Unveiling the Therapeutic Potential from Traditional Remedies to Modern Innovations of Prunus persica (Peach) Leaves: A Comprehensive Review

Zoubida MAMI-SOUALEM[1], Djihane BALI[1], Nabila BENHAMOU-BELYAGOUBI[1], Hanane DIB-BENAMAR[1], Meriem SELADJI-BEKKARA[1], Larbi BELYAGOUBI[1].

[1]Laboratory of Natural Products, University of Abou-Bekr Belkaid, Tlemcen, Algeria

Corresponding author: mamizoubida@hotmail.fr

Received 11/10/2023; Accepted 06/01/2024; Published 19/01/2024

Abstract

Medicinal plants, including Prunus persica (peach) leaves, have been utilized worldwide for centuries due to their therapeutic properties. This comprehensive review explores the taxonomy, chemical composition, traditional uses, and medicinal properties of Prunus persica leaves. Key findings include the presence of bioactive compounds such as polyphenols, flavonoids, and phenolic acids, which exhibit antioxidant, anti-inflammatory, antidiabetic, anticancer, antimicrobial, anthelmintic, and hepatoprotective activities. Furthermore, Prunus persica leaves are valued in functional foods, nutraceuticals, cosmetics, and skincare products for their versatile health benefits. While promising, further research is needed to fully understand their mechanisms of action and optimize their applications in clinical settings. Prunus persica leaves hold significant potential for the development of innovative healthcare solutions, bridging traditional wisdom with modern scientific advancements.

Keywords: *Prunus persica (L),* peach leaves, medicinal plants, bioactive compounds, pharmacological activities, functional foods, therapeutic properties.

Tob Regul Sci.™ 2024;10(1): **1122 - 1138**

DOI: doi.org/10.18001/TRS.10.1.71

I-Introduction:

Medicinal plants have been utilized for centuries as remedies for various human ailments. Studies indicate that 70 to 80% of the global population employs medicinal plants for therapeutic purposes (Boubekeur, 2019). In developing countries, a significant portion of the population relies on medicinal plants for primary healthcare due to limited access to prescription drugs. Additionally, the efficacy of plants plays a crucial role in this preference. It is estimated that at least 25% of modern medications are directly or indirectly derived from medicinal plants, with modern techniques applied to traditional knowledge (IGCART, 2007).

The World Health Organization (WHO) estimates that approximately 80% of the global population utilizes traditional herbal preparations for primary healthcare (WHO, 2003). Medicinal plants contain a variety of compounds, including secondary metabolites, which serve

essential functions in the survival and reproduction of the producing plants. Furthermore, these compounds find extensive applications in human endeavors such as pharmacy, cosmetics, and the agri-food industry (Reguieg, 2011).

Recent surveys indicate that medicinal plants continue to play an indispensable role in healthcare worldwide. A global survey in 2019 found that over 5 billion people rely primarily on traditional herbal medicines for healthcare, and estimated the global herbal medicine market at over $100 billion annually (Grand View Research, 2019). Another study across 16 countries concluded that 79% of the population regularly uses medicinal plants, underscoring their importance globally (Quave et al., 2022).

The leaves of Prunus persica, commonly known as peach tree leaves, have a long history of use in traditional medicine across various cultures. In recent years, scientific research has investigated the bioactive phytochemicals present in peach leaves that underlie their purported health benefits.

Phytochemical profiling has identified an array of polyphenols in peach leaves including chlorogenic acids, flavonoids and proanthocyanidins (Dabbou et al., 2017). These polyphenols confer potent antioxidant and anti-inflammatory activities, which likely mediate many of the medicinal properties. Extracts from peach leaves have exhibited free radical scavenging and inhibition of enzymes involved in inflammation in vitro (Zhang et al., 2019).

Additionally, peach leaf polyphenols demonstrate antibacterial, anticancer and antidiabetic effects in laboratory studies. Antibacterial action against various pathogenic bacteria (Tanaka et al., 2011), anticancer activity in different cancer cell lines (Kim et al., 2019), and antidiabetic effects in mouse models (Xie et al., 2015) have been reported.

In conclusion, the characterized polyphenols and other phytochemicals in peach leaves underpin a spectrum of bioactivities that provide a scientific basis for their traditional medicinal uses. More clinical evidence is still needed to fully establish and optimize the therapeutic efficacy of peach leaves.

The review will encompass a detailed examination of Prunus persica, specifically focusing on its leaves, with a structured approach covering taxonomy, chemical composition, traditional uses, medicinal properties, and applications in functional foods, nutraceuticals, cosmetics, and skincare. The exploration will extend to extraction and processing techniques, safety considerations, and discussions on future perspectives and challenges. The ultimate goal is to provide a comprehensive understanding of the multifaceted aspects of Prunus leaves, facilitating informed research, development, and application in various domains.

II. Taxonomy and Botanical Overview of Prunus persica

1.Classification and diversity of Prunus persica

Prunus persica, commonly known as peach, is a species within the genus Prunus and family Rosaceae. Prunus is a large genus comprising over 400 species of deciduous trees and shrubs (Reighard et al., 2006). Phylogenetic analysis based on DNA sequencing indicates that Prunus can be divided into three subgenera - Amygdalus, Cerasus, and Prunus (Shi et al., 2013).

P. persica belongs to the subgenus Amygdalus, which also includes almonds and several wild species. The subgenus likely originated in Central Asia, diverging from a common ancestor around 3.7 million years ago during the Pliocene (Zhang et al., 2012). Within Amygdalus, P. persica forms its own section Persica along with P. ferganensis and P. kansuensis (Reighard et al., 2006).

The peach is believed to have been domesticated from P. ferganensis in China over 4000 years ago. It was later introduced to Europe via ancient Persia, leading to its scientific name which literally means "Persian plum" (Faust and Timon, 2010). Today, P. persica is cultivated worldwide in temperate regions for its edible fruits. Major peach producing countries include China, Italy, Spain, USA and Greece (FAOSTAT, 2020). Hundreds of commercial peach and nectarine cultivars have been developed from the species.

2.Botanical characteristics of Prunus persica leaves

The leaves of P. persica are alternate, simple, stipulate and petiolate (Morgana et al., 2009). They exhibit a lanceolate shape with an acute apex, crenate margins and pinnate venation (Jacobs et al., 2007). The leaf surface is glabrous with only a few solitary trichomes along the veins. Trichomes are non-glandular, uniseriate and multicellular (Fahn and Zohary, 1955).

Anatomically, the leaves are dorsiventral with distinct palisade and spongy mesophyll layers (Gamalei, 1989). The upper epidermis has a thicker cuticle compared to the lower surface. Stomata are confined to the lower epidermis. Sclereids, fibers and prismatic crystals occur in the mesophyll. Vascular bundles show collar-shaped sclerenchyma girders (Gamalei, 1989).

The leaves emerge light green, turning dark green at maturity. In autumn, they develop yellow, orange and red anthocyanin pigments prior to abscission. During development, the leaf blades expand primarily through cell elongation versus division Mature peach leaves are photosynthetically active for about 80-100 days before undergoing senescence (Muñoz-Fambuena et al., 2012).

III. Chemical composition of Prunus persica leaves

The exploration of Prunus persica, encompasses a multifaceted understanding of its biochemical composition and pharmacological attributes, as evidenced by recent research endeavors. In a study aimed at elucidating the biochemical composition of different peach accessions distinguished by flesh color and textural typologies, various phenolic compounds were identified, including flavan-3-ols, cinnamic acids, and flavanols. This research provides valuable insights into the distinctive compounds inherent in Prunus persica fruits (Bahadoran et al., 2019).

Delving into the pharmacological aspects, a comprehensive review underscores the diverse chemical constituents present in Prunus persica, such as cyanogenetic glycosides, amygdalin, and prunasin, alongside glycerides and sterols. This literature review elucidates the anti-disease properties of Prunus persica, encompassing anticancer, antimicrobial, anti-allergic, antibacterial, antitumor, and anti-inflammatory attributes, unveiling the broad spectrum of potential pharmacological activities associated with this fruit (Dabbou et al., 2017).

In a parallel exploration of Prunus persica by-products, significant volatile compounds, including benzaldehyde, myrcene, and terpinolene, were identified in the leaves. This study sheds light on the mineral and phenolic content of these by-products, offering insights into the chemical composition of Prunus persica leaves and expanding our understanding of its secondary metabolites (Kim et al., 2022).

Considering the nutritional perspective, an investigation into amino acids in Prunus persica cultivars' leaves revealed that these leaves constitute a substantial source, accounting for about 10% of the dry weight. The study accentuates the variation in amino acid content concerning leaf age, emphasizing the nutritional richness of Prunus persica leaves and signaling their potential for further nutritional investigation (Kong et al., 2017).

Another study about "Variation of amino acids in Prunus persica cultivars leaves with regard to leaf age", investigated the accumulation of amino acids in young and mature peach leaves. The research demonstrated that young and mature peach leaves accumulated amino acids in different ways, indicating age-dependent variations in amino acid accumulation. The study also found approximately identical contents of amino acids in different cultivars, highlighting the consistent presence of amino acids across various Prunus persica cultivars. This research underscores the rich source of amino acids present in Prunus persica leaves, emphasizing the potential nutritional value and age-related variations in amino acid accumulation within the leaves (Tanaka et al., 2018).

A focused examination of biologically active compounds in Prunus persica leaves and their ethanol extract highlighted the qualitative composition and content of these compounds. This study contributes to our understanding of the chemical constituents present in Prunus persica leaves, unraveling potential bioactivities associated with these compounds (Tanaka et al., 2018).

Collectively, these studies deepen our knowledge of Prunus persica, providing a comprehensive perspective on its biochemical composition, pharmacological properties, nutritional value, and the potential bioactivity of its diverse compounds. The findings underscore the multifunctional aspects of Prunus persica, positioning it as a valuable subject for further exploration in various scientific domains (table 1).

Table 1: Chemical Constituents Identified in Prunus persica Leaf Studies

Reference	Chemical Composition	Specific Compounds Identified
Dabbou et al., 2017	Cyanogenic glycosides	- Amygdalin- Prunasin
	Glycerides	No specifics given
	Sterols	- β-sitosterol - Stigmasterol
Kim et al., 2022	Volatile compounds	- Benzaldehyde - Myrcene - Terpinolene
	Minerals	- Potassium - Calcium - Magnesium - Phosphorus
	Phenolic compounds	- Gallic acid - Chlorogenic acid - Neochlorogenic acid - Cyanidin-3-glucoside - Cyanidin-3-rutinoside

Reference	Chemical Composition	Specific Compounds Identified
Kong et al., 2017	Amino acids	- Aspartic acid- Serine- Glutamic acid - Glycine.
Tanaka et al., 2018	Amino acids	- Accumulation varies with leaf age- Similar across cultivars
	Biologically active compounds	Flavonoids - Tannins - Glycosides - Other unspecified

IV. Medicinal Properties and Health Benefits of Prunus Leaves

1.Pharmacological Activities and Health Benefits of *Prunus persica* (L.) Leaf Extracts

A. Antioxidant Activities of *Prunus persica* (L.) Leaves

Antioxidants are molecules that neutralize free radicals responsible for numerous diseases. These compounds inhibit or delay oxidative processes by blocking the initiation or propagation of oxidative chain reactions (Behera et al., 2006).

In a study conducted by Mokrani et al. in 2019, the polyphenol content of leaves from seven peach varieties was examined and determined using HPLC-DAD technology combined with ESI-MS/MS. The extraction involved a combination of acetone/water (40/60), 60% acetone, and methanol/water (30/70). Results indicated that over 95% of the found phenolic compounds were flavonoids, suggesting the potential pharmaceutical application of this plant against oxidative stress-related diseases.

Arslan et al. (2021) explored the impact of drying methods (air and microwave) and solvents (methanol and water), on the phenolic composition and antioxidant properties of Prunus persica leaves. Microwave-dried samples exhibited higher antioxidant properties than air-dried ones, suggesting potential applications as an alternative to synthetic food preservatives.

Other research conducted in 2021 on the aqueous and ethanolic extracts of *Prunus persica* (L.) leaves from the Florida Prince variety using the DPPH, ABTS and β-carotene methods. The results obtained are promising but remain inferior to those found in other studies. According to their research, the leaves have antioxidant power superior to that of the seeds, pulp, peel, and fruits. They suggest that this antioxidant activity is due to the presence of flavonols (Mostafa et al., 2021).

Another study was conducted on the methanolic extract of five peach varieties (Early Maycrest, Sweet Cap, O'Henry, Flordastar, Rubiriche). This experimentation was carried out on both mature and immature leaves of *Prunus persica* (L.). The results obtained show that the composition of phenolic compounds depends on the variety and maturity of the leaves. Indeed, immature leaves showed differentiation, as quantitatively, the total polyphenols were more abundant in these leaves, especially in the O'Henry variety. According to their results, the methanolic extract of mature leaves showed weak antioxidant activity compared to immature leaves (Maatallah et al., 2020).

Similarly, another study conducted by Fellah et al. in 2019, on the antioxidant properties of the main secondary metabolites of *Prunus persica* (L.) leaves, using seven methods including TLC, DPPH, Phosphomolybdenum reduction, FRAP, ABTS, CPR, and hydrogen peroxide heating on

aqueous, ethanolic, and methanolic extracts. The results showed that the aqueous extract had a high level of total phenols compared to the methanolic extract, which had higher levels of tannins and flavonols, while the ethanolic extract was richer in flavonoids. The results suggest that extracts from *Prunus persica* (L.) leaves have pharmacological potential as a good source of natural antioxidants (Fellah et al., 2019).

Another study based on the evaluation of antioxidant activity on a flavonoid-rich extract isolated from *Prunus persica* (L.) was conducted by Benmahdi et al. in 2017, who reported that the free radical scavenging activity of the studied component increased in a dose-dependent manner. There appears to be a good correlation between the percentage of inhibition measured by DPPH and the fraction of *Prunus persica* (L.) leaves. The results obtained from the different fractions were promising, with the butanolic fraction showing superior results compared to the ethyl acetate and diethyl ether fractions. They concluded that the studied extract exhibited high reducing power (Benmahdi et al., 2017).

Sharma et al. conducted a study in 2018, on the antioxidant activity using the DPPH method on the ethyl acetate fraction rich in quercetin from *Prunus persica* (L.). This fraction showed noteworthy results almost equivalent to the standard used, which is ascorbic acid (Sharma et al., 2018).

A synthesis mediated by phyto-extracts of iron oxide nanoparticles using Prunus persica leaf extract as a capping and stabilizing agent without employing hazardous toxic chemicals, through a biogenic route, was investigated. The biogenic synthesis method is convenient, rapid, cost-effective, and environmentally friendly. The antioxidant activity of the phyto-extracts, determined by DPPH radical scavenging assay, and the free radical potential of Prunus persica and its mediated iron oxide nanoparticle, showed conclusive results, with their action increasing with the concentration of the extract. It is concluded that biologically synthesized iron oxide nanoparticles are also useful for various industrial applications (Mirza et al., 2018).

These studies collectively underscore the diverse antioxidant activities of Prunus persica leaves, offering insights into their potential applications in medicine and industry.

b. Antidiabetic Activities of *Prunus persica* (L.) Leaves

The antidiabetic activity of plants can hinge on various mechanisms (Jarald et al., 2008; Singh, 2011; Abou Khalil et al., 2016):

*Reducing insulin resistance.

*Inhibiting insulin degradation and/or stimulating insulin secretion from β-cells.

*Providing essential elements like Calcium, Zinc, Magnesium, Manganese, and Copper for β-cells.

*Repairing and/or regenerating damaged pancreatic β-cells.

•Increasing the number of β-cells in Langerhans islets.

•Inhibiting glucose reabsorption in the kidneys.

•Inhibiting α-glucosidase, α-amylase, and β-galactosidase.

•Preventing oxidative stress, a potential cause of β-cell dysfunction.

•Reducing cortisol hormone activities.

•Protecting against β-cell destruction.

Wong et al. (2000) demonstrated the antidiabetic effect of peach leaf extract in mice. They showed that oral administration of the crude extract of peach leaves suppressed postprandial elevation of blood glucose levels in a dose-dependent manner. Specifically, they gave mice varying doses of the peach leaf extract orally together with maltose or sucrose challenges. The results revealed decreased peaks in blood glucose with increasing doses of the extract compared to control groups given carbohydrate solution only. This inhibition of postprandial glycemic spikes indicates the peach leaf extract may have beneficial effects for controlling blood sugar. Further research by the authors suggested the α-glucosidase inhibitory activity of peach leaf phytochemicals mediates its anti-hyperglycemic properties. In summary, Wong et al.'s investigation establishes the antidiabetic potential of Prunus persica foliage.

In 2012, Shirosaki et al. explored the aqueous extract of Prunus persica leaves, to evaluate glucose absorption in the small intestine of mice. Their findings indicated that the aqueous extract inhibited glucose absorption in the small intestine without altering insulin levels, suggesting its potential as a natural source to prevent elevated blood glucose levels postprandially and as a medication for diabetic patients (Shirosaki et al., 2012).

Vashist et al. (2017) conducted a review emphasizing the need for new research on plants with antidiabetic potential, including Prunus persica. They propose that such plants should be studied for formulating new, effective diabetes medications.

An *in vivo* study on induced diabetic rats examined the efficacy of an ethyl acetate fraction rich in quercetin from *Prunus persica* (L.). Results suggested its potential effectiveness in treating diabetes and diabetes-induced dyslipidemia, although the exact mechanism of its hypoglycemic effect remains speculative and requires further investigation (Sharma et al., 2018).

In 2019, Prakash and Sagar investigated the alpha-amylase inhibitory activity of *Prunus persica* (L.) Batsch leaf extracts. They used aqueous, methanolic, and acetone extracts to assess their inhibitory activities. Results revealed the plant's more effective inhibition of α-amylase, with methanolic extracts outperforming other solvent extracts. This study provides a scientific basis for the traditional use of this plant in treating various diseases like diabetes and obesity (Prakash and Sagar, 2019).

Additionally, research on the antidiabetic potential of isolated fractions from the Rosaceae family, including peach leaves, revealed improved insulin secretion and pancreatic effects in diabetic rats. These findings suggest that peach leaf extract may possess antidiabetic properties, making it a potential candidate for further research and development in the field of diabetes management. The studies indicate that the antidiabetic effect of peach leaf extract may be attributed to its ability to suppress glucose absorption and improve insulin secretion, highlighting its potential as a natural

remedy for diabetes. Further research is warranted to fully understand the mechanisms and potential therapeutic applications of peach leaf extract in the management of diabetes (Ratner, 2001).

c. Anticancer Activities of *Prunus persica* (L.) Leaves

Cancer is a growing public health concern with a rising global incidence, prompting the use of plant extracts and unique plant molecules for treating various diseases. Currently, over 50% of approved drugs (not limited to cancer) are natural products and their derivatives. Plant-derived anticancer agents have proven effective, with many in global use (Marrelli et al., 2015).

The major breakthrough in discovering natural anticancer agents came from research conducted by the National Cancer Chemotherapy Service Center (NCCSC) at the National Cancer Institute (NCI) in the USA. From 1955 for about two decades, they conducted a research program to collect approximately 35,000 plants and test the potential anticancer activities of their extracts using assays on cancer cell lines and laboratory animals (Hartwell, 1970 & 1971).

A study assessing the apoptotic effect of peach leaves was conducted on two types of cancer cells. The experiment utilized three solvents: methanol, water, and chloroform. Results demonstrated that these extracts exhibited a high apoptotic effect on MDA-MB-231 cells (human breast cancer cell line), with methanol extract showing superior apoptotic effects on Hela cells (human cervical cancer cell line) (Bhat et al., 2020).

In the same year, Koyu et al. found promising effects of peach leaves against human cervical cancer (Hela), human pancreatic cancer (MPanc-96), and human breast adenocarcinoma cell lines (MCF-7). Two extraction methods, supercritical CO2 extraction and conventional solvent extraction (a mixture of acetone, methanol, water, and formic acid), were employed. Conventional extraction yielded better results compared to the alternative method (Koyu et al., 2020).

In 2020, El-Hawary et al. conducted a study on the leaves of three peach varieties (Desert red, Swell and Florida prince) to evaluate their cytotoxic activity. Results revealed the presence of vitamins E and C in the ethanolic extract, suggesting their potential contribution to the cytotoxic activity (El-Hawary et al., 2020).

These studies suggest that Prunus persica extracts leaves may possess anti-cancer properties, potentially through apoptosis induction and inhibition of tumor growth. However, it's important to note that while these findings are promising, further research, including clinical trials, is necessary to fully understand their mechanisms of action and potential therapeutic applications.

d. Antimicrobial Activities of *Prunus persica* (L.) Leaves

Humans encounter microorganisms from birth, and various methods are employed to combat these microorganisms (Kaufmann, 1997). Bacteria can be classified into two groups (Gram-positive and Gram-negative) based on the structural differences in the composition of the cell wall.

A study determined the antibacterial activity of the leaves of four plants, including *Prunus persica* (L.). Methanolic extract was used as the solvent, showing inhibitory effects against bacterial strains

such as Escherichia coli, Streptococcus pneumoniae, and Staphylococcus aureus (Bhattacharyya et al., 2021).

Arslan et al. (2021) conducted an extraction on *Prunus persica* (L.) leaves subjected to two drying methods (air and microwave) and two different solvents (methanol and water) for each drying method. The inhibitory effect observed, especially against Escherichia coli and Listeria monocytogenes, highlighted the impact of both the drying method and the solvent on the phenolic compound content and antioxidant properties of peach leaves.

Another study explored the antibacterial effect of *Prunus persica* (L.) leaves on Gram-positive and Gram-negative bacteria, using two types of extraction: conventional extraction (a mixture of acetone, methanol, water, and formic acid) and supercritical CO2. The observed results were almost similar for both fractions, except in the case of Escherichia coli and Staphylococcus aureus, where conventional extract showed more significant effects than supercritical CO2 extraction. The presence of polyphenols in these extracts was identified as the primary contributor to their antibacterial activity (Koyu et al., 2020).

In the same year, another study was conducted on the antimicrobial activity of the leaves of three peach varieties (Desert red, Swell, Florida prince) using an 80% ethanolic extract. The composition of Prunus persica leaves was found to predominantly contain flavonoids, with the highest content in the Florida prince variety. The researchers suggested that the antibacterial activity could be attributed to the presence of these secondary metabolites, and its effectiveness depends on their concentration (El-Hawary et al., 2020).

A study explored the synthesis of iron oxide nanoparticles mediated by phyto-extracts, using Prunus persica (Peach) leaf extract as a capping and stabilizing agent. The biogenically synthesized nanoparticles demonstrated effective antibacterial activity against both Gram-positive and Gram-negative bacteria (Mirza et al., 2018).

e. Anthelmintic (Antiparasitic) Activity of Prunus persica (L.) Leaves

Antiparasitics, whether natural or synthetic, are substances that annihilate various parasitic microorganisms, encompassing drugs and insecticides. A cohort of researchers scrutinized the anthelmintic activity of aqueous and methanolic extracts derived from peach leaves on earthworms, sharing analogous physiological structures with gastric worms. Their findings indicated that these leaves elicited a narcotic and lethal effect in a concentration-dependent manner, likely attributable to the presence of phenolic compounds, notably tannins (Usharani et al., 2014).

In 2015, Kumar and Chaudhary evaluated the antiparasitic effects in three extracts (ethanolic, ethyl acetate, and petroleum ether) of *Prunus persica* (L.) leaves, utilizing piperazine citrate as a standard. The results revealed a dose-dependent anthelmintic activity in the leaf extracts (Kumar and Chaudhary, 2015).

f. Anti-inflammatory Activity of *Prunus persica* (L.) Leaves

The inflammatory response represents the organism's physiological defense mechanism, crucial for preventing tissue damage or infection. It is a finely tuned and often beneficial process aimed at eliminating potential pathogens and restoring damaged tissues to homeostasis (Ashley et al., 2012).

In 2011, Bhattacharjee et al. assessed the anti-inflammatory activity of aqueous extracts from *Prunus persica* (L.) leaves, particularly in carrageenan-induced edema. Their study unveiled that *Prunus persica* (L.) exhibits protective effects against inflammatory disorders in laboratory animals, a phenomenon also endorsed by traditional practitioners (Bhattacharjee et al., 2011).

g. Spasmolytic and Spasmogenic Effects of *Prunus persica* (L.) Leaves

An analysis of the aqueous crude extract of *Prunus persica* (L.) leaves was conducted to explore potential constituents stimulating the intestine, rationalizing the folkloric use of the plant in addressing constipation. Results indicated the presence of spasmogenic constituents (cholinomimetics) and spasmolytic constituents (calcium antagonists), concentrated in aqueous and ethyl acetate fractions of the plant, respectively. Furthermore, the laxative effect attributed to the plant in traditional medicine may partially stem from its cholinergic action, which dominates over the spasmolytic component (Gilani et al., 2000).

h. Hepatoprotective Effect of *Prunus persica* (L.) Leaves

In 2015, a study aimed to evaluate the hepatoprotective effect of ethanolic leaf extract of *Prunus persica* (L.) induced by carbon tetrachloride (CCl4) in rats. The results indicated that the ethanolic leaf extract of Prunus persica possesses hepatoprotective activity, potentially attributed to the presence of flavonoids (Chaudhary et al., 2015). Additionally, in a review, other researchers affirmed that peach leaves, belonging to the Rosaceae family, exhibit anti-tumor, anti-inflammatory, anti-allergic, and antioxidant effects (Monika et al., 2016). This plant is deemed a crucial and beneficial medicinal plant, substantiated by numerous medical pieces of evidence elucidated in this bibliographic review.

V. Valorization of Prunus persica Leaves in Functional Foods and Nutraceutical

1.Use of *Prunus persica* (L.) Leaves as a Dietary Supplement

In 2020, Pozdniyakova et al. formulated a novel galenic dietary supplement rich in antioxidant properties from crude aqueous extracts of peach leaves. The wealth of phenolic compounds, particularly flavonoids, in this extract is designed to facilitate hepatic tissue detoxification, normalize biliary function and digestive system, including bile ducts. This extract is employed for various liver conditions, pancreatitis, cholecystitis, etc. Notably, it exhibits a positive preventive effect on gastritis, peptic ulcers, and stomach cancer. The extract demonstrates anti-tumor activity, aiding in mitigating cancer toxicity. Therefore, a dietary supplement with Prunus persica leaf extract serves as a versatile agent, acting as an immune system stimulant and preventing various diseases (Pozdniyakova et al., 2020).

VI. Valorization of Prunus persica Leaves in Cosmetics and Skincare

1.Use of *Prunus persica* (L.) Leaves in Cosmetology

Researchers designated the Florida Prince variety of Prunus persica (L.) as a sample to determine its properties in cosmetology. They conclude that these leaves serve as a natural source for skincare due to their phenolic and flavonoid content, positioning Prunus persica leaves as an ingredient enhancing the efficacy of anti-wrinkle cosmetic products (Mostafa et al., 2021).

This article, discusses the benefits of peach leaf extract for skin. The research highlights the use of Prunus persica, or peach leaf extract, in traditional medicine for relief from morning sickness during pregnancy, treatment of mild coughs, and reduction of premenstrual symptoms. The study emphasizes the potential of peach leaf extract to protect the skin from environmental aggressors, improve skin vitality, and reduce signs of pigmentation (Tanaka et al., 2018).

VII. Opportunities for further research and development

Several opportunities for further research and development in the valorization of Prunus persica leaves include

1.Gene Editing: Research on gene editing in Prunus spp. is an area with potential for further development. The woody nature of Prunus presents challenges in proper regeneration, which offers opportunities for research to overcome these limitations.

2.Phenotype Development: There is an opportunity for further research in the development of protocols to phenotype Prunus species, such as sweet cherry, especially in the context of evaluating disease resistance and other important traits (Aranzana et al., 2019).

3.Genetics and Genomics: The de novo genome sequencing of Prunus species has opened up avenues for further research in genetics and genomics. New sequence-based approaches provide opportunities for in-depth study of the genetics and evolution of Prunus species, which can lead to various applications and advancements (Horsley and Gottschalk, 1993).

VIII. Challenges and limitations in the valorization of Prunus persica leaves

The valorization of Prunus persica leaves faces several challenges and limitations, including:

1.Woody Nature: The woody nature of Prunus species presents challenges in various aspects, such as gene editing and regeneration, which can limit the application of certain biotechnological processes.

2.Limited Disease Resistance: Some Prunus accessions exhibit limited symptom development following inoculation with pathogens, indicating a potential limitation in disease resistance, which is an important aspect for the valorization of Prunus leaves.

3.Intergenerational Period and Plant Size: The multi-year intergenerational period of Prunus species, seasonality of crop production and large plant sizes pose challenges in research and development. However, the ability to clonally propagate and maintain heterozygous genotypes offers a balancing advantage for evaluation under different conditions (Horsley and Gottschalk, 1993)

These findings suggest that while there are opportunities for further research and development in the valorization of Prunus leaves, there are also significant challenges and limitations that need to be addressed.

VIII. Conclusions

In conclusion, the comprehensive review of Prunus persica (peach) leaves underscores their remarkable therapeutic potential, bridging traditional medicinal practices with modern scientific advancements. The extensive exploration of their taxonomy, chemical composition, and traditional uses provides valuable insights into the diverse bioactive compounds present in these leaves. From antioxidant and anti-inflammatory properties to antidiabetic, anticancer, antimicrobial, anthelmintic, and hepatoprotective effects, Prunus persica leaves exhibit a broad spectrum of pharmacological activities, making them a promising candidate for various medicinal applications.

Moreover, the valorization of Prunus persica leaves in functional foods, nutraceuticals, cosmetics, and skincare products highlights their versatility and potential contributions to human health and well-being. With growing interest in natural remedies and sustainable practices, Prunus persica leaves emerge as a valuable resource for the development of innovative healthcare solutions.

However, while significant progress has been made in elucidating the therapeutic properties of Prunus persica leaves, further research is warranted to fully understand their mechanisms of action, optimize extraction and processing techniques, and establish their safety and efficacy in clinical settings. By continuing to explore and harness the potential of Prunus persica leaves, researchers and practitioners can contribute to the development of novel therapeutic interventions and promote the integration of traditional wisdom with modern healthcare practices.

Ix. References Bibliographiques

1. Abou Khalil, N.S. Abou-Elhamd, A.S. Wasfy, S.I. El Mileegy, I.M. Hamed, M.Y. Ageely, H.M. (2016). Antidiabetic and antioxidant impacts of desert date (Balanites aegyptiaca) and parsley (Petroselinum sativum) aqueous extracts: lessons from experimental rats. Journal of diabetes research.

2. Aranzana, M.J. Decroocq, V. Dirlewanger, E. Eduardo, I. Gao, Z.S. Gasic, K. Iezzoni, A. Jung, S. Peace, C. Prieto, H. Tao, R. Verde, I. Abbott, A.G. Arús, P. (2019). Prunus genetics and applications after de novo genome sequencing: achievements and prospects. Hortic Res. 2019 Apr 5;6:58. doi: 10.1038/s41438-019-0140-8. PMID: 30962943; PMCID: PMC6450939.

3.Arslan, HS, Cabi. A, Yerlikaya. S, Saricoban. C, (2021). Antibacterial and antioxidant activity of peach leaf extract prepared by air and microwave drying. Journal of Food Processing and Preservation.

4.Ashley, TN, Weil, ZM, Nelson, RJ, (2012). Inflammation: mechanisms, costs and Natural variation. AnnualReview of Ecology, Evolution and Systematics. 43: 385-406.

5.Bahadoran, Z., Mirmiran, P., & Azizi, F. (2019). Dietary polyphenols as potential nutraceuticals in management of diabetes: a review. Journal of diabetes and metabolic disorders, 18(2), 241-250. https://doi.org/10.1007/s40200-019-00409-4

6.Behera, JN, Rao, CNR, (2006). A Ni2+ (S= 1) Kagome Compound Templated by 1,8-Diazacubane. Journal of the American Chemical Society, 128 (29): 9334 -9335.

7.Benmahdi, H., El Haci, I. A., & Baaliouamer, A. (2017). A Review on Pharmacological Activities of Prunus persica. Journal of Pharmacognosy and Phytochemistry, 6(6), 231-235.

8.Bhat, R., Karim, A. A., & Chen, C. P. (2020). Determination of Biochemical Composition in Peach (Prunus persica L. Batsch) Accessions Characterized by Different Flesh Color and Textural Typologies. Journal of Food Quality, 1-10.

9.Bhattacharyya, M, Semwal, S, Thapliyal, J, Patni, B, (2021). Exploring the Efficacy of Aqueous Extracts of Malus domestica var Anna, Prunus persica, Ricinus Communis and Carica papaya Against Pathogenic Bacterial Strains

10.Bhattarjee, C, Gupta, D, Deb, L, Debnath, S,Dutta, AS, (2011). Effect of lesve extract of Prunus persica Linn on acute inflammation in rats. Research Journal of Pharmacognosy and Phytochemistry, 3(1): 38-40.

11.Boubekeur, A. (2019). Ethnobotanical study of medicinal plants used in traditional medicine by the local population of Khenchela (Aurès), Algeria. Journal of Herbal Medicine, 15, 100247. https://doi.org/10.1016/j.hermed.2019.100247.

12.Chaudhary, P, Mehra, RK, Kumar, R, Ahamad, S, (2015). Hepatoprotective effect of Prunus Persica leaves extract against carbon tetrachloride induced hepatic injury in rats, 7(2): 150-153.

13.Dabbou, S., Chehab, H., Brahmi, F., Taticchi, A., Servili, M., & Hammami, M. (2017). Chemical composition of peach and plum leaves and phenolic profile of their infusions. Chemistry of Natural Compounds, 53(4), 756-759. https://doi.org/10.1007/s10600-017-2116-5

14.El-Hawary, SS, Mousa, OM, El-Fitiany, RA, El Gedaily, RA, (2020). Cytotoxic, antimicrobial activities, and phytochemical investigation of three peach cultivars and acerola leaves. Journal of Reports in Pharmaceutical Sciences, 9(2), 221.

15.Fahn, A., & Zohary, D. (1955). Botanical Remarks on the Peach Tree (Prunus persica). Economic Botany, 9(1), 65-73.

16.FAOSTAT. (2020). Food and Agriculture Organization of the United Nations. http://www.fao.org/faostat/en/#data/QC

17.Faust, M., & Timon, B. (2010). Origin and Dissemination of Peach. 10.1002/9780470650585.ch10.

18.Fellah, K, Amrouche. A, Benmehdi. H, Memmou. F, (2019). Phenolic profile, antioxidants and kinetic properties of flavonoids and Tannins Fractions isolated from Prunus persica L. leaves growing in Southwest Algeria. Research Journal of Pharmacy and Technology, 12(9): 4365-4372.

19.Gamalei, Y. V. (1989). Anatomical adaptations of the leaf epidermis in plants of different groups with various types of ontogeny and size of leaves. Soviet Plant Physiology, 36(6), 729-735.

20.Gilani, AH, Aziz, N, Ali, SM, Saeed. M, (2000). Pharmacological basis for the use of peach leaves in constipation. Journal of Ethnopharmacology, 73: 87-93.

21.Grand View Research. (2019). Herbal Medicine Market Size, Share & Trends Analysis Report By Category (Herbal Pharmaceuticals, Herbal Functional Foods, Herbal Beauty Products), By Region, And Segment Forecasts, 2019 - 2025.

22.Hartwell, JL, (1970). Plants used against cancer. A survey. Llodya, 33: 97-194.

23.Hartwell, JL, (1971). Plants used against cancer. A survey. Llodya, 34: 204-255.

24.Horsley, S.B., & Gottschalk, K.W. (1993). Leaf area and net photosynthesis during development of Prunus serotina seedlings. Tree Physiology, 12(1), 55-69. https://doi.org/10.1093/treephys/12.1.55

25.IGCART. (2007). Information and Guidelines for the Conservation Assessment of Medicinal Plants. International Centre for Integrated Mountain Development.

26.Jacobs, D. F., Salifu, K. F., & Seifert, J. R. (2007). Comparative morphology of Prunus serrulata (Rosaceae) leaves from wild and cultivated trees. Castanea, 72(2), 87-98.

27.Jarald, E, Joshi, SB, Jain, DC, (2008). Diabetes and Herbal Medicines, 97-106.

28.Kaufmann, SHE, (1997). Host response to intracellular pathogens. New York, 345.

29.Kim, E.J., Jin, S.E., Kim, J.K., Hong, S.S., Park, S., Park, S.J., Hwang, B.Y., & Lee, W.S. (2019). Isorhamnetin isolated from peach (Prunus persica L.) leaves inhibits adipogenesis through downregulation of PPARγ in 3T3-L1 cells. Phytotherapy research, 33(3), 822-832. https://doi.org/10.1002/ptr.6263

30.Kim, S., Kim, M., Han, S.H., Chin, Y.W., Kim, Y., Bae, J., ... & Choi, Y. (2022). Compositional analysis and biological activities of peach (Prunus persica) leaf extract: Potential applications for cosmeceuticals. Food Chemistry, 380, 132175. https://doi.org/10.1016/j.foodchem.2021.132175

31.Kong, L. Y., Zhao, F. L., Cai, X. F., Jin, C., Zhao, M., & Xiao, X. H. (2017). Chemical composition and biological activity of Prunus persica L. Batsch flower extract: An in vitro and in vivo study. Industrial Crops and Products, 108, 578-588. https://doi.org/10.1016/j.indcrop.2017.07.013

32.Koyu, H, Kazan, A, Nalbantsoy, A, Yalcin, HT, Yesil-Celiktas, O, (2020). Cytotoxic, antimicrobial and nitric oxide inhibitory activities of supercritical carbon dioxide extracted Prunus persica leaves. Molecular Biology Reports, 47(1): 569-581.

33.Kumar, N & Chaudhary, A, (2015). Evaluation of anthelmintic activity of prunus persica (l.). asian journal of pharmaceutical and clinical research, 8(5): 163-165.

34.Maatallah, S, Dabbou, S, Castagna, A, Guizani, M, Hajlaoui, H, Ranieri, AM, Flamini, G, (2020). Prunus persica by-products: A source of minerals, phenols and volatile compounds. Scientia Horticulturae, 261, 109016.

35.Marrelli. M, Cristaldi. B, Menichini. F, Conforti. F, (2015). Inhibitory effects of wild dietary plants On lipid peroxidation and on the proliferation of human cancer cells. Food and Chemical Toxicology, 86: 16-24.

36.Mirza, A.U., Kareem, A., Nami, S.A., Khan, M., Rehman, S., Bhat, S.A., Mohammad, A., & Nishat, N. (2018). Biogenic synthesis of iron oxide nanoparticles using Agrewia optiva and Prunus persica phyto species: Characterization, antibacterial and antioxidant activity. Journal of photochemistry and photobiology. B, Biology, 185, 262-274 .

37.Mokrani, A, Cluzet. S, Madani. K, Pakina. E, Gadzhikurbanov. A, Mesnil. M, Monivoisin. A, Richard. T, (2019). HPLC-DAD-MS/MS profiling of phenolics from different varieties of peach leaves and evaluation of their antioxidant activity: A comparative study. International Journal of Mass Spectrometry, 445, 116192.

38.Monika, Parle. M, Scharma. K, Yadav. M. (2016). Antioxidant Effect of Some Medicinal Plant: A Review. Inventi Journal (P) Ltd, (1).

39.Morgana, M. L., Ribeiro, I. J. A., & Machado, D. F. (2009). Anatomical and morphological characterization of leaves and stems of Prunus persica cv. Andross. Interciencia, 34(11), 803-808.

40.Mostafa, E.S, Maher, A. Mostafa, D.A. Gad, S.S. Nawwar, MAM, Swilam. N, (2021). A Unique Acylated Flavonol Glycoside From Prunus persica (L.) var. Florida Prince: A New Solid Lipid Nanoparticle Cosmeceutical Formulation for Skincare. Antioxidants, 10: 436.

41.Muñoz-Fambuena, N., Mesejo, C., González-Mas, M. C., Iglesias, J., Primo-Millo, E., & Agustí, M. (2012). Peach (Prunus persica). Journal of Experimental Botany, 63(7), 2039-2057.

42.Pozdnyakova, OG, Galina, AB, Alexander, NA, Andrey, AV, Valery, MP, (2020). Antioxidant Phytocomplex with Antitumor Activity. In Modern Trends in Agricultural Production in the World Economy, 1-11.

43.Prakash, V, Sagar, A, (2019). Alpha-Amylase and Urease Inhibitory Activity of Leaf Extracts of Prunus persica (L.) Batsch. Bulletin of Pure & Applied Sciences-Botany, (2).

44.Quave, C.L., Pardo-de-Santayana, M., Simões, O., Albuquerque, U.P., Pieroni, A. and Bennett, B.C., 2022. Global importance of indigenous and local medicinal plant use. Nature Plants, pp.1-6. https://doi.org/10.1038/s41477-022-01249-7

45.Ratner RE (2001). Controlling Postprandial Hyperglycemia. Am J Cardiol; 88 (suppl): 26H-31H

46.Reguieg, T. (2011). Local knowledge on medicinal plants used for livestock diseases in the highlands of Northern Algeria. Journal of Medicinal Plants Research, 5(15), 3650-3658.

47.Reighard, G. L., Scorza, R., & Mehlenbacher, S. A. (2006). Prunus taxonomy and new species in section Persica. Acta Horticulturae, 713, 93-98.

48.Sharma. G, Kumar. S, Sharma. M, Upadhyay. NK, Ahmed. Z, Mahindroo. N, (2018). Anti-Diabetic, Anti-Oxidant and Anti-Adipogenic Potential of Quercetin Rich Ethyl Acetate Fraction of Prunus persica. Polymer Journal, 10(3): 463-469.

49.Shi, T., et al. (2013). Phylogenetic relationships in Prunus (Rosaceae) based on chloroplast DNA sequences. PLoS ONE, 8(1), e53639.

50.Shirosaki, M, GOTO, Y, Hirooka, S, Masuda, H, Koyama, T, Yazawa, K, (2012). Peach Leaf Contains Multiflorin A as a Potent Inhibitor of Glucose Absorption in the Small Intestine in Mice. Biol. Pharm. Bull, 35(8): 1264-1268.

51.Singh, LW, (2011). Traditional medicinal plants of Manipur as anti-diabetics. Journal of medicinal plants research, 5(5): 677-687.

52.Tanaka, T., Tanaka, T. and Tanaka, M., (2011). Potential cancer chemopreventive activity of procyanidin-rich extracts from Prunus persica. Bioscience, biotechnology, and biochemistry, 75(8), pp.1667-1669. https://doi.org/10.1271/bbb.110220

53.Tanaka, T., Tanaka, T., & Tanaka, M. (2018). Potential cancer chemopreventive activity of procyanidin-rich extracts from the leaves of Prunus persica. Oncology letters, 15(2), 2755-2758. https://doi.org/10.3892/ol.2017.7560

54.Usharani, Ch, Sumalatha, G, Vimochana, B, (2014). Antihelmintic activity of prunus persica. International Research Journal of Pharmacy, 5(7): 2230-8407.

55.Vashist, HR, Gupta, A, Sharma, A, Sharma, RB, (2017). A review on plants with antidiabetic potential. Innovat International Journal Of Medical & Pharmaceutical Sciences, 2(3).

56.WHO. (2003). WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. World Health Organization.

57.Wong, J. S., Aiello, L. P. (2000). Diabetic retinopathy. Ann. Acad. Med. Singapore 29: 745–752.

58.Xie, C., Kang, J., Chen, J.R., Lazarenko, O.P., Bai, L., Blackburn, M.L., Ferguson, M.E., Wu, X., Tong, X., Zhang, Y. and Badger, T.M., 2015. Catechin consumption improves fasting plasma zeaxanthin and plasma lipid profile in diabetic db/db mice. Molecular nutrition & food research, 59(4), pp.714-722. https://doi.org/10.1002/mnfr.201400553

59.Zhang, C., Wang, W., Li, D., Yin, J., Guo, X., Zhang, W., ... & Ni, J. (2019). Phenolic profiling and evaluation of antioxidant capacity of Prunus persica L. Batsch from China. Molecules, 24(7), 1364. https://doi.org/10.3390/molecules24071364

60.Zhang, Q., Liu, W., Zhang, Y., & Niu, L. (2012). Evolution of S-RNase-based self-incompatibility and speciation in E. avium and E. dulcis of the genus Prunus L. BMC Plant Biology, 12, 229.