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An overview of *Prunus cerasus (Aalu balu)*: Traditional knowledge and pharmacological insights

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Abstract
A fruit-bearing member of the *Rosaceae* family, *Prunus cerasus* L. [sour or tart cherry] has long been used to treat metabolic, inflammatory, and urinary issues. It has garnered interest for its varied biological properties, including antioxidant, anti-inflammatory, cardioprotective, and neuroprotective activity, due to its high polyphenolic composition, including anthocyanins, phenolic acids, and flavonoids. Its botanical features, phytochemical components, pharmacological activities, traditional uses, toxicity, and clinical applications are all summarized in this review. Clinical validation and standardization are still essential for its development as a nutraceutical or therapeutic agent, despite a wealth of preclinical evidence.

Keywords: *Prunus cerasus*, sour cherry, anthocyanins, phytochemicals, pharmacology, antioxidant, Unani medicine

Introduction
Prunus cerasus, commonly referred to as sour cherry or tart cherry, is a deciduous tree or shrub belonging to the *Rosaceae* family, native to regions of Europe and southwestern Asia. Typically, it grows between 4 and 10 meters tall, forming a broadly rounded crown with numerous slender branches. In its natural habitat, the plant often develops thickets as it readily produces suckers from its roots. The bark is thin and smooth, occasionally peeling off, while the young twigs are brown to gray in color with distinct terminal buds. The leaves are simple and alternately arranged, ovate to elliptic in shape, usually measuring 5-8 cm long and 3-7 cm wide, with finely serrated edges and a smooth, glossy surface. The petioles are typically glanded, and the foliage is deciduous, falling off during winter. During late spring, the plant bears clusters of white flowers, each consisting of five petals and measuring around 2-3 cm in diameter, supported by a bell-shaped [campanulate] calyx tube. These flowers develop into small, round drupes of 15-25 mm diameter, which mature from bright red to dark red or black, and occasionally yellow in certain varieties. The flesh of the fruit is soft, juicy, and distinctly tart, enclosing a single stone [seed]. Although closely related to *Prunus avium* (sweet cherry), *P. cerasus* differs in its smaller size, higher acidity, and unique calyx morphology. Botanically, it is believed to be a natural hybrid between *P. avium and P. fruticosa*, forming a tetraploid species [2n = 32]. The sour cherry is extensively cultivated both for its culinary value being a popular ingredient in pies, jams, preserves, and beverages and for its ornamental appeal, offering showy spring blossoms and colorful autumn foliage. It is self-pollinating, cold-tolerant, and grows best in full sunlight and well-drained soils. Beyond its use as food, *Prunus cerasus* has a long-standing role in traditional medicine, attributed to its rich content of bioactive and antioxidant compounds, which contribute to its potential health-promoting properties [1-5].

Methodology
Numerous databases, including PubMed, Elsevier, Scopus, Science Direct, Springer, and Google Scholar, were used to gather the data. The article's keywords were *P. cerasus* and its conventional equivalents, such as *Aalu balu*. "Sour cherry," "chemical ingredients," "phytochemistry," "anti-oxidant," "anti-inflammatory property," "*Prunus sp.*," and other terms are also used in the search. An effort was made to record high-caliber research,

but only English-language was preferred for search on the studies. The evaluation and methodical compilation of several papers on a single platform made it easier to identify important gaps in the body of research.

Botanical Data [6-9]

Fig 1a, and b: Botanical description of plant of *Prunus cerasus*

Table 1: Botanical Data of *Prunus cerasus*

Botanical Feature	Description
Scientific Name	*P. cerasus* linn.
Family	*Rosaceae*
Common Names	Sour cherry, Tart cherry
Origin	Likely hybrid of *Prunus avium* & *Prunus fruticosa* [Europe, Western Asia]
Plant Type	Deciduous tree or large shrub
Height	4-10 meters
Stem and Bark	Erect trunk; bark grayish-brown, fissured with age
Leaves	Simple, Alternate, obviate to elliptic, 5-10 cm, serrated margin, glossy surface
Flowers	White, 2-4 in clusters, 5 petals, 15-20 stamens, hermaphrodite, spring blooming
Fruit	Drupe, shape is Generally round [globose] to slightly flattened [subglobose] bright red to dark crimson when mature [52,53], Color is Bright red to dark red or purplish, depending on variety, some varieties may be more heart-shaped, but most sour cherries are nearly spherical, Flesh is juicy, acidic, and sour in taste [51,52,54]. Size is Small to medium [1-2 cm in diameter]
Seed	Hard stone [endocarp], single seed inside
Roots	Shallow, spreading; often grafted on *P.mahaleb or P.avium* rootstocks
Flowering Season	Spring [March to May depending on region]
Pollination	Entomophilous [insect-pollinated]/ Usually self-fertile, Insect-pollinated [bees]
Chromosome Number	2n = 16
Fruiting Season	Early to mid-summer [June-July]
Habitat	Temperate regions; prefers full sun and well-drained soil
Lifespan	15-30 years under cultivation
Distinguishing Features	Tart fruit, more spreading habit than *P.avium*, high cold tolerance

Vernacular Names [10]: *P.cerasus* is known by different names depending where it is being cultivated in the world. Vernacular names of *P. cerasus* are listed below:

Table 2: Vernacular Names of *Prunus cerasus*

Arabic	***Farasia, Jerasayna, Kerasya***
English	Cherry Tree, Common Cherry, Dwarf Cherry, Sour Cherry, Wilol Cherry
French	Cerisier, Gobet, Guin, Guindoux
German	Amarelle, Ambrella, Ammer, Garten-kirsche, Glaskirsche, Kirschebaum, Maikirsche, Marille, Morelle, Morille, Sauerkirsche, Suesskirsche, Weichselkirsche Catalan Cirer, Citer moll, Cirer de cireras castaleras, Cirer de cireras duras, Cirerer, Guinder
Chinese	Ying, Tao; Dutch: Karsseboom, Kerse-boom
Greek	Kerasia
Hungarian	Cseresznyefa
Italian	Ciliegio, Ciliegio montanaro, Ciriegio
Persian	*Alubalu, Alubuali, Kilas*
Polish	Wisn
Portuguese	Cerejeira
Punjab	Gilas
Russian	Vishennoi dyerevo
Spanish	Cerezo, Cerezo comun, Cerezo durazno, Cerezo garrafal de cerezas costaleras, Cerezo garrafal de corazon de cabrito, Cerezo mollar, Guindo, Guindo comun, Guindo garrafal
Swedish	Koersbaer
Urdu	*Aalu balu*

Taxonomical Classification [11-15]

Table 3: Taxonomical Classification of *Prunus cerasus*

Kingdom	***Plantae***
Subkingdom	*Tracheobionta Viridiplantae*
Super division	*Embryophyta/spermatophyta*
Division	*Magnoliphyta/Tracheophyta [vascular plants]*
Subdivision	*Spermatophytina [seed plants]*
Class	*Magnoliopsida [Dicotyledons]*
Order	*Rosales*
Superorder	*Rosanae*
Family	*Rosaceae*
Subfamily	*Amygdaloidene [formerly Spiracoideae]*
Tribe	*Amygdalae*
Genus	*Prunus*
Species	*cerasus*

Morphological Description in Unani System of Medicine
It is the fruit of a tree, whose branches are scattered, straight and reddish. The leaves are similar to the branches and leaves of red and yellow potatoes. The fruit is a small round achene, which is attached to a single piece of wood by a high bar of its small branch. Most are hanging and there are two of them at once as shown in fig-1. The raw *Aalu Balu* is green, astringent and, semi-ripe, red and sour, and the ripe one is black, syrupy and slightly tangy in nature. The seed is small, the size of a gram, the bark is hard white and the pulp is white. One type of *Aalu Balu* is initially black. Some *Aalu balu* are sweet, some are syrupy, some are sour and some are astringent. The tree is also called *Kailas*, which is the *Aalu Balu* tree. Its fruit is very large and becomes sweet when ripe like a raw sour cherry. The best *Aalu Balu* is the ripe and fresh *Aalu Balu* [16]. They are of four types in terms of taste which sweet and sour [17]. Do not use anything that is green and has been picked before it is ripe or even those that turn very sweet when over ripe should not be consumed.

Temperament [*Mijaz*]
Cold, Dry 2nd Degree [18]

- **Adverse Effects [*Muzir*]:** It causes *Zof-e-hazm, tukhma and zof e ma'aida* [20]
- **Corrective [*Musleh*]:** *Sikanjbeen nanai, Mirch siyah* [20]*, Namak ta'am, hot and muqawwi jawarish* [21]
- **Therapeutic Dose [*Miqdar e Khuraq*]:** Most commonly used as 4.5gm [19]

Medicinal Actions [*Afal Wa Khwas*] [23, 24]
Mufattit-e-Hasat [Lithotriptic], *Mudirr-e-Bawl* [Diuretic], *Mudirr-e-Haiz* [Emmenagogue], *Muqawwi-e-Jigar* [Hepatotonic], *Musakkin Safra'wa Josh Dam, Musakkini-Hararat* [Febrifuge], *Muqawwi-e-Maida* [Stomachic tonic], *Daf-e-Hararat* [Antipyretic], *Qabid* [Astringent], *Jali* [Detergent], *Mulattif* [Demulcent], *Qati'-e-Mawad, Muzayyid Mani* [Spermatogenic], *Muqawwi-e-bah* [Aphrodisiac], *Musakkin Atash, Muqawwi-e-Dimagh* [Braintonic], *Daf-e-iltehab* [Anti-inflammatory], *Musakkin* [Sedative], *Suzak* [gonorrhea], *Daad* [ringworm].

Phytochemical Compounds
P cerasus [sour cherry] features a broad spectrum of phytochemicals, comprising both primary and secondary metabolites. The bioactive substances present in sour cherry are among the most thoroughly examined and abundant [22, 23]. Cherries contain significant phytochemicals such as carotenoids, phenolic compounds, flavonoids, anthocyanins, and flavonols [22-25]. Within the carotenoid group, β-carotene, Lutein and zeaxanthin are extensively found in cherries [25]. Furthermore, the main phenolic constituents of cherries are hydroxycinnamic acid and hydroxy benzoic acid, Flavan-3-ols and Anthocyanins. These secondary aromatic compounds play a role in antioxidant stress and flavor biogenesis. Flavonoids, especially anthoxanthins, flavanones, flavans, and anthocyanidins, act as defensive agents against toxic substances and pathogens. These compounds are integral to its nutritional properties and pharmacological benefits.

Recent Health and Therapeutic studies

- **Ulcerative Colitis Management:** A randomized controlled trial conducted in 2025 examined the health advantages of Montmorency tart cherry juice supplementation in adults suffering from mild to moderate ulcerative colitis. The findings revealed enhancements in disease activity and quality of life, indicating a possible supportive role for tart cherry juice in the management of this condition [29].
- **Cardiovascular Health:** A study examining the impact of anthocyanin-rich *p.cerasus* extract [PCE] on rabbits suffering from atherosclerosis-related cardiac dysfunction revealed that PCE enhanced lipid profiles and cardiac performance. The treatment correlated with elevated myocardial levels of endothelial nitric oxide synthase [eNOS], protein kinase G [PKG], and sarco/endoplasmic reticulum calcium ATPase 2a [SERCA2a], indicating possible therapeutic advantages for cardiovascular conditions [30].
- **Pediatric Kidney Stone Management:** Nephrolithiasis in Children- A randomized clinical trial evaluated the effectiveness of sour cherry concentrate in comparison to Polycitra-K for the treatment of nephrolithiasis [kidney stones] in pediatric patients. Both interventions led to a significant decrease in the number of kidney stones, suggesting that sour cherry concentrate could serve as a feasible alternative therapy [31].
- **Sleep and Anxiety:** An investigation was conducted to explore the combined impact of Montmorency tart cherry and *Apocynum venetum* on sleep and anxiety among adults experiencing insomnia. The outcomes imply potential improvements in sleep quality and a reduction in anxiety symptoms [32].
- **Sleep Modulation:** The consumption of tart cherry juice has been correlated with better sleep quality and longer duration. This phenomenon is ascribed to the natural melatonin found in the fruit, which plays a role

in regulating sleep-wake cycles [35].

- **Skin Protection from Oxidative Stress:** An analysis was conducted to assess the protective effects of tart cherry pit extracts on human skin cells. The outcomes showed that these extracts might protect skin cells against oxidative stress, suggesting their potential incorporation into skincare products aimed at mitigating oxidative damage [33]. Moreover, these analyses enrich the accumulating evidence that supports the wide-ranging pharmacological benefits of *P.cerasus*, particularly in the domains of antioxidant function, sleep enhancement, and skin protection.
- **Cosmeceutical Applications:** Another research published in 2023 indicated that tart cherry pit extracts have antioxidant characteristics that are beneficial for skin health. These extracts were shown to lower oxidative stress in human skin cells and adjust gene expression linked to antioxidant defenses, implying their potential use in natural skincare formulations [33].
- **Natural Food Preservation:** The antimicrobial properties of sour cherry leaf extracts, which are high in polyphenols, have been the subject of study. When these extracts are applied to meat products, they inhibit microbial growth and lipid oxidation, thus extending shelf life and presenting a natural option in place of synthetic preservatives [34].

Pharmacological Studies

- Antioxidants serve to neutralize reactive oxygen species (ROS), which helps in reducing oxidative stress and cellular damage. The bioactive compounds involved are anthocyanins, flavonols, and phenolic acids [36, 37].
- Anti-inflammatory substances work by suppressing pro-inflammatory cytokines [IL-6, TNF-α] and enzymes like COX-2, with bioactive compounds such as cyanidin-3-glucoside, quercetin, and melatonin [38].
- Cardioprotective agents are known to lower blood pressure, inhibit LDL oxidation, and improve vascular function, with bioactive compounds including anthocyanins, potassium, and kaempferol [39, 40].
- Anti-diabetic properties enhance insulin sensitivity and reduce fasting glucose levels, with bioactive compounds including chlorogenic acid, catechin, and oleanolic acid [41].
- Neuroprotective effects safeguard neurons against oxidative stress and amyloid-β toxicity, featuring bioactive compounds such as anthocyanins, quercetin, and melatonin [42].
- Anti-cancer properties inhibit tumor cell proliferation, angiogenesis, and promote apoptosis, with bioactive compounds like ursolic acid, procyanidins, and ellagic acid [50, 51].
- The sleep-enhancing properties improve sleep duration and quality through the regulation of circadian rhythms, with natural melatonin as the bioactive compound [49].
- The anti-obesity effects inhibit fat accumulation and adipogenesis, regulating lipid metabolism through bioactive compounds such as anthocyanins and chlorogenic acid [48].
- Hepatoprotective benefits reduce liver enzyme levels and improve liver histology in models of hepatotoxicity, with bioactive compounds including oleanolic acid and ursolic acid [46, 47].
- Anti-hyperuricemia agents that lower uric acid levels and decrease the frequency of gout attacks contain bioactive compounds such as anthocyanins and chlorogenic acid [44, 45].
- Anti-microbial properties that inhibit the growth of various bacteria and fungi are attributed to bioactive compounds like phenolic acids and flavonoids [43].

Conclusion

This review presents information on *P. cerasus (Aalu balu)* in Unani, various traditional texts, and research studies. From the information gathered above, it can be inferred that *Aalu balu* possess Kidney Stone Management, Antioxidant, Anti-Inflammatory, Hypoglycemic, Sleep Modulation, Gastroprotective Properties and Antimicrobial Activity. Being a remedy that has been successfully utilized in the Unani medical system for centuries to address kidney stone cases and various kidney conditions. Unani doctors proposed numerous validated remedies and formulations drawn from their experiences and observations, which continue to be effective for kidney stone patients. With a clearly defined understanding of disease and treatment protocols, the action mechanism of *Aalu balu* in relation to its physicochemical attributes is warranted. Its numerous additional characteristics are confirmed through *in vitro* and *in vivo* pharmacological research. Additionally, since it poses no danger when taken either in small amounts or over an extended period, it is considered safe for human consumption, though with some exceptions. Based on the results mentioned, it can be stated that claims found in Unani texts regarding *Aalu balu* could support the treatment of various health conditions such as kidney issues, adjacent therapy in cancer, and painful urination etc., through extensive research on the subject.

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