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Medicinal Plants Most Commonly Used for Non-Alcoholic Fatty Liver Disease: A Review of Traditional Iranian Medicine

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ABSTRACT

Non-alcoholic fatty liver disease (NAFLD), characterized by hepatic steatosis unrelated to significant alcohol consumption, represents a growing global health concern closely associated with metabolic syndrome. Traditional Iranian Medicine (TIM) recognizes this condition as a diet-related disorder and offers numerous herbal interventions. This study identifies the most frequently documented medicinal plants in TIM for NAFLD management. We conducted a comprehensive review of classical TIM texts alongside systematic searches in modern scientific databases including Google Scholar, PubMed, SID, Magiran, and ISC. Search terms encompassed both Persian and English keywords related to medicinal plants, NAFLD, therapeutic efficacy, and safety profiles. The investigation identified 37 medicinal plants commonly utilized in TIM for NAFLD treatment. Prominent species include *Silybum marianum*, *Taraxacum officinale*, *Curcuma longa*, *Zingiber officinale*, and *Glycyrrhiza glabra*. These plants demonstrate multiple pharmacological mechanisms including lipid metabolism regulation, antioxidant activity, and anti-inflammatory effects through their diverse bioactive constituents. Traditional Iranian Medicine offers a substantial repertoire of medicinal plants with potential therapeutic value for NAFLD. The documented plants show promising mechanisms of action that warrant further pharmacological investigation and clinical validation for evidence-based application in modern hepatology.

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Introduction

Chronic diseases have become one of the most pressing global health challenges, affecting millions of people every year. Their rising prevalence and incidence not only impose a heavy economic and social burden but also pose a serious threat to healthcare systems and overall quality of life (Hajiesmaello et al. 2019; Mohammadi and Abdi, 2025). Chronic diseases, including diabetes, cardiovascular diseases, cancer, and liver disorders, are among the most significant health challenges facing humans in the present century. The high prevalence of unhealthy lifestyles and poor nutrition places a heavy burden on healthcare systems. Prevention and management of these diseases improve quality of life and reduce healthcare costs (Hajiesmaello et al. 2019; Mohammadi and Abdi, 2025). The liver is a vital organ responsible for multiple essential functions, including metabolism, energy storage, detoxification, protein synthesis, and bile production (Ozougwu JC, 2017). Maintaining liver health is critical for overall physiological homeostasis, and impairment of liver function can lead to chronic, potentially life-threatening diseases (Gershwin et al., 2013). Liver disorders such as hepatitis, cirrhosis, hepatocellular carcinoma, and fatty liver disease rank among the most common global health challenges, often arising from poor diet, obesity, diabetes, genetic predisposition, and alcohol consumption (Tajiri & Shimizu, 2013).

Non-alcoholic fatty liver disease (NAFLD), also known as metabolic-associated steatotic liver disease (MASLD), is characterized by excessive fat deposition in hepatocytes without significant alcohol intake (Yki-Järvinen, 2016). Distinct from alcoholic fatty liver disease, NAFLD is closely associated with metabolic conditions such as obesity and type 2 diabetes. NAFLD can progress from simple steatosis to non-alcoholic steatohepatitis (NASH), which may ultimately lead to fibrosis and cirrhosis if left untreated (Bellentani, 2017). Epidemiological data indicate a rising prevalence, affecting approximately 25–30% of the global population (Bellentani & Marino, 2009). Pathophysiological mechanisms underlying NAFLD include lipid metabolism dysfunction, oxidative stress, cellular inflammation, and hepatocyte injury, culminating in NASH, fibrosis, and cirrhosis (Pouwels et al., 2022; Grander et al., 2023).

Pharmacological treatments for NAFLD include antioxidants, insulin sensitizers, lipid-lowering agents, and anti-inflammatory drugs (Grander et al., 2023). However, long-term use of these medications may result in gastrointestinal disturbances, hepatic and renal dysfunction, hypersensitivity, and other adverse effects (Rong et al., 2020; Paternostro & Trauner, 2022).

In this context, Traditional Iranian Medicine (TIM) and the use of medicinal plants have gained attention as natural, low-risk strategies for liver protection and the treatment of hepatic disorders, particularly NAFLD (Yao et al., 2016). Medicinal plants contain bioactive compounds such as flavonoids, silymarin, catechins, and terpenoids, which confer hepatoprotective, antioxidant, anti-inflammatory, and lipid-modulating effects (Bagherniya et al., 2018). Beyond their direct therapeutic benefits, these plants may serve as adjuncts to reduce dependency on synthetic drugs and mitigate associated adverse effects (Xiao et al., 2013).

Given the global burden of liver disease and the increasing prevalence of NAFLD, reviewing medicinal plants used in Traditional Iranian Medicine (TIM) can provide valuable insights for developing safe and evidence-based natural therapies. However, current studies are limited, and there is a need for a comprehensive scientific integration of TIM knowledge with modern evidence. Therefore, this review was conducted with the aim of identifying and summarizing the most commonly used medicinal plants in TIM for the prevention and treatment of NAFLD, with an emphasis on their bioactive compounds and potential therapeutic mechanisms.

Materials and Methods

This study employed a narrative review approach to examine medicinal plants used in the management of NAFLD. Initially, traditional Iranian medical texts, including classical manuscripts and reference books, were meticulously reviewed to identify plant species, traditional administration methods, and therapeutic prescriptions.

A complementary search was then conducted in reputable modern databases, including PubMed, Google Scholar, SID, ISC, and Magiran, to collect contemporary scientific evidence on the therapeutic efficacy and safety of these plants. Both Persian and English keywords were used, such as “medicinal plants,” “non-alcoholic fatty liver disease,” “therapeutic efficacy,” “safety,” and related terms.

Included studies comprised experimental (in vitro and in vivo), clinical, and previous review studies

that provided empirical data on the effects, mechanisms, dosages, or safety of medicinal plants for NAFLD. Studies were excluded if they lacked sufficient data, were of low methodological quality, or were not relevant to the scope of this review.

Extracted data were systematically organized and presented in tabular and narrative formats. Classification was performed according to plant species, bioactive compounds, clinical or experimental effects, dosage, and safety profiles. This structured approach allows a clear, reproducible overview of both traditional knowledge and contemporary scientific evidence regarding medicinal plants used in NAFLD management.

Results

Our review identified a range of medicinal plants frequently cited in TIM for NAFLD management, including *Silybum marianum, Taraxacum officinale, Camellia sinensis, Zingiber officinale, Citrus limon, Allium schoenoprasum, Glycyrrhiza glabra, Curcuma longa, Allium sativum, Juglans regia, Rubus idaeus, Vaccinium corymbosum, Citrus aurantium, Cinnamomum verum, Cichorium intybus, Rosmarinus officinalis, Crataegus monogyna, Cynara scolymus, Tribulus terrestris, Elaeagnus angustifolia, Malus domestica, Olea europaea, Linum usitatissimum, Arctium lappa, Melissa officinalis, Foeniculum vulgare, Ficus carica, Morus nigra, Morus alba, Solanum lycopersicum, Ziziphus jujuba, Crocus sativus, Berberis vulgaris, Salvia hispanica, Chrysanthemum morifolium,* and *Salvia officinalis*. Table 1 provides a summary of the most frequently cited plants, while table 2 details their traditional uses, bioactive compounds, and proposed mechanisms of action in NAFLD management.

Discussion

Non-alcoholic fatty liver disease (NAFLD) is characterized by excessive fat accumulation in hepatocytes in the absence of significant alcohol consumption and is commonly associated with obesity, type 2 diabetes, and metabolic disorders. The disease spectrum ranges from simple steatosis to inflammation and fibrosis, with management primarily relying on lifestyle modification, weight control, and physical activity (Jedidi et al., 2022). Herbal therapy has gained significant attention in the management of NAFLD, as many medicinal plants contain bioactive compounds with antioxidant, anti-inflammatory, and hepatoprotective properties. Compared to conventional pharmacological treatments, herbal interventions generally exhibit fewer adverse effects, making them a viable complementary or preventive strategy in NAFLD management (Nie et al., 2025). Studies indicate that medicinal plants exert diverse and complementary mechanisms against NAFLD. Some herbs, such as Silybum marianum, Melissa officinalis, and Foeniculum vulgare, provide hepatocyte protection, antioxidant activity, and anti-inflammatory effects, thereby reducing cellular liver damage (Jafari Shiran et al., 2022; Hosseini et al., 2018; Salem et al., 2025; Bawazeer & Qahl, 2016). Other plants facilitate bile secretion and promote diuresis, contributing to toxin elimination and decreased hepatic fat accumulation (Medina-Urrutia et al., 2020; Li et al., 2023; Hosseini et al., 2018). Evidence suggests that herbal remedies can effectively reduce hepatic steatosis and inflammation, complementing lifestyle interventions in NAFLD management (Neda et al., 2022). Multiple mechanisms have been identified, including enhanced lipid metabolism, reduced oxidative stress and inflammation, and stimulation of bile acid synthesis. Plant-derived polyphenols and antioxidants, due to their protective and therapeutic effects, represent promising adjuncts for NAFLD treatment, warranting further investigation (Ghanadi et al., 2023). A recent review highlighted that medicinal plants can prevent and manage NAFLD through multiple pathways, including oxidative stress reduction, anti-inflammatory activity, regulation of lipid accumulation, normalization of liver enzymes, and detoxification. Notable examples include green tea, milk thistle, licorice, black seed, ginger, chives, chicory, aloe vera, garlic, lemon, avocado, and olive oil. However, administration of these herbs should always be supervised by healthcare professionals to minimize potential adverse effects (Aghaei et al., 2019). The most pronounced effects of natural compounds such as curcumin and silymarin were observed in reducing ALT, AST, and GGT levels in NAFLD patients, whereas changes in ALP were not statistically significant (Fakhri et al., 2025). Preclinical and clinical studies have shown that specific herbal compounds and functional blends, including blueberry polysaccharides, garlic-derived components, resveratrol from red grapes, and milk thistle derivatives, can target NAFLD-related pathological processes (Xiao et al., 2013).

Table 1. Commonly Used Medicinal Plants in Traditional Iranian Medicine for Non-Alcoholic Fatty Liver Disease (NAFLD)

Persian Name	Common English Name	Scientific Name	Family	Plant Part Used	Life Cycle	Reference
Kharmaryam	Milk Thistle	*Silybum marianum* L.	Asteraceae	Seeds, leaves	Annual/Biennial	Ghahreman, 2008
Ghasedak	Dandelion	*Taraxacum officinale* L.	Asteraceae	Leaves, roots	Perennial	Aqili Khorasani, 2008
Chayesabz	Green Tea	*Camellia sinensis* (L.) Kuntze	Theaceae	Leaves	Perennial	Ghahreman, 2008
Zanjabil	Ginger	*Zingiber officinale* Roscoe	Zingiberaceae	Rhizome	Perennial	Avicenna, 2005
Limo	Lemon	*Citrus limon* (L.) Osbeck	Rutaceae	Fruit, leaves	Perennial	Mozaffarian, 2007
Shahtareh	Chives	*Allium schoenoprasum* L.	Amaryllidaceae	Leaves, flowers	Perennial	Ghahreman, 2008
Shirinbayan	Licorice	*Glycyrrhiza glabra* L.	Fabaceae	Root	Perennial	Dastjerdi, 2010
zardchobeh	Turmeric	*Curcuma longa* L.	Zingiberaceae	Rhizome	Perennial	Avicenna, 2005
Sir	Garlic	*Allium sativum* L.	Amaryllidaceae	Bulb	Perennial	Ghahreman, 2008
Gerdoyechatri	Umbrella Walnut	*Juglans regia* L.	Juglandaceae	Fruit, leaves	Perennial	Aqili Khorasani, 2008
Tameshk	Raspberry	*Rubus idaeus* L.	Rosaceae	Leaves, fruit	Perennial	Avicenna, 2005
Zoghalakhte	Blueberry	*Vaccinium corymbosum* L.	Ericaceae	Fruit	Perennial	Khorasani, 2015
Portaghaltalkh	Bitter Orange	*Citrus aurantium* L.	Rutaceae	Fruit, peel	Perennial	Dastjerdi, 2010
Darchin	Cinnamon	*Cinnamomum verum* J. Presl	Lauraceae	Bark	Perennial	Ghahreman, 2008
Kasni	Chicory	*Cichorium intybus* L.	Asteraceae	Roots, leaves	Perennial	Avicenna, 2005
Rozmari	Rosemary	*Rosmarinus officinalis* L.	Lamiaceae	Leaves, flowers	Perennial	Mozaffarian, 2007
zalzalakkouhi	Hawthorn	*Crataegus monogyna* Jacq.	Rosaceae	Fruit, flowers	Perennial	Khorasani, 2015
Kangar	Artichoke	*Cynara scolymus* L.	Asteraceae	Flower buds, leaves	Perennial	Rhazes, 2008
Kharshotor	Tribulus	*Tribulus terrestris* L.	Zygophyllaceae	Fruit, root	Annual/Biennial	Ghahreman, 2008
Bidmeshk	Musk Willow	*Elaeagnus angustifolia* L.	Elaeagnaceae	Flowers, leaves	Perennial	Aqili Khorasani, 2008
Sib	Apple	*Malus domestica* Borkh.	Rosaceae	Fruit	Perennial	Alavi, 2013
Zeytoun	Olive	*Olea europaea* L.	Oleaceae	Fruit, leaves	Perennial	Avicenna, 2005
Katan	Flax	*Linum usitatissimum* L.	Linaceae	Seeds, stems	Annual	Mozaffarian, 2007
Babaadam	Greater Burdock	*Arctium lappa* L.	Asteraceae	Root, leaves	Biennial	Aqili Khorasani, 2008
badranjbouyeh	Lemon Balm	*Melissa officinalis* L.	Lamiaceae	Leaves	Perennial	Dastjerdi, 2010
razianeh	Fennel	*Foeniculum vulgare* Mill.	Apiaceae	Seeds, leaves, root	Biennial/Perennial	Mozaffarian, 2007
Anjir	Fig	*Ficus carica* L.	Moraceae	Fruit, leaves	Perennial	Hajhashemi, 2011
Totesiah	Mulberry	*Morus nigra* L.	Moraceae	Fruit, leaves	Perennial	Alavi, 2013
Totesefid	White Mulberry	*Morus alba* L.	Moraceae	Fruit, leaves	Perennial	Dastjerdi, 2010
Goje	Tomato	*Solanum lycopersicum* L.	Solanaceae	Fruit	Annual	Aqili Khorasani, 2008
Anab	Jujube	*Ziziphus jujuba* Mill.	Rhamnaceae	Fruit	Perennial	Mozaffarian, 2007
Zafaran	Saffron	*Crocus sativus* L.	Iridaceae	Flower (stigma)	Perennial	Hajhashemi, 2011
Zereshk	Barberry	*Berberis vulgaris* L.	Berberidaceae	Fruit, root	Perennial	Hajhashemi, 2011
Khakeshir	Salvia Seeds	*Salvia hispanica* L.	Lamiaceae	Seeds	Biennial/Perennial	Dastjerdi, 2010
Goledavoudi	Chrysanthemum	*Chrysanthemum morifolium* Ramat.	Asteraceae	Flowers	Perennial	Chardin, 2010
Maryamgoli	Sage	*Salvia officinalis* L.	Lamiaceae	Leaves	Perennial	Mozaffarian, 2007

Table 2. Medicinal Plants: Traditional Uses, Active Compounds, and Mechanisms of Action on Fatty Liver in Traditional Iranian Medicine

Scientific Name	Traditional Use	Main Bioactive Compounds	Mechanism of Action	Reference
Silybum marianum L.	Infusion	Silymarin, flavonoids	Hepatoprotective, antioxidant, anti-inflammatory	Cacciapuoti et al., 2013
Taraxacum officinale L.	Infusion	Inulin, tannins, flavonoids	Choleretic, diuretic, antioxidant	Davaatseren et al., 2013
Camellia sinensis (L.) Kuntze	Infusion	Catechins, caffeine, polyphenols	Antioxidant, lipid-lowering, anti-inflammatory	Jin et al., 2024
Zingiber officinale Roscoe	Infusion	Gingerols, shogaols	Anti-inflammatory, antiemetic, digestive aid	Prabhakar et al., 2024
Citrus limon (L.) Osbeck	Fruit juice or extract	Vitamin C, flavonoids	Antioxidant, anti-inflammatory, immune-boosting	Jiang et al., 2019
Allium schoenoprasum L.	Fresh or infusion	Flavonoids, organosulfur compounds	Antioxidant, cholesterol-lowering, anticoagulant	Goorani et al., 2019
Glycyrrhiza glabra L.	Infusion	Glycyrrhizin, flavonoids	Anti-inflammatory, antiviral, mucosal protection	Wang et al., 2016
Curcuma longa L.	Powder or infusion	Curcumin, terpenoids	Anti-inflammatory, antioxidant, hepatoprotective	Rahmani et al., 2016
Allium sativum L.	Raw or cooked	Allicin, antioxidants	Antibacterial, cholesterol-lowering, anticoagulant	Mardi et al., 2023
Juglans regia L.	Fruit or extract	Tannins, flavonoids	Antioxidant, anti-inflammatory, hepatoprotective	Moon et al., 2022
Rubus idaeus L.	Infusion	Tannins, anthocyanins	Antioxidant, anti-inflammatory, menstrual regulation	VandenAkker et al., 2021
Vaccinium corymbosum L.	Fresh fruit	Anthocyanins, flavonoids	Antioxidant, anti-inflammatory, vascular protection	Książek et al., 2024
Citrus aurantium L.	Extract or infusion	Flavonoids, citral	Antioxidant, anti-inflammatory, calming	Han et al., 2019
Cinnamomum verum J.Presl	Decoction	Cinnamaldehyde, flavonoids	Antibacterial, anti-inflammatory, digestive aid	Hasheminasab et al., 2020
Cichorium intybus L.	Infusion	Inulin, flavonoids	Choleretic, antioxidant	Wu et al., 2018
Rosmarinus officinalis L.	Infusion	Rosmarinic acid, carnosol	Antioxidant, anti-inflammatory, cognitive enhancement	Wang et al., 2019
Crataegus monogyna Jacq.	Infusion	Flavonoids, proanthocyanidins	Antioxidant, cardioprotective, circulatory support	Dallak, 2018
Cynara scolymus L.	Infusion	Cynarin, flavonoids	Hepatoprotective, choleretic, antioxidant	Eslahi et al., 2018
Tribulus terrestris L.	Extract	Saponins, flavonoids	Sexual function support, antioxidant	Almasi et al., 2017
Malus domestica Borkh.	Fresh or extract	Polyphenols, fiber	Antioxidant, cholesterol-lowering, digestive aid	Pour et al., 2025
Olea europaea L.	Oil or extract	Polyphenols, oleuropein	Antioxidant, anti-inflammatory, hepatoprotective	Wani et al., 2015
Linum usitatissimum L.	Powder	Omega-3 fatty acids, lignans	Cholesterol-lowering, anti-inflammatory, cardioprotective	Yari et al., 2016
Arctium lappa L.	Infusion	Inulin, flavonoids	Antioxidant, hepatoprotective, blood purifier	Jafari Shiran et al., 2022
Melissa officinalis L.	Infusion	Flavonoids, aldehydes	Sedative, anti-inflammatory, digestive aid	Hosseini et al., 2018
Foeniculum vulgare Mill.	Decoction	Anethole, flavonoids	Antispasmodic, digestive aid, anti-inflammatory	Salem et al., 2025
Ficus carica L.	Fresh or extract	Fiber, polyphenols	Digestive aid, hypoglycemic, antioxidant	Bawazeer & Qahl S, 2016
Morus nigra L.	Decoction	Anthocyanins, flavonoids	Antioxidant, hypoglycemic, hepatoprotective	Zhang et al., 2025
Morus alba L.	Infusion	Anthocyanins, phytochemicals	Hypoglycemic, antioxidant, hepatoprotective	Hu et al., 2020
Solanum lycopersicum L.	Decoction	Lycopene, vitamin C	Antioxidant, cardioprotective, anti-inflammatory	Natali et al., 2025
Ziziphus jujuba Mill.	Decoction	Flavonoids, terpenoids	Sedative, anti-inflammatory, antioxidant	Eslahi et al., 2018
Crocus sativus L.	Decoction	Crocin, safranal	Antioxidant, antidepressant, sedative	Parsi et al., 2020
Berberis vulgaris L.	Decoction	Berberine	Anti-inflammatory, antibacterial, hypoglycemic	Kashkooli et al., 2015
Salvia hispanica L.	Infusion	Omega-3 fatty acids, lignans	Cholesterol-lowering, antioxidant, cardioprotective	Medina-Urrutia et al., 2020
Chrysanthemum morifolium Ramat.	Infusion	Flavonoids, carotenoids	Antioxidant, anti-inflammatory, sedative	Li et al., 2023
Salvia officinalis L.	Decoction	Rosmarinic acid, flavonoids	Antioxidant, anti-inflammatory, cognitive enhancement	Hosseini et al., 2018

The use of medicinal plants in the management of NAFLD may serve as a complementary approach to improve liver function, reduce hepatic fat accumulation, and enhance insulin sensitivity. Clinical studies have shown that plants such as Chlorella vulgaris, Camellia sinensis, Glycyrrhiza glabra, Silybum marianum, and Cinnamomum zeylanicum, and Berberis vulgaris exhibit the most significant and positive effects in lowering liver enzymes ALT and AST, as well as improving metabolic profiles. Some plants, including Cuminum cyminum and Phyllanthus urinaria, showed limited effects or changes that were not statistically significant. These findings highlight the considerable potential of medicinal plants in NAFLD management, while also underscoring the need for larger and longer-term clinical trials to establish optimal dosing and evaluate long-term safety (Nikkhajoei et al., 2016). The use of medicinal plants may serve as a viable alternative strategy for the prevention and management of NAFLD, particularly given the slow progression of chronic liver diseases, which often remain asymptomatic. Nevertheless, further research is essential to identify the bioactive compounds, develop pharmacological formulations or standardize raw extracts, and assess potential herb-drug interactions when administered concurrently.

Moreover, many of these herbs contribute to systemic health by lowering blood lipids, enhancing immune function, and exerting antiviral or antibacterial effects. Plants with digestive, antiemetic, sedative, or cognitive-enhancing properties can also improve patients' quality of life and alleviate NAFLD-associated complications (Xiao et al., 2013).

Conclusion

Traditional Iranian medicine, utilizing medicinal plants, offers an effective and low-risk approach for the prevention and management of NAFLD. Herbs such as milk thistle, green tea, ginger, and licorice reduce hepatic fat accumulation and liver injury through antioxidant, anti-inflammatory, and hepatoprotective mechanisms. These plants can normalize abnormal liver enzymes, improve lipid metabolism, and enhance immune function. Integrating traditional knowledge with modern scientific evidence provides safe and effective strategies for NAFLD management.

Declarations

Conflict of interest

The authors have no competing interests to declare that are relevant to the content of this article.

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Consent for publications

The authors gave approval for the publication of the manuscript.

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Authors' contributions

EM: Conceptualization, Data collection, Clinical supervision, and Draft preparation. MH: Study design, Literature review, Data interpretation, Manuscript writing, and Final approval of the version to be published.

Ethical considerations

The authors have fully adhered to ethical standards, ensuring no issues related to plagiarism, misconduct, data fabrication, falsification, duplicate publication or submission, or redundancy.

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