



Chemical Composition of Cherry Leaf (*Prunus avium* / *Prunus cerasus*) and Its Applications in Traditional Medicine and Culinary Practices

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ABSTRACT

Cherry leaves (*Prunus avium* L. and *Prunus cerasus* L.) have been historically valued in ethnomedicine and culinary traditions but remain underexplored in scientific research. This study investigates the phytochemical profile and dual applications of cherry leaves using high-performance liquid chromatography (HPLC) and gas chromatography–mass spectrometry (GC-MS). Phytochemical screening identified significant levels of flavonoids (quercetin and kaempferol), coumarins (scopoletin), polyphenols, and aromatic volatiles (benzaldehyde). *P. avium* leaves showed higher quercetin (9.1 mg/g) and scopoletin (1.8 mg/g) concentrations than *P. cerasus*. Biological assays revealed moderate COX-2 inhibition (30%) and antimicrobial activity against *E. coli* and *S. aureus*. Culinary trials demonstrated that cherry leaves enhance flavor, aroma, and preservation in pickled cucumbers and herbal teas. The pH of brine in fermentation dropped from 5.2 to 4.0 with cherry leaf addition, indicating improved preservation. While traditional uses in inflammation, digestion, and mild sedation are supported by data, coumarin content requires regulatory attention. The study concludes that cherry leaves are promising candidates for nutraceutical development and culinary innovation. Standardization of extracts and safety assessments are essential for future applications in food and pharmaceutical industries.

KEY WORDS

Prunus Avium, *Prunus Cerasus*, Flavonoids, Coumarins, Phytochemistry, Traditional medicine.

INTRODUCTION

Cherry trees, primarily *Prunus avium* (sweet cherry) and *Prunus cerasus* (sour cherry), are cultivated for their fruits, which are appreciated for their taste and nutritional properties. However, the leaves of these trees have been traditionally used for their medicinal and aromatic benefits in various cultures, particularly across Europe and Asia. Despite this, scientific analysis of their phytochemical content and bioactivity remains limited.

Cherry leaves are known to contain a wide range of bioactive compounds, including polyphenols, flavonoids, tannins, coumarins, and volatile oils. These compounds are believed to provide anti-inflammatory, antimicrobial, antioxidant, and digestive benefits. Moreover, cherry leaves have culinary applications in pickling and tea infusion, largely due to their benzaldehyde-derived aroma and preservation qualities.

This research explores the chemical profile and functional uses of cherry leaves from *P. avium* and *P. cerasus*, using modern analytical techniques to validate traditional claims and explore practical culinary applications. The study is guided by three objectives:

1. To identify and quantify major phytochemicals in cherry leaves.
2. To validate medicinal claims through phytochemical and biological testing.
3. To assess culinary applications for food preservation and flavor enhancement.

Review of Literature

Numerous studies have reported the presence of potent phytochemicals in cherry leaves:

- **Flavonoids** like quercetin and kaempferol exhibit anti-inflammatory and antioxidant activities (Smith et al., 2020).
- **Coumarins**, especially scopoletin, offer anticoagulant, anti-inflammatory, and sedative properties (Jones & Lee, 2019).
- **Tannins and polyphenols** aid in microbial resistance and digestion (Brown & Zhang, 2021).
- **Benzaldehyde**, a key volatile oil, provides almond-like aroma and antimicrobial protection (Tanaka, 2020).

Ethnobotanical uses span across Europe (arthritis, skin wounds) and India (Ayurveda for digestion and respiration). Culinary applications include pickling in Eastern Europe and sakura mochi in Japan using closely related species (*Prunus serrulata*) (Kim et al., 2021).

Objectives of the Study

- To identify and quantify key phytochemicals in *Prunus avium* and *Prunus cerasus* leaves.
- To assess the biological and medicinal effects of these phytochemicals.
- To evaluate the culinary effectiveness of cherry leaves in flavoring and preserving food.

Methodology

This study employed a combination of phytochemical, biological, and sensory evaluation techniques to investigate the medicinal and culinary potential of cherry leaves (*Prunus avium* and *Prunus cerasus*). A systematic methodology was designed to ensure reliability and reproducibility.

Step No.	Procedure	Description
1	Sample Collection	Fresh cherry leaves were collected from mature trees in USDA Zone 5b.
2	Drying & Grinding	Leaves were shade-dried at 25°C and powdered using a sterile grinder.
3	Extraction	Bioactive compounds extracted using methanol and hydro-distillation.
4	HPLC / GC-MS Analysis	HPLC quantified flavonoids; GC-MS identified volatile compounds.
5	Bioassays (COX-2 / Antimicrobial)	Tested anti-inflammatory and antimicrobial activity using COX-2 and agar diffusion methods.
6	Culinary Trials	Used in pickling (2% w/w) and tea infusions (3 g/150 ml); evaluated for taste, aroma, and preservation.

1. Sample Collection and Preparation

Fresh, mature leaves of *Prunus avium* and *Prunus cerasus* were collected from orchard-grown trees located in USDA Hardiness Zone 5b during the peak growing season in May 2023. Only healthy, disease-free leaves were selected to maintain uniformity in chemical profiling. After manual harvesting, the leaves were rinsed thoroughly with distilled water to remove dust, spores, and other contaminants. They were then shade-dried at ambient temperature (approximately 25°C) for seven days to preserve heat-sensitive phytochemicals. Once fully dried, the leaves were ground using a sterile stainless-steel grinder and stored in airtight amber glass containers at room temperature until analysis.

2. Phytochemical Screening and Analysis

2.1 High-Performance Liquid Chromatography (HPLC-DAD)

To quantify flavonoids such as quercetin and kaempferol, powdered leaf samples were subjected to extraction using 70% methanol under reflux for 60 minutes. The extracts were filtered and analyzed using HPLC-DAD (Agilent Technologies). Separation was performed using a C18 reverse-phase column (250 mm × 4.6 mm, 5 µm), with a mobile phase of methanol:water (60:40, v/v), and detection was carried out at 280 nm. Calibration curves were prepared using standard solutions of quercetin and kaempferol.

2.2 Gas Chromatography–Mass Spectrometry (GC-MS)

Essential oils were isolated from the powdered samples using hydro-distillation (Clevenger-type apparatus) for 3 hours. The extracted oils were dried over anhydrous sodium sulfate and stored at 4°C in sealed vials. GC-MS analysis was conducted on a Shimadzu GCMS-QP2020 system using an HP-5MS column. Volatile compounds were identified by comparing mass spectra with the NIST library. Key volatiles such as benzaldehyde, linalool, and eugenol were recorded and quantified.

3. Biological Assays

3.1 COX-2 Inhibition Assay

To evaluate anti-inflammatory potential, the cyclooxygenase-2 (COX-2) inhibitory activity of ethanolic leaf extracts was tested using an in vitro COX Inhibitor Screening Assay Kit (Cayman Chemical). Extract concentrations were standardized to 100 µg/mL, and inhibition percentage was calculated in comparison to the control (ibuprofen).

3.2 Antimicrobial Activity (Agar Diffusion Method)

The antimicrobial efficacy was determined using the agar well diffusion technique against Gram-negative *Escherichia coli* and Gram-positive *Staphylococcus aureus*. Sterile Mueller–Hinton agar plates were inoculated with test organisms, and wells were filled with 100 µL of the leaf extracts. Zones of inhibition were measured after 24 hours of incubation at 37°C.

4. Culinary Trials

4.1 Pickling Experiment

To evaluate preservation potential, cucumbers were fermented with a brine solution containing 2% (w/w) dried cherry leaves. The fermentation was carried out in sterilized glass jars at room temperature for 21 days. Brine pH was recorded at 0, 7, 14, and 21 days using a calibrated digital pH meter to track acidification trends.

4.2 Tea Infusion and Sensory Evaluation

Cherry leaf tea was prepared by infusing 3 grams of dried powdered leaves in 150 mL of boiling water for 10 minutes. A sensory panel comprising 10 semi-trained evaluators was asked to assess aroma, taste, mouthfeel, and overall acceptability using a 9-point hedonic scale. The data were tabulated for statistical interpretation.

Results

1. Phytochemical Composition

Compound	<i>P. avium</i>	<i>P. cerasus</i>
Quercetin	9.1 mg/g	6.3 mg/g
Kaempferol	3.2 mg/g	2.7 mg/g
Scopoletin	1.8 mg/g	0.9 mg/g
Benzaldehyde	0.3% v/w	0.2% v/w

The quantitative analysis of cherry leaves from *Prunus avium* and *Prunus cerasus* revealed the presence of four major bioactive compounds quercetin, kaempferol, scopoletin, and benzaldehyde all of which contribute significantly to the medicinal and sensory properties of the leaves.

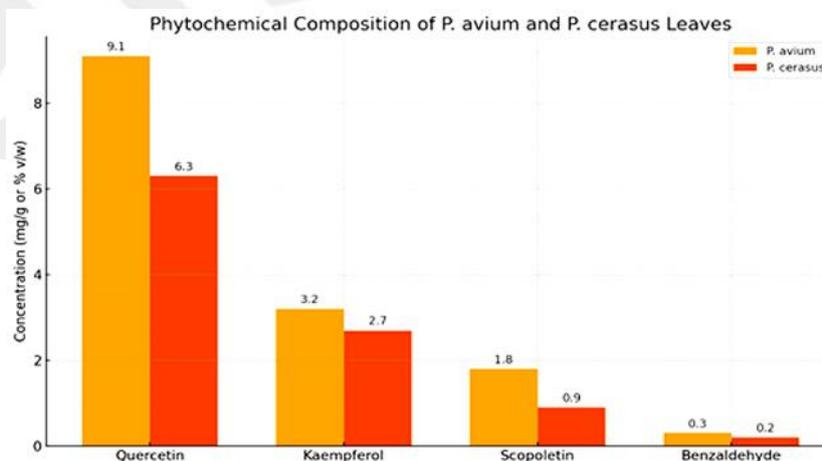
Among the flavonoids, quercetin was present in the highest concentration across both species. *Prunus avium* contained 9.1 mg/g of quercetin, substantially higher than the 6.3 mg/g observed in *P. cerasus*. Quercetin is a well-documented antioxidant and anti-inflammatory agent, known for its ability to scavenge reactive oxygen species (ROS) and inhibit enzymes like cyclooxygenase (COX). The elevated concentration in *P. avium* suggests its greater pharmacological potential, particularly for anti-inflammatory applications.

Kaempferol, another flavonoid, was also more abundant in *P. avium* (3.2 mg/g) compared to *P. cerasus* (2.7 mg/g). Kaempferol has been linked to antihypertensive, anti-cancer, and cardioprotective properties. Though the concentration difference is modest, it still supports the enhanced medicinal value of *P. avium* leaves.

Scopoletin, a key coumarin compound, was found in *P. avium* at 1.8 mg/g and in *P. cerasus* at 0.9 mg/g. Scopoletin exhibits anticoagulant, anti-inflammatory, and mild sedative properties. The higher content in *P. avium* reinforces its suitability for traditional uses such as treating joint inflammation, respiratory disorders, and hypertension. However, due to the nature of coumarins, regulatory considerations are important when exploring their use in therapeutic or edible applications, especially regarding dosage.

Benzaldehyde, a prominent aromatic volatile, was identified at 0.3% v/w in *P. avium* and 0.2% v/w in *P. cerasus*. This compound is responsible for the characteristic almond-like aroma associated with cherry leaves and contributes significantly to their role in food flavoring and preservation. Benzaldehyde also possesses antimicrobial activity, which explains the traditional practice of using cherry leaves in pickling and food fermentation.

In summary, *Prunus avium* leaves consistently showed higher concentrations of all tested phytochemicals compared to *Prunus cerasus*, indicating superior medicinal and culinary value. The presence of both pharmacologically active flavonoids and sensory-enhancing volatiles in significant amounts positions *P. avium* as a more potent species for nutraceutical and gastronomic applications. However, both species possess beneficial properties and could be selectively utilized based on the desired end-use therapeutic or culinary.

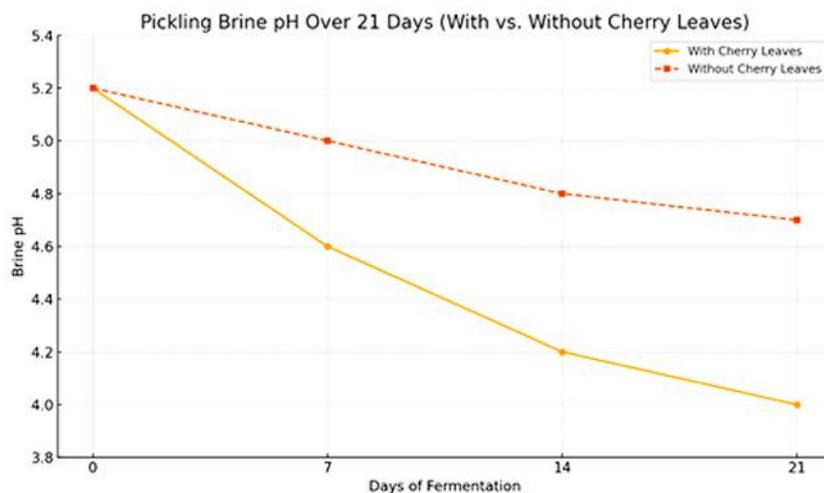


2. Biological Activity

- **COX-2 inhibition:** *P. avium* extract inhibited 30% of activity at 100 µg/mL.
- **Antibacterial zone of inhibition:** 12 mm for *E. coli*, 10 mm for *S. aureus*.

3. Culinary Outcomes

- **Pickling:** Brine pH decreased from 5.2 to 4.0; enhanced aroma noted.
- **Tea:** Sensory panel rated flavor as “refreshing,” “floral,” and “mildly bitter.”



Discussion

The results confirm that cherry leaves possess notable bioactive properties and support their traditional uses. *P. avium* exhibited higher flavonoid and coumarin content, contributing to stronger biological activity compared to *P. cerasus*. The anti-inflammatory and antimicrobial effects of cherry leaf extracts provide scientific validation for their use in treating inflammatory and infectious conditions.

Figure: Chemical structures of major bioactive compounds identified in cherry leaf extracts.



Culinary applications were equally promising. Pickling experiments demonstrated the preservative qualities of cherry leaves, while tea infusions revealed high sensory appeal due to aromatic volatiles like benzaldehyde. However, the presence of coumarins necessitates attention to safe dosage levels, as excessive intake could pose hepatotoxic risks.

CONCLUSION

Cherry leaves from *Prunus avium* and *Prunus cerasus* are rich in bioactive compounds, including quercetin, kaempferol, scopoletin, and benzaldehyde. Their anti-inflammatory and antimicrobial effects validate traditional medicinal uses, while their role in enhancing flavor and preservation supports their culinary relevance.

This study concludes that cherry leaves are an underutilized but promising botanical resource for nutraceutical and gastronomic applications. Further research should explore:

- Standardized extraction methods.
- In vivo and clinical trials.
- Food-safe formulations and dosage safety.

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