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Key Bioactive Constituents in Loquat and Their Potential Applications in Modern Medicine

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Abstract The study reveals that loquat contains a variety of bioactive compounds, including phenolics, terpenoids, polysaccharides, and triterpenoids, which exhibit significant pharmacological properties. These compounds have demonstrated anti-inflammatory, antidiabetic, antioxidant, antitumor, and hepatoprotective activities. Specific compounds such as ursolic acid, maslinic acid, and various sesquiterpene glycosides have shown promising effects in treating conditions like non-alcoholic fatty liver disease (NAFLD) and skin disorders. Additionally, loquat leaves and fruits are rich in vitamins, minerals, and fibers, contributing to their overall health benefits. The findings suggest that loquat and its bioactive constituents hold significant potential for developing new therapeutic agents in modern medicine. The diverse pharmacological activities of these compounds underscore the importance of further research to fully understand their mechanisms and optimize their use in clinical applications.
Keywords Loquat (*Eriobotrya japonica* Lindl.); Bioactive compounds; Phenolics, Terpenoids; Polysaccharides; Triterpenoids; Pharmacological properties; Modern medicine

1 Introduction

Loquat (*Eriobotrya japonica* Lindl.) is a subtropical evergreen tree native to China and widely cultivated in various regions, including the Mediterranean. The tree produces fruits that are not only consumed fresh but also processed into various products such as jams, jellies, and juices (Dhiman et al., 2021). The loquat fruit is known for its high content of vitamins, minerals, and bioactive compounds, making it a valuable horticultural product (Dhiman et al., 2021; Abdelrahman et al., 2023). Additionally, loquat leaves have been traditionally used in medicine, particularly in treating diabetes and its complications (Khouya et al., 2022).

The bioactive constituents of loquat, including phenolic compounds, flavonoids, and triterpenoids, have garnered significant attention due to their diverse pharmacological properties. These compounds exhibit anti-inflammatory, antitumor, antioxidative, antimutagenic, and antidiabetic activities, among others (Zhang et al., 2015; Dhiman et al., 2021; Khouya et al., 2022). For instance, loquat leaves are rich in polyphenols such as naringenin, procyanidin C1, epicatechin, and rutin, which have shown promising antidiabetic and antihyperlipidemic effects in animal models (Khouya et al., 2022). Furthermore, the antioxidant properties of loquat phenolics contribute to its potential in preventing oxidative stress-related diseases (Zhang et al., 2015). Understanding these bioactive constituents is crucial for developing new therapeutic agents and functional foods.

This study aims to provide a comprehensive review of the key bioactive constituents found in loquat and their potential applications in modern medicine. The objectives are threefold to summarize the current knowledge on the nutritional and phytochemical composition of loquat fruits, leaves, and seeds, evaluate the pharmacological properties of these bioactive compounds, with a focus on their anti-inflammatory, antidiabetic, and antioxidative effects, and explore the potential applications of loquat-derived compounds in developing new therapeutic agents and functional foods. By synthesizing findings from recent studies, this study hopes to highlight the therapeutic potential of loquat and encourage further research into its bioactive constituents.

2 Botanical and Phytochemical Profile of Loquat

2.1 Botanical description and distribution

Loquat (*Eriobotrya japonica* Lindl.) is an evergreen tree belonging to the Rosaceae family. It is native to China and has been introduced to various regions, including the Mediterranean countries and parts of Asia (Liu et al., 2016; Khouya et al., 2022). The tree thrives in subtropical climates and is known for its high medicinal value. Loquat trees produce fruits that are not only consumed fresh but also processed into various products such as jams, jellies, and juices (Dhiman et al., 2021).

2.2 Traditional uses in folk medicine

Historically, different parts of the loquat tree, including its leaves, fruits, and seeds, have been used in traditional medicine, particularly in Chinese and Moroccan folk medicine (Liu et al., 2016; Khouya et al., 2022). The leaves have been utilized to treat diabetes and its complications, while the fruits are known for their nutritional benefits. Traditional applications also include the use of loquat extracts for treating inflammation, bacterial infections, and other health issues (Liu et al., 2016; Khouya et al., 2022; Wu et al., 2022).

2.3 Overview of phytochemical composition

Loquat is rich in various bioactive compounds, including phenolics, flavonoids, terpenoids, and vitamins. The leaves, in particular, contain significant amounts of phenolic compounds such as naringenin, procyanidin C1, epicatechin, and rutin, which contribute to their antioxidant and antidiabetic properties (Hasibuan et al., 2020; Silva et al., 2020; Khouya et al., 2022). Additionally, loquat fruits are a good source of vitamins A, B2, B6, B12, and C, as well as minerals like potassium, calcium, magnesium, and iron (Dhiman et al., 2021; Khouya et al., 2022). The presence of these compounds underpins the pharmacological activities of loquat, including anti-inflammatory, antitumor, and antimicrobial effects (Ercişli et al., 2012; Liu et al., 2016; Ashokkumar et al., 2020; Xiao et al., 2023).

3 Major Bioactive Constituents in Loquat

3.1 Identification and classification of key bioactive compounds

Loquat (*Eriobotrya japonica*) is a rich source of various bioactive compounds that have significant potential in modern medicine. The primary bioactive constituents in loquat include triterpenoids, phenolics, flavonoids, and essential vitamins and minerals.

Triterpenoids are a class of chemical compounds composed of three terpene units, which are known for their diverse biological activities. In loquat, triterpenoids such as ursolic acid and oleanolic acid have been identified. These compounds exhibit a range of pharmacological properties, including anti-inflammatory, antitumor, and antioxidative activities (Dhiman et al., 2021; Xiao et al., 2023). Ursolic acid and oleanolic acid are particularly noted for their potential in combating cancer and reducing inflammation, making them valuable in therapeutic applications (Dhiman et al., 2021).

Phenolic compounds are another significant group of bioactive constituents in loquat. These compounds are known for their antioxidant properties, which help in neutralizing free radicals and reducing oxidative stress. Key phenolic acids identified in loquat include chlorogenic acid, caffeic acid, and ellagic acid (Silva et al., 2020; Sun and Shahrajabian, 2023). These phenolics contribute to the plant's antidiabetic, cardioprotective, and anti-inflammatory effects, making them crucial for medicinal purposes (Khouya et al., 2022; Sun and Shahrajabian, 2023).

Flavonoids are a diverse group of phytonutrients found in many fruits and vegetables, including loquat. The primary flavonoids in loquat leaves include naringenin, procyanidin C1, epicatechin, and rutin. These compounds have been shown to possess strong antioxidant and anti-inflammatory properties, which are beneficial in treating conditions such as chronic obstructive pulmonary disease (COPD) and diabetes (Jian et al., 2020; Khouya et al., 2022). Flavonoids also play a role in modulating various signaling pathways, thereby offering protective effects against oxidative stress and inflammation (Jian et al., 2020).

Loquat is also a rich source of essential vitamins and minerals, which contribute to its overall nutritional and therapeutic value. The leaves and fruits of loquat contain significant amounts of vitamins B2, B6, B12, and C, as well as minerals such as potassium, calcium, magnesium, and iron (Lopes et al., 2018; Dhiman et al., 2021; Khouya et al., 2022). These micronutrients are vital for maintaining various bodily functions and enhancing the immune system, thereby supporting overall health and well-being (Dhiman et al., 2021; Khouya et al., 2022).

3.2 Methods of extraction and analysis

The extraction and analysis of bioactive compounds from loquat involve various techniques to ensure the efficient isolation and identification of these constituents. One common method is solvent extraction, which uses solvents like ethanol and methanol to extract phenolic compounds and other bioactives from loquat leaves. The choice of solvent and extraction conditions, such as temperature and duration, can significantly influence the yield and composition of the extracts. For instance, ethanol extraction at 40°C has been found to yield high levels of total phenolics and antioxidant activities (Silva et al., 2020).

Ultrasound-assisted extraction is another effective technique that enhances the extraction efficiency by using ultrasonic waves to disrupt plant cell walls, thereby facilitating the release of bioactive compounds. This method has been shown to be particularly effective in extracting chlorogenic, caffeic, and ellagic acids from loquat leaves (Silva et al., 2020).

High-Performance Liquid Chromatography (HPLC) is widely used for the profiling and quantification of phenolic compounds in loquat. This technique allows for the precise identification and measurement of individual phenolics, providing detailed insights into the composition of loquat extracts (Khouya et al., 2022). Paper Spray Mass Spectrometry (PS-MS) is a rapid and simple analytical technique used to identify a wide range of chemical constituents in loquat extracts. This method has been demonstrated to effectively identify various organic acids, phenolic acids, flavonoids, sugars, quinones, and terpenes in loquat leaves (Silva et al., 2020).

4 Pharmacological Properties and Mechanisms of Action

4.1 Antioxidant properties

Loquat (*Eriobotrya japonica* Lindl.) exhibits significant antioxidant properties, primarily attributed to its high content of bioactive compounds such as flavonoids, phenolic acids, and vitamins. These compounds act as free radical scavengers, reducing oxidative stress and preventing cellular damage. For instance, the total flavonoids derived from loquat leaves have demonstrated remarkable antioxidant activities by inhibiting the generation of malondialdehyde (MDA) and enhancing the activity of superoxide dismutase (SOD) in chronic obstructive pulmonary disease (COPD) models (Jian et al., 2020). Additionally, loquat leaf extracts have shown high antioxidant activity, particularly when extracted with ethanol and subjected to ultrasound, which maximizes the retention of phenolic compounds (Silva et al., 2020).

4.2 Anti-inflammatory effects

Loquat leaves and their extracts possess potent anti-inflammatory properties, which are beneficial in treating various inflammatory conditions. The bioactive compounds in loquat, such as total flavonoids, have been shown to suppress the production of pro-inflammatory cytokines like interleukin 6 (IL-6), IL-1β, and tumor necrosis factor α (TNF-α) (Jian et al., 2020). These compounds also inhibit the activation of key inflammatory pathways, including the NF-κB signaling pathway, thereby reducing inflammation and associated symptoms. Furthermore, loquat flower water extracts have demonstrated significant anti-inflammatory performance by inhibiting the production of prostaglandin E2 (PGE2), a marker of inflammation (Chen et al., 2023) (Figure 1).

4.3 Anticancer activities

The anticancer potential of loquat is attributed to its rich content of polyphenolic compounds, which exhibit anti-tumor activities. These compounds can induce apoptosis in cancer cells, inhibit cell proliferation, and modulate various molecular targets involved in cancer progression. For example, loquat leaves have been reported to contain bioactive components that exhibit anti-tumor activities, making them valuable in cancer prevention and treatment (Ibrahim, 2021). The presence of compounds like kaempferol and quercetin in loquat further enhances its anticancer properties by targeting specific signaling pathways involved in tumor growth and metastasis (Dhiman et al., 2021).

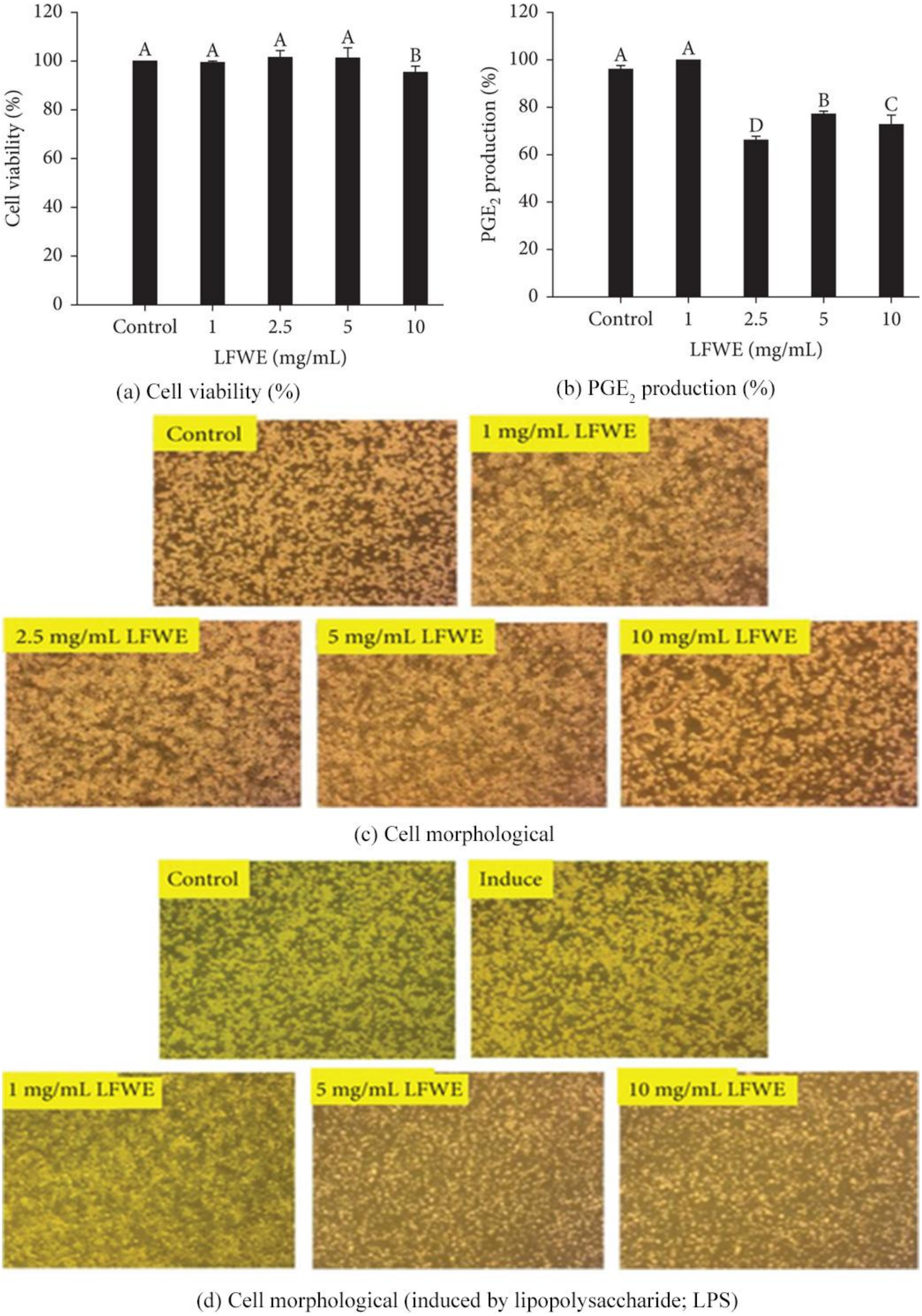

Figure 1 Effects of different concentrations of LFWE on the (a) cell viability, (b) PGE2 production, and (c, d) cell morphological of mouse macrophage RAW264.7 cell lines (Adopted from Chen et al., 2023)

Image caption: All values were expressed as mean ± standard deviation (n=3), while different lowercase letters in the figure represent significant differences (p<0.05) (Adopted from Chen et al., 2023)

4.4 Antimicrobial and antiviral properties

Loquat extracts have demonstrated significant antimicrobial and antiviral activities, making them useful in combating various infections. The bioactive compounds in loquat, such as phenolic acids and flavonoids, inhibit the growth of pathogenic microorganisms. For instance, loquat leaf extracts have shown antimicrobial properties against Staphylococcus aureus, a common bacterial pathogen (Silva et al., 2020). Additionally, loquat has been traditionally used in Chinese medicine for its antiviral properties, particularly in treating respiratory infections (Ibrahim, 2021).

4.5 Cardiovascular benefits

Loquat exhibits cardioprotective effects, which are beneficial in maintaining cardiovascular health. The bioactive compounds in loquat, such as ursolic acid and oleanolic acid, contribute to its hypolipidemic and anti-atherosclerotic activities. These compounds help in reducing cholesterol levels, preventing the formation of atherosclerotic plaques, and improving overall heart function (Dhiman et al., 2021). Moreover, loquat has been used in traditional medicine to prevent cardiovascular diseases, highlighting its potential in modern therapeutic applications (Chen et al., 2023).

4.6 Neuroprotective effects

The neuroprotective properties of loquat are attributed to its ability to modulate oxidative stress and inflammation in the nervous system. Bioactive compounds in loquat, such as flavonoids, have been shown to protect neuronal cells from oxidative damage and reduce neuroinflammation. For example, astragalin, a flavonoid found in loquat, exhibits neuroprotective effects by regulating various molecular targets involved in neuronal survival and function (Riaz et al., 2018). These properties make loquat a promising candidate for the prevention and treatment of neurodegenerative diseases such as Alzheimer's and Parkinson's (Ibrahim, 2021).

5 Potential Applications in Modern Medicine

5.1 Development of nutraceuticals and dietary supplements

Loquat leaves and fruits are rich in bioactive compounds such as polyphenols, sesquiterpene glycosides, and flavonoids, which have shown significant health benefits. These compounds can be harnessed to develop nutraceuticals and dietary supplements aimed at improving overall health and preventing chronic diseases. For instance, the antioxidant and anti-inflammatory properties of loquat extracts make them suitable candidates for supplements designed to combat oxidative stress and inflammation (Silva et al., 2020; Khouya et al., 2022; Xiao et al., 2023).

5.2 Integration into pharmaceutical formulations

The bioactive components of loquat, including sesquiterpene glycosides and phenolic compounds, have demonstrated potential in pharmaceutical applications. These compounds can be integrated into pharmaceutical formulations to enhance their therapeutic efficacy. For example, sesquiterpene glycosides from loquat leaves have been shown to modulate key signaling pathways involved in glucose and lipid metabolism, making them promising candidates for diabetes medications (Wu et al., 2021; Pawłowska et al., 2023). Additionally, the antimicrobial properties of loquat extracts can be utilized in developing new antibiotics or enhancing existing ones (Silva et al., 2020).

5.3 Clinical trials and studies

To fully realize the potential of loquat bioactive constituents in modern medicine, extensive clinical trials and studies are necessary. These studies should focus on evaluating the safety, efficacy, and optimal dosages of loquat-derived compounds in human subjects. Preliminary research has shown promising results in animal models, such as the amelioration of insulin resistance and reduction of inflammatory markers in diabetic mice treated with loquat extracts (Wu et al., 2021; 2022) (Figure 2). Conducting well-designed clinical trials will help translate these findings into practical medical applications.

5.4 Potential for use in treating specific diseases and conditions

Loquat extracts have exhibited antiproliferative activities against various cancer cell lines, including breast adenocarcinoma, colon adenocarcinoma, and glioblastoma. The high content of polyphenolic compounds in loquat leaves is believed to contribute to their chemopreventive properties, making them potential candidates for cancer treatment and prevention (Pawłowska et al., 2023).

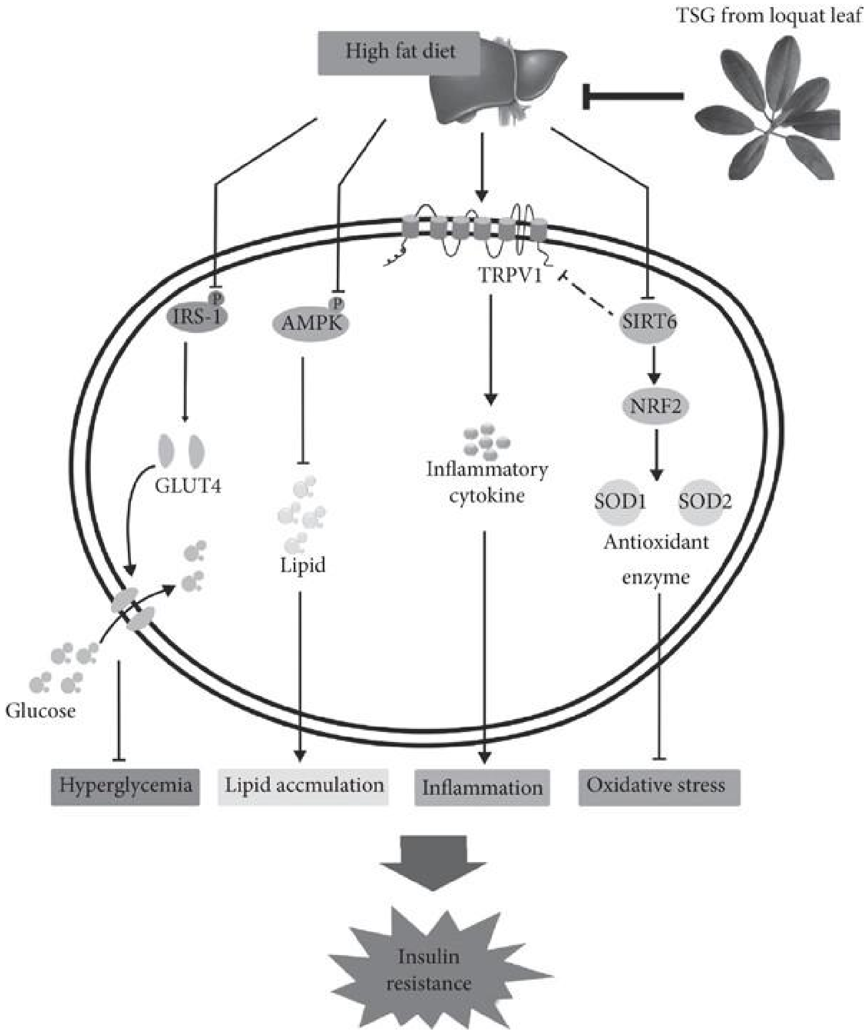

Figure 2 Potential Molecular Mechanism of TSG from Loquat Leaf in Alleviating Insulin Resistance Induced by High-Fat Diet via Modulation of IRS-1/GLUT4, AMPK, TRPV1, and SIRT6/Nrf2 Signaling Pathways (Adapted from Wu et al., 2021)

Loquat leaves have been traditionally used to treat diabetes, and recent studies have provided scientific evidence supporting their antidiabetic effects. Compounds such as sesquiterpene glycosides have been shown to improve insulin sensitivity, reduce blood glucose levels, and modulate gut microbiota, thereby offering a natural therapeutic option for managing type 2 diabetes mellitus (Wu et al., 2021; Khouya et al., 2022; Wu et al., 2022).

The antioxidant and anti-inflammatory properties of loquat extracts can play a crucial role in preventing and managing cardiovascular diseases. By reducing oxidative stress and inflammation, loquat bioactive compounds can help protect against atherosclerosis, hypertension, and other cardiovascular conditions (Silva et al., 2020; Xiao et al., 2023).

The neuroprotective potential of loquat bioactive constituents is an area of growing interest. The antioxidant properties of these compounds can help mitigate oxidative damage in neural tissues, potentially offering therapeutic benefits for neurodegenerative disorders such as Alzheimer's and Parkinson's diseases (Silva et al., 2020; Xiao et al., 2023). Loquat leaves have been used in traditional medicine to treat respiratory conditions such as coughs and bronchitis. The anti-inflammatory and antimicrobial properties of loquat extracts can help alleviate symptoms and improve respiratory health, making them valuable in the treatment of respiratory ailments (Silva et al., 2020).

6 Case Studies and Clinical Evidence

6.1 Review of key clinical studies and trials

Several clinical studies have investigated the bioactive constituents of loquat (*Eriobotrya japonica*) and their potential therapeutic applications. One notable study focused on sesquiterpene glycosides isolated from loquat leaves, which demonstrated significant effects on hyperglycemia and inflammation in a type 2 diabetes mellitus (T2DM) mouse model. The study found that SG1, a specific sesquiterpene glycoside, could prevent insulin resistance and inflammation by modulating gut microbiota composition (Wu et al., 2022). Another study evaluated the nutritional value and polyphenol composition of loquat leaf aqueous extract (LLE) and its antidiabetic and antihyperlipidemic properties in mice. The results indicated that LLE ameliorated hyperglycemia, insulin resistance, oxidative stress, and hyperlipidemia in a dose-dependent manner (Khouya et al., 2022).

6.2 Real-world examples of loquat-based therapies

In traditional Chinese and Moroccan medicine, loquat leaves have been used to treat various ailments, including diabetes and its complications. For instance, the administration of loquat leaf extracts has shown promising results in reducing body weight, total cholesterol, and triglyceride levels in high-fat diet-induced obese mice. This effect is attributed to the restoration of gut microbiota diversity and the modulation of key metabolic pathways (Jian et al., 2022). Additionally, loquat leaf extracts have demonstrated antifungal activity against Cryptococcus neoformans, suggesting their potential use in managing cryptococcosis (Bisso et al., 2022).

6.3 Analysis of efficacy and safety data

The efficacy of loquat-based therapies has been supported by various studies. For example, the administration of total sesquiterpenoids from loquat leaves significantly reduced obesity-related parameters and improved gut microbiota composition in obese mice (Jian et al., 2022) (Table 1). Similarly, the aqueous extract of loquat leaves showed a dose-dependent improvement in metabolic parameters in diabetic mice, with a median lethal dose higher than 5000 mg/kg body weight, indicating a high safety margin (Khouya et al., 2022). Furthermore, the antifungal activity of loquat extracts against Cryptococcus neoformans highlights their potential as safe and effective antifungal agents (Bisso et al., 2022).

In conclusion, the bioactive constituents of loquat, particularly sesquiterpene glycosides and polyphenols, have shown significant therapeutic potential in preclinical studies. These findings support the traditional use of loquat in managing metabolic disorders and infections, and further clinical trials are warranted to confirm their efficacy and safety in humans.

Table 1 Antifungal activity of *E. japonica* extracts and antifungals against clinical isolates of *C. neoformans* (Adopted from Jian et al., 2022)

Extracts	Isolates																			
	CN		CN169		CN173		CN047		CN091		CN165		CN118		CN046		CN096		CN158	
	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC	MIC	MFC
HeS	512	-	1024	-	512	-	1024	-	256	-	512	-	64	256	1024	-	256	-	512	-
ChS	1024	-	1024	-	1024	-	512	-	512	-	1024	-	512	-	512	-	1024	-	1024	-
EaS	1024	-	512	-	1024	-	64	256	1024	-	1024	-	256	-	256	1024	512	-	512	-
MeS	1024	-	512	-	512	-	32	128	512	-	256	1024	512	-	128	512	128	1024	512	-
HeL	1024	-	512	-	1024	-	512	-	256	512	32	256	32	128	32	128	256	512	128	256
ChL	256	-	512	-	1024	-	1024	-	1024	-	512	-	256	512	1024	-	512	-	1024	-
EaL	512	-	1024	-	1024	-	1024	-	512	-	1024	-	1024	-	512	-	1024	-	512	-
MeL	512	-	512	-	1024	-	256	-	1024	-	512	-	1024	-	256	-	512	-	512	-
HeB	1024	-	1024	-	1024	-	512	-	512	-	512	-	1024	-	512	-	1024	-	1024	-
ChB	1024	-	512	-	1024	-	1024	-	512	-	512	-	512	-	1024	-	512	-	1024	-
EaB	512	-	256	1024	256	512	256	1024	128	512	1024	-	1024	-	512	-	512	-	1024	-
MeB	512	-	128	512	1024	-	1024	-	256	1024	1024	-	512	-	256	512	128	512	512	-
Nystatin	8	8	32	256	16	32	4	8	8	128	16	64	4	8	32	128	4	8	4	8
Clotrimazole	16	64	32	128	2	8	2	16	2	16	8	32	4	32	4	32	4	16	2	16

Image caption: −, >1024 μg/mL for extracts; HeS, hexane extract of seed; ChS, chloroform extract of seed; EaS, ethyl acetate extract of seed; MeS, methanol extract of seed; HeL, hexane extract of leaves; ChL, chloroform extract of leaves; EaL, ethyl acetate extract of leaves; MeL, methanol extract of leaves; HeB, hexane extract of bark; ChB, chloroform extract of bark; EaB, ethyl acetate extract of bark; MeB, methanol extract of bark. Bold values represent significant antifungal activity

7 Challenges and Future Perspectives

7.1 Current limitations in research and application

Despite the promising bioactive properties of loquat leaves, several limitations hinder their full potential in modern medicine. One significant challenge is the variability in the chemical composition of loquat extracts due to differences in extraction methods, solvent types, and leaf dehydration processes. For instance, the extraction method and solvent type significantly influence the yield and bioactivity of the compounds, as demonstrated by the varying results obtained using ethanol and methanol solvents with different extraction techniques (Silva et al., 2020). Additionally, the complexity of the bioactive compounds, such as sesquiterpene glycosides and polysaccharides, requires advanced analytical techniques for accurate identification and quantification, which are not always accessible (Fu et al., 2019; Wu et al., 2021).

7.2 Technological and regulatory hurdles

The technological hurdles in the extraction and standardization of bioactive compounds from loquat leaves are substantial. Conventional extraction methods often result in low yields and high energy costs, necessitating the development of more efficient techniques like enzyme-assisted extraction and supercritical-fluid extraction (Sosa-Hernández et al., 2018). Moreover, the regulatory landscape for herbal medicines and functional foods is stringent, requiring extensive safety and efficacy data. The variability in bioactive compound concentrations further complicates the standardization and regulatory approval processes (Dhiman et al., 2021; Xiao et al., 2023).

7.3 Future research directions

Future research should focus on optimizing extraction methods to enhance the yield and bioactivity of loquat leaf compounds. Advanced techniques such as paper spray mass spectrometry (PS-MS) have shown promise in quickly and accurately profiling the chemical constituents of loquat extracts, which could be further explored (Silva et al., 2020). Additionally, more in vivo studies are needed to elucidate the mechanisms of action of these bioactive compounds, particularly their effects on insulin resistance, inflammation, and gut microbiota (Wu et al., 2021; 2022). Investigating the synergistic effects of different bioactive compounds in loquat leaves could also provide insights into their combined therapeutic potential (Khouya et al., 2022).

7.4 Potential for commercial development

The commercial potential of loquat leaf extracts is significant, given their diverse bioactive properties and applications in the food and pharmaceutical industries. The development of functional foods and nutraceuticals incorporating loquat leaf extracts could provide new avenues for managing chronic diseases such as diabetes and obesity (Fu et al., 2019; Wu et al., 2020). Additionally, the use of loquat leaf extracts in cosmetic and personal care products could be explored, leveraging their antioxidant and anti-inflammatory properties (Dhiman et al., 2021). However, successful commercialization will require overcoming the current technological and regulatory challenges, as well as ensuring consistent quality and efficacy of the products (Sosa-Hernández et al., 2018; Xiao et al., 2023).

8 Concluding Remarks

Loquat (*Eriobotrya japonica* Lindl.) has been extensively studied for its rich array of bioactive compounds and their potential health benefits. The various parts of the loquat tree, including leaves, fruits, and flowers, contain significant amounts of phenolics, terpenoids, flavonoids, and other bioactive compounds. These compounds exhibit a wide range of biological activities, such as antioxidant, anti-inflammatory, antidiabetic, antimicrobial, and anticancer properties. For instance, triterpenoids from loquat leaves have shown promising effects in preventing and treating skin disorders, while sesquiterpene glycosides have demonstrated potential in managing type 2 diabetes by modulating gut microbiota. Additionally, loquat leaves have been found to be rich in micronutrients and polyphenols, contributing to their antidiabetic and antihyperlipidemic effects.

The bioactive compounds identified in loquat have significant implications for modern medicine. The antioxidant and anti-inflammatory properties of these compounds can be harnessed to develop new treatments for chronic diseases such as diabetes, cardiovascular diseases, and cancer. The antimicrobial properties of loquat extracts also suggest potential applications in developing new antibiotics or antiseptics. Furthermore, the skin-care benefits of triterpenoids from loquat leaves indicate their potential use in cosmetic formulations for anti-aging and anti-acne treatments. The ability of loquat compounds to modulate gut microbiota opens new avenues for research into gut health and its impact on overall well-being.

While the current research highlights the promising potential of loquat bioactive compounds, further studies are needed to fully understand their mechanisms of action, bioavailability, and long-term safety. Future research should focus on clinical trials to validate the efficacy of these compounds in human populations. Additionally, exploring the genetic basis of bioactive compound production in loquat could lead to the development of new cultivars with enhanced medicinal properties. Investigating the synergistic effects of different loquat compounds and their interactions with other medications could also provide valuable insights for developing comprehensive treatment strategies. Overall, the integration of loquat bioactive compounds into modern medicine holds great promise for improving health outcomes and enhancing the quality of life.

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Conflict of Interest Disclosure

The authors affirm that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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