energy. In terms of daily nutritional value, it contains water (80-90 g), protein (0.15-0.59 g), carbohydrates (9-14g), fat (0.1-0.69 g), calcium (6-10 mg), ash (0.4-0.7 g), fiber (0.3-0.9 g), phosphorus (16-36 mg), iron (0.3-0.7 mg), niacin (0.2-0.45 mg), ascorbic acid (4-25 mg), and trace amounts of thiamine, riboflavin, flavonoid, pyridoxine, cobalamin, carotene, phenolic, betanin, betacyanin, polyphenol, and phytoalbumin (Uguz and Gazici 2021; Chen et al., 2025). It has been shown that dragon fruit, which has antioxidant activity, may provide various benefits in conditions such as diabetes, dyslipidemia, metabolic syndrome, cardiovascular diseases, and cancer due to the presence of bioactive compounds that include potassium, p-coumaric acid, vanillic acid, and gallic acid (Nishikito et al., 2023; Garimella et al., 2025). While dragon fruit is an important source of bioactive compounds, its bioavailability is low. The development of delivery systems such as gold nanoparticles containing these compounds may be an alternative to reach target tissues, making it a potential therapeutic agent in the fields of medicine and pharmacy (Nishikito et al., 2023).

Considering the health benefits of adequate antioxidant intake, there is a need to find the most effective antioxidant agents. The toxic effects of synthetic antioxidants have driven researchers' attention to natural antioxidants in food plants, owing to their pharmacological and biological properties. In this study, we aimed to determine the antioxidant levels of some tropical fruits grown in Türkiye and to identify the fruit with the highest antioxidant capacity.

2. Materials and methods

This study was conducted in the Research Laboratory of the Department of Medical Biochemistry at the Faculty of Medicine, Sutcu Imam University, Kahramanmaras. Five fresh avocados (*P. americana*), dragon fruits (*H. undatus*), kiwis (*A. deliciosa*), pineapples (*A. comosus*), and passion fruits (*P. ligularis*) were purchased from local markets in the cities of Mersin and Kahramanmaras.

2.1. Preparation for the extraction of fruit samples

For the extraction process, the inner parts of the fruits were blended by a mixer after being peeled. The crushed fruit pieces were subsequently homogenized with 1.15% KCl and then the obtained fruit homogenates were centrifuged at 14,000 rpm for 30 minutes, and then the supernatant was separated and transferred to Eppendorf tubes. The levels of catalase (CAT) activities, Superoxide dismutase (SOD), antioxidant enzymes, and malondialdehyde (MDA), which is a good indicator of oxidative stress and lipid peroxidation, were measured spectrophotometrically in the supernatants. Each fruit was studied five times. Values are given as mean and standard deviation, and median.

2.2. Determination of catalase (CAT) enzyme activity

The Beutler method was used to determine the CAT enzyme activity in each fruit extract (Beutler, 1984). The reaction mixture was prepared as follows: 1 M Tris-HCl (pH 8.0), 10 mM H_2O_2, distilled water, and the fruit extract containing the enzyme. At 37°C, the activity of the enzyme was assessed at 230 nm using a Shimadzu UV-1601 spectrophotometer (Shimadzu, Kyoto, Japan) by measuring the absorbance changes of the cleaved H_2O_2 every 5 minutes for a total period of 10 minutes. The results were expressed as U/mg protein.

2.3. Determination of superoxide dismutase (SOD) enzyme activity

The Fridovich method was used to determine SOD activity (Fridovich, 1995). Following the method, the fruit extract was diluted 65-fold with 0.01 M phosphate buffer (pH 7.0), and the enzyme activity level was determined at this dilution ratio. The reaction mixture consisted of the fruit extract, a mixture of xanthine and INT (p-iodonitrotetrazolium violet) containing mixed substrate, and the xanthine oxidase enzyme. A blank tube was prepared in the same manner as the sample, except that phosphate buffer was added instead of the sample. The initial absorbance measurement (A1) was recorded at 505 nm against air for the first 30 seconds at 37°C. Simultaneously, the final absorbance (A2) was measured after 3 minutes using a Shimadzu UV-1601 spectrophotometer (Shimadzu, Kyoto, Japan). The values were calculated from a standard curve. The results were expressed as U/mg protein.

2.4. Determination of malondialdehyde (MDA) levels

The Ohkawa method, the gold standard for determining lipid peroxidation, was used to measure MDA levels (Ohkawa et al., 1979). This method is based on the formation of a pink-colored complex between MDA and thiobarbituric acid (TBA) under aerobic conditions at pH 3.4. The intensity of the color formed is directly proportional to the concentration of MDA in the sample. Both sample and blank readings were measured spectrophotometrically at 532 nm (Shimadzu UV-1601, Shimadzu, Kyoto, Japan). MDA results were reported in nmol/mg protein.

2.5. Determination of protein levels

The Lowry method was used to determine the protein content of the fruit extract (Lowry et al., 1951). It is based on the principle that proteins form a blue-colored complex with phosphotungstic acid in the presence of alkaline copper sulfate. The absorbance of this colored complex was determined spectrophotometrically at 750 nm using a Shimadzu UV-1601, Shimadzu, Kyoto, Japan, to determine the protein content quantitatively.

2.6. Statistical analysis

Statistical analysis was performed using IBM SPSS software version 22.0. Numerical variables were presented as mean ± standard deviation (SD) for normally distributed data. Median and minimum-maximum values were used to describe non-normally distributed data. The Mann-Whitney U test was used for independent group comparisons. The $p<0.05$ level was accepted as significant.

3. Results

As shown in Table, the *H. undatus* exhibited the highest levels of the antioxidant enzyme activities (SOD and CAT) and while the A. *comosus* fruit showed the lowest levels ($p<0.05$). CAT levels were significantly higher in *H. undatus* than in *P. americana* and *A. comosus* ($p=0.012$, $p=0.001$, respectively). Furthermore, a significant difference was observed in CAT concentrations between *A. comosus* and *P. americana*, $p=0.025$ (Table). In our analysis, *H. undatus* exhibited significant higher SOD levels than *P. americana* ($p<0.05$). Moreover, statistically significant differences in SOD levels were observed between *H. undatus* and *A. comosus* ($p=0.001$), as well as between *A. comosus* and *P. americana* ($p=0.032$). Conversely, no statistically significant differences were observed in either SOD or CAT levels between *P. ligularis* and *A. deliciosa* ($p=0.425$, $p=0.812$, respectively). The *H. undatus* showed the highest levels of the antioxidant enzyme capacity, followed by *P. ligularis*, *A. deliciosa*, *P. americana*, and *A. comosus*.

In contrast, *A. comosus* fruit exhibited the highest levels of oxidative stress (MDA), while the *H. undatus* fruit demonstrated the lowest levels ($p<0.05$). *H. undatus* demonstrated significantly lower MDA levels compared to *P. americana* and *A. comosus* ($p=0.014$, $p=0.001$, respectively). In addition, a significant difference was observed between *Ananas comosus* and *P. americana* with a p-value of 0.016. Moreover, MDA levels were significantly lower in *P. liguraris* than in *A. deliciosa* ($p=0.042$) (Table). Ranking the MDA levels of tropical fruits in descending order, *A. comosus* demonstrated the highest levels, followed by *P. americana*, *A. deliciosa*, *P. ligularis*, and *H. undatus*.

Table
Antioxidant (SOD and CAT) capacity and MDA levels in fresh tropical fruits.

	SOD(U/mg protein)	CAT(U/mg protein)	MDA(nmol/mg protein)
H. undatus	708.54±47.87*	0.455±0.042*	1.98±0.29*
P. ligularis	613.88±58.68**	0.396±0.037**	2.37±0.21
A. deliciosa	576.42±42.97**	0.286±0.022**	3.09±0.37
P. americana	439.28±37.29*	0.207±0.016*	3.65±0.32*
A. comosus	259.36±34.72*	0.165±0.014*	4.02±0.61*

Each fruit was analyzed five times. CAT, MDA, and SOD were presented as mean ± standard error (SE). MDA levels were expressed as nmol/mg protein, while CAT and SOD levels were expressed as U/mg protein.
*Significant statistical differences were observed among fruits in terms of SOD, CAT, and MDA ($p<0.05$) (Mann Whitney-U test)
** There is no statistically significant difference.

4. Discussion

Living cells produce various reactive oxygen species (ROS). Excessive ROS production, triggered by physiological functions, can contribute to the development of certain diseases. The antioxidant defense network balances this situation by minimizing oxidative damage and thereby preventing cell damage (Halliwell, 2024). Natural or synthetic antioxidants are grouped as primary (chain-breaking) or secondary (preventive) antioxidants according to their functions. The primary antioxidant group includes enzymes such as SOD, CAT, glutathione peroxidase (GPx), and DT-diaphorase, as well as compounds like beta-carotene, vitamin E, and uric acid. They act by scavenging reactive oxygen species/reactive nitrogen species (ROS/RNS) in oxidation reactions (Davies, 1988; Flieger et al., 2021). Phosphatides, propyl gallate, butylated hydroxyanisole and hydroxytoluene (BTA and BTH), butyl hydroquinone, and metal chelating agents, which are generally sulfur- and phosphorus-based compounds, belong to the secondary antioxidant group. They function by chelating transition metal ions or converting hydroperoxides to alcohols, thus reducing oxidative stress (Flieger et al., 2021; Kusumawati and Indravanto, 2023). Synthetic secondary antioxidants such as BTA, BTH, and propyl gallate pose a potential health risk due to the formation of hazardous by-products, toxic solvents, and chemical precursor contamination. Moreover, considering the high cost and low efficiency of synthetic antioxidants, the use of natural antioxidants is more attractive (Flieger et al., 2021).

For centuries, humans have used medicinal plants to treat diseases, but conscious research on the benefits of polyphenols for human health is relatively new. Polyphenols are secondary metabolites with antioxidant properties and are abundantly found in the diet (Albarracin et al., 2012). In total, more than 8000 of these compounds have been identified. Polyphenols are classified into phenolic acids, stilbenes, flavonoids, and lignans, and are primarily found in various fruits, vegetables, herbs, and beverages such as tea, wine, and fruit juices (Albarracin et al., 2012; Jiang et al., 2023). Each polyphenol has distinct properties and bioavailability, and it has been observed that polyphenols in tropical fruits differ somewhat from those in fruits grown in other geographical regions (Ditano-Vázquez et al., 2019; Jiang et al., 2023). Due to the conditions created by sunlight and warm climate, tropical fruits have higher polyphenol content compared to fruits grown in other regions, making them valuable for health due to their antioxidant, anticancer, and anti-inflammatory properties (Jiang et al., 2023). In the present study, we compared the antioxidant and oxidative stress levels of tropical fruits such as Pineapple, Avocado, Kiwi, Passion Fruit, and Dragon Fruit, grown in Türkiye's Mediterranean and Aegean regions. Although each of these fruits is rich in antioxidants due to their polyphenol content, Dragon Fruit was found to have the highest antioxidant level, followed by Passion Fruit, Kiwi, Avocado, and Pineapple. Over 800 studies in the literature have mentioned the health benefits of Dragon Fruit, such as analgesic, antidiabetic, and anticancer effects, but clinical research was only conducted in five studies (Nishikito et al., 2023; Garimella et al., 2025). These clinical studies were conducted only on the *H. polyrhizus* subtype of Dragon Fruit, and there are only a few animal model studies on the *H. undatus* species, used in our study, leaving this area relatively unexplored (Nishikito et al., 2023). When investigating the effects of *H. undatus* juice on obesity-related metabolic disorders in a C57BL/6J mouse model fed a high-fat diet, it was observed that this application reduced insulin resistance and improved hepatic steatosis (Song et al., 2016). Additionally, a study conducted on this fruit revealed that its peel contains more flavonoids than its fleshy part (Nishikito et al., 2023). It seems that the full health benefits of this fruit are not yet known, but our study, which shows that its antioxidant content is higher than the other fruits included in our study, suggests that it may be beneficial for health.

Studies on passion fruit, which has the second highest antioxidant activity in our study, have focused on determining the content of leaves, seeds, peel, and fruit, but there is not enough data yet. In their research, in 2022, Wiliantari et al. reported that the Passion Fruit seeds had the highest flavonoid and polyphenol content and, consequently, the highest antioxidant capacity (Wiliantari et al., 2022). In 2021, a study using an obese Wistar-rat model revealed that the consumption of polyphenol extracts from Passion Fruit was beneficial in controlling weight, establishing blood glucose balance, reducing cholesterol and triglyceride levels, and inactivating excessive cytokine production (Angel-Isaza et al., 2021). The results of our study showed that this fresh fruit possesses substantial antioxidant capacity; however, additional human studies are required to assess its potential health benefits in humans.

Kiwi fruit, known as Chinese Gooseberry, has multiple health benefits. Its amino acid composition supports digestive function, while its unique "kiwellin" protein enhances gastrointestinal health. Moreover, kiwi's anti-inflammatory and antioxidant properties make it a valuable addition to a healthy diet (Hussain et al., 2021; Kim et al., 2025). In a study conducted on kiwi, which is used for therapeutic purposes in traditional medicine, it was shown that the administration of kiwi fruit extract to diabetic Wistar rats had an effective function in the improvement of diabetes-induced testicular dysfunction and in maintaining glucose balance (El-Demerdash et al., 2024). In a meta-analysis study, nine clinical studies were examined, and it was reported that kiwi fruit can stimulate intestinal function in proportion to the fiber and water contents and may have anti-inflammatory and antioxidant effects due to its vitamin, mineral, and polyphenol contents (Antonelli and Donelli, 2021). Our study found that kiwi fruit exhibited a higher antioxidant activity compared to avocado and pineapple. A comparative analysis of the contents of these fruits could shed light on the underlying reasons for this difference.

While avocado, a tropical/subtropical fruit, has recently gained popularity due to weight loss diets, it is primarily recognized as a highly nutritious fruit, categorized as a functional food by the Food and Agriculture Organization of the United Nations, especially due to its omega-3 and omega-6 fatty acid content (Genc et al., 2021). Interestingly, Conceicão et al. (2022) evaluated the effects of avocado fruit on weight loss in their meta-analysis study. Despite the positive effects on the lipid profile, the results did not show a direct correlation with weight loss. In 2024, James-Martin et al. conducted a meta-analysis that suggested that regular consumption of this fruit, despite its lack of correlation with weight loss, could regulate cholesterol levels and positively impact the cardiovascular system. Contrary to popular belief, this fruit, which is not strongly associated with weight loss, is rich in flavonoids and phenolic compounds and is therefore known for its high antioxidant activity. In our study, we examined the activity of five fresh avocados and found them to support this data, although they fell behind dragon fruit, passion fruit, and kiwi.

There is a profound connection between diet and healthy living. Pineapple fruit, widely used in the food sector due to its taste and smell, benefits health due to the minerals and vitamins it contains (Mohd et al., 2020). Vitamin C, which is the main contributor to the antioxidant capacity of the fruit with its polyphenol content, also exhibits synergistic effects with phenolic compounds. While showing weak secondary antioxidant activity, it acts strongly as a primary antioxidant, exhibiting radical scavenging activity, ferric-reducing power, and iron-chelating ability (Yuris and Siow, 2014; Sharma et al., 2024). Our study determined that this fruit, known for its high antioxidant capacity in other studies, had higher MDA levels and a lower antioxidant capacity compared to other fruits. There are very few clinical studies on tropical fruits, including pineapple. The growing recognition of phytotherapy necessitates further research to bridge the gaps in the literature.

5. Conclusions and recommendations

There is a growing scientific consensus that antioxidants, especially their polyphenolic forms, can help reduce the incidence of certain diseases like cancer, cardiovascular, neurodegenerative, and DNA damage diseases, and may even have anti-aging properties. Considering the side effects and costs of synthetic antioxidants, it was observed that natural antioxidants are increasingly being studied in the medical and pharmaceutical fields. This study has clearly revealed that dragon fruit has a tremendous level of antioxidants. The fact that these fruits consistently absorb sunlight more intensely than other geographical regions and have higher and different polyphenol content makes them a strong candidate for a potential therapeutic agent. However, more comprehensive longitudinal studies are needed to fully understand the therapeutic potential of dragon fruit and shape the future of dietary recommendations.

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Conflict of interest: The authors declare that they have no conflict of interests.

Informed consent: The authors declare that this manuscript did not involve human or animal participants and informed consent was not collected.

References

Albarracin, S. L., Stab, B., Casas, Z., Sutachan, J. J., Samudio, I., Gonzalez, J., ... & Barreto, G. E. (2012). Effects of natural antioxidants in neurodegenerative disease. *Nutritional Neuroscience*, *15*(1), 1-9.

Angel-Isaza, J., Carmona-Hernandez, J. C., Narváez-Solarte, W., & Gonzalez-Correa, C. H. (2021). Polyphenols from Passiflora ligularis regulate inflammatory markers and weight gain. *Biomolecular Concepts*, *12*(1), 36-45.

Anusooriya, P., Malarvizhi, D., Gopalakrishnan, V. K., Manickam, R., & Sundaram, R. (2014). Antioxidant and antidiabetic effect of aqueous fruit extract of *Passiflora ligularis* Juss. on streptozotocin-induced diabetic rats. *International Scholarly Research Notices, 2014*, 130342

Antonelli, M., & Donelli, D. (2021). Kiwifruit (*Actinidia* spp.) dietary consumption for constipation: A systematic review and meta-analysis. *Future Pharmacology, 1*(1), 27-40.

Beutler, E. (1984). *Red cell metabolism: A manual of biochemical methods*. Grune and Starton (Editors) 2nd Edition, New York 11-12.

Celik, A. S., & Ayran, I. (2020). Antioksidan kaynağı olarak bazı tıbbi ve aromatik bitkiler. *Türk Bilimsel Derlemeler Dergisi, 13*(2), 115-125.

Chen, S., Li, Y., Kang, J., Su, C., Liu, Y., Cheng, Y., ... & Li, C. (2025). Evaluate the Effects of Different Processing Methods on Red Dragon Fruit (Hylocereus species) Juice from the Perspective of Physicochemical Properties and Metabolic Profiles. *Foods*, *14*(5), 793.

Conceicão, A. R., Fraiz, G. M., Rocha, D. M. U. P., de Castro, R. M., Pessoa, M. C., Mendes, D. R. G., Hermsdorff, H. H. M., & Bressan, J. (2022). Can avocado intake improve weight loss in adults with excess weight? A systematic review and meta-analysis of randomized controlled trials. *Nutrition Research, 102*, 45-58.

Davies, K. J. A. (1988). A secondary antioxidant defense role for proteolytic system. *Basic Life Sciences, 40*, 575-585.

Ditano-Vázquez, P., Torres-Peña, J. D., Galeano-Valle, F., Pérez-Caballero, A. I., López-Miranda, J., & Delgado-Lista, J. (2019). The fluid aspect of the Mediterranean diet in the prevention and management of cardiovascular disease and diabetes: The role of polyphenol content in moderate consumption of wine and olive oil. *Nutrients, 11*(11), 2833.

Du, L., Sun, G., Zhang, X., Xu, X., Hu, X., & Wang, Y. (2016). Comparisons and correlations of phenolic profiles and antioxidant activities of seventeen varieties of pineapple. *Food Science and Biotechnology, 25*(2), 445-451.

Echeverry González, S. M., Santos, A. M., Júnior, C. C. S., Restrepo, J. C. A., González, C. A. B., & Cardona, D. M. P. (2025). Natural therapies: A systematic review of the medicinal applications of *Passiflora ligularis*. *Phytochemistry Reviews*. Advance online publication.

El-Demerdash, F. M., Naoom, A. Y., Ghanem, N. F., Soliman, H. A., & Abdel-Rahman, H. G. (2024). Kiwifruit (*Actinidia deliciosa*) aqueous extract improves hyperglycemia, testicular inflammation, apoptosis, and tissue structure induced by streptozotocin via oxidative stress inhibition. *Tissue and Cell, 88*, 102426.

Fernandes Melo, B., Almeida-Bezerra, J. W., & Gonçalves de Sousa, S. D. (2025). Chemical composition and evaluation of antioxidant, antibacterial, and synergistic activities of the fixed oil of *Persea americana* Miller (Lauraceae). *Environ Soc Manag J, 19*(3), 1-19.

Flieger, J., Flieger, W., Baj, J., Maciejewski, R., Buszewicz, G., & Terpiłowska, S. (2021). Antioxidants: Classification, natural sources, activity/capacity measurements, and usefulness for the synthesis of nanoparticles. *Materials, 14*(15), 4135.

Fridovich, I. (1995). Superoxide radical and superoxide dismutases. *Annual Review of Biochemistry, 64*(1), 97-112.

Garimella, J. N., Jaddu, S., & Pradhan, R. C. (2025). Effect of non-thermal plasma on physiochemical properties, antioxidant activities, morphological and crystalline structures of red dragon fruit (*Hylocereus polyrhizus*) juice during storage. *Food Measurement and Characterization*. Advance online publication.

Genc, E., Vardin-Yıldırım, A., & Yorulmaz, A. (2021). Avokado yapının karakteristik özellikleri ve üretim teknolojisi. *ABMYO Dergisi, 16*(64), 291-320.

Halliwell, B. (2024). Understanding mechanisms of antioxidant action in health and disease. *Nature Reviews Molecular Cell Biology, 25*, 13-33.

Hussain, S. Z., Naseer, B., Qadri, T., Mushtaq, A., & Rather, S. A. (2021). Kiwifruit (*Actinidia deliciosa*)—Morphology, taxonomy, composition and health benefits. In M. I. Rather, S. A. Mir, & A. A. Ganie (Eds.), *Fruits grown in highland regions of the Himalayas* (pp. 145-156). Springer.

James-Martin, G., Brooker, P. G., Hendrie, G. A., Shahid, R., Charlton, K. E., McEvoy, M., Page, M., & Cassady, B. A. (2024). Avocado consumption and cardiometabolic health: A systematic review and meta-analysis. *Journal of the Academy of Nutrition and Dietetics, 124*(2), 233-248.

Jiang, Q., Charoensiddhi, S., Xue, X., Zhang, H., Yu, J., Chen, Z., & Zhao, J. (2023). A review on the gastrointestinal protective effects of tropical fruit polyphenols. *Critical Reviews in Food Science and Nutrition, 63*(24), 7197-7223.

Kim, H. G., Park, W. L., Min, H. J., Kim, S. Y., Jeong, S. H., & Lee, H. Y. (2025). Antioxidant and anticancer effects of kiwi (*Actinidia deliciosa*) fermented beverage using *Lactobacillus plantarum*. *Food Science and Biotechnology, 34*, 207-216.

Kumar, S., Kumar, V., Singh, S., Sharma, A., & Patel, R. (2024). A comprehensive review of phytochemical and pharmacological properties of *Actinidia deliciosa*. *International Journal of Pharmacognosy and Pharmaceutical Research, 6*(1), 86-92.

Kurutas, E. B. (2016). The importance of antioxidants which play the role in cellular response against oxidative/nitrosative stress: Current state. *Nutrition Journal, 15*, 71.

Kusumawati, I., & Indrayanto, G. (2023). Natural antioxidants in cosmetics. In A. ur Rahman (Ed.), *Studies in natural products chemistry* (Vol. 40, pp. 485-505). Elsevier.

Lowry, O. H., Rosebrough, N. J., Farr, A. L., & Randall, R. J. (1951). Protein measurement with the Folin phenol reagent. *Journal of Biological Chemistry, 193*(1), 265-275.

Mazumder, S., Chanda, S., & Banerjee, S. (2025). Phytochemical profile and chemopreventive properties of potential bioactive ingredients. In

D. Lahiri, M. Nag, D. Bhattacharya, S. Pati, & T. Sarkar (Eds.), *Bioactive ingredients for healthcare industry* (Vol. 1, pp. 25-56). Springer.

Mohd Ali, M., Hashim, N., Abd Aziz, S., Lasekan, O., Shukri, R., & Chong, G. H. (2020). Pineapple (*Ananas comosus*): A comprehensive review of nutritional values, volatile compounds, health benefits, and potential food products. *Food Research International, 137*, 109675.

Nishikito, D. F., Borges, A. C. A., Laurindo, L., Silva, A. M. O., Rodrigues, C. E. S., & Peres, M. F. S. (2023). Anti-inflammatory, antioxidant, and other health effects of dragon fruit and potential delivery systems for its bioactive compounds. *Pharmaceutics, 15*(1), 159.

Ohkawa, H., Ohishi, N., & Yagi, K. (1979). Assay for lipid peroxides in animal tissues by thiobarbituric acid reaction. *Analytical Biochemistry, 95*(2), 351-358.

Satpal, D., Kaur, J., Bhadariya, V., & Sharma, K. (2021). *Actinidia deliciosa* (kiwi fruit): A comprehensive review on the nutritional composition, health benefits, traditional utilization, and commercialization. *Journal of Food Processing and Preservation, 45*(6), e15588.

Sharma, A., Kumar, L., Malhotra, M., Singh, R., & Gupta, V. (2024). *Ananas comosus* (Pineapple): A comprehensive review of its medicinal properties, phytochemical composition, and pharmacolo-pgical activities. *Journal of Drug Delivery & Therapeutics, 14*(5), 148-157.

Song, H., Zheng, Z., Wu, J., Lai, J., Wang, Y., & Liu, H. (2016). White pitaya (*H. undatus*) juice attenuates insulin resistance and hepatic steatosis in diet-induced obese mice. *PLoS ONE, 11*(2), e0149670.

Sar, S. (2011). Bazı üzümsü meyvelerin kullanımlarının eczacılık ve tıp tarihi açısından incelenmesi. *Mersin Üniversitesi Tıp Fakültesi Lokman Hekim Tıp Tarihi ve Folklorik Tıp Dergisi, 1*(2), 1-6.

Uguz, M. T., & Gazici, A. (2021). Ejder meyvesinin ozmotik dehidrasyonu ve kuruma özelliklerinin değerlendirilmesi. *OKU Fen Bilimleri Enstitüsü Dergisi, 4*(2), 149-157.

Varlı, M., Hancı, H., & Kalafat, G. (2020). Tıbbi ve aromatik bitkilerin üretim potansiyeli ve biyoyararlılığı. *Research Journal of Biomedical and Biotechnology, 1*(1), 24-32.

Vilain, Y. (2011). Benefits of the passion fruit. *Passiflora Online Journal, 1*, 34-36.

Wiliantari, S., Iswandana, R., & Elya, B. (2022). Total polyphenols, total flavonoids, antioxidant activity and inhibition of tyrosinase enzymes from extract and fraction of *Passiflora ligularis* Juss. *Pharmacognosy Journal, 14*(3), 672-680.

Yuris, A., & Siow, L. F. (2014). A comparative study of the antioxidant properties of three pineapple (*Ananas comosus* L.) varieties. *Journal of Food Studies, 3*(1), 40-56.

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