Effects of the nutraceutical myricetin on liver health: a systematic review

Efeitos do nutracêutico miricetina na saúde hepática: uma revisão sistemática

Efectos del nutracéutico miricetina en la salud hepática: una revisión sistemática

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ABSTRACT
This article presents a systematic review addressing the effects of the nutraceutical myricetin on liver health. Nutraceuticals are natural or bioactive substances known for their health benefits and their crucial role in the prevention and treatment of liver diseases. In this context, myricetin, a flavonoid found in various food sources, emerges as a relevant nutraceutical for liver health.
This review analyzes 20 preclinical studies demonstrating the benefits of myricetin on liver health, including improvement in Non-Alcoholic Fatty Liver Disease (NAFLD), attenuation of liver injuries, and even its therapeutic potential in the treatment of liver cancer in animal models. However, it was observed that there is a lack of clinical trials that fully explore the potential of myricetin as a nutraceutical. Most existing research is based on preclinical studies, such as animal or cell experiments. Therefore, there is a need for clinical studies to assess the efficacy of myricetin in humans. Furthermore, future research approaches are suggested, including investigating the mechanisms of action of myricetin, determining optimal doses and long-term safety, and developing dietary supplements.

**Keywords:** preclinical trials, flavonoids, liver, nutrition, hepatic therapy.

**RESUMO**
Este artigo apresenta uma revisão sistemática que aborda os efeitos do nutracêutico miricetina na saúde hepática. Os nutracêuticos são substâncias naturais ou bioativas conhecidas por seus benefícios à saúde e seu papel fundamental na prevenção e tratamento de doenças hepáticas. Neste contexto, a miricetina, um flavonóide encontrado em várias fontes alimentares, emerge como um nutracêutico relevante para a saúde hepática. Esta revisão analisa 20 estudos pré-clínicos que demonstram os benefícios da miricetina na saúde hepática, incluindo a melhoria da Estenose Hepática Não Alcoólica (EHNA), a atenuação de lesões hepáticas e até mesmo seu potencial terapêutico no tratamento de câncer de fígado em modelos animais. Entretanto, foi observado que há uma carência de ensaios clínicos que explorem totalmente o potencial da miricetina como um nutracêutico. A maioria das pesquisas existentes baseia-se em estudos pré-clínicos, como ensaios em animais ou em células. Portanto, há uma necessidade de estudos clínicos para avaliar a eficácia da miricetina em seres humanos. Além disso, são sugeridas abordagens futuras para as pesquisas, incluindo a investigação dos mecanismos de ação da miricetina, a determinação de doses ideais e segurança a longo prazo e o desenvolvimento de suplementos alimentares.

**Palavras-chave:** ensaios pré-clínico, flavonóides, fígado, nutrição, terapia hepática.

**RESUMEN**
Este artículo presenta una revisión sistemática que aborda los efectos del nutracéutico miricetina en la salud hepática. Los nutracéuticos son sustancias naturales o bioactivas conocidas por sus beneficios para la salud y su papel fundamental en la prevención y tratamiento de enfermedades hepáticas. En este contexto, la miricetina, un flavonoide encontrado en varias fuentes alimenticias, emerge como un nutracéutico relevante para la salud hepática. Esta revisión analiza 20 estudios preclínicos que demuestran los beneficios de la miricetina en la salud hepática, incluyendo la mejora de la Estenosis Hepática No Alcohólica (EHNA), la atenuación de lesiones hepáticas e incluso su potencial terapéutico en el tratamiento de cáncer de hígado en modelos animales. Sin embargo, se observó una falta de ensayos clínicos que exploren completamente el potencial de la miricetina como un nutracéutico. La mayoría de las investigaciones existentes se basan en estudios preclínicos, como ensayos en animales o en células. Por lo tanto, hay una necesidad de estudios clínicos para evaluar la eficacia de la miricetina en humanos. Además, se sugieren enfoques futuros para la investigación, incluyendo la investigación de los mecanismos de acción de la miricetina, la determinación de dosis ideales y seguridad a largo plazo, y el desarrollo de suplementos alimenticios.
INTRODUCTION

In recent years, dietary trends have played a significant role in the context of metabolic pathologies, with a growing focus on liver conditions. The relationship between diet and liver health has gained prominence as studies have demonstrated that certain dietary patterns can positively or negatively influence liver function and the development of diseases. In this scenario, the liver's function has been increasingly recognized as crucial for the overall well-being of the human body. The liver performs various vital functions, including nutrient metabolism, glucose storage, production of important proteins, detoxification of the body, and regulation of cholesterol levels (Ray, 2022).

The liver can be affected by a variety of illnesses that threaten its ability to perform its primary functions. It is susceptible to damage in various ways, including excessive alcohol consumption, metabolic syndrome, accumulation of cholesterol or triglycerides, viral hepatitis, and injuries caused by chemicals and minerals, among other factors (Ginès et al., 2022). Prevention, early medical intervention, vaccination, adoption of a healthy lifestyle, and diet are essential for mitigating these risks and preserving liver function (Ray, 2022).

Maintaining liver health is essential for the proper functioning of the body. In this context, nutraceuticals have emerged as a growing area of interest in the fields of nutrition and health (Ray, 2022). Nutraceuticals are natural or bioactive substances found in foods or supplements that have the potential to benefit health, often beyond basic nutritional functions. They play a fundamental role in maintaining liver health, helping to prevent damage and promote recovery (Semwal et al., 2016).

A notable example of a nutraceutical that benefits liver health is myricetin, a compound with antioxidant properties that has attracted considerable interest. Myricetin is a compound belonging to the class of polyphenols found in vegetables, berries, medicinal herbs, and teas, and is known for its ability to protect liver cells and potentially mitigate risks associated with various liver diseases (4–7).

Scientific evidence has shown that myricetin exhibits therapeutic properties in a variety of liver health-related disorders, such as non-alcoholic fatty liver disease (NAFLD) (Yao et al.,...
2020), hepatic fibrosis (Geng et al., 2017), hepatoprotection (Rostami et al., 2013) and even in the treatment of liver cancer in animal models (Seydi et al., 2016). However, myricetin has been poorly explored in clinical trials as a nutraceutical.

In light of the foregoing, this review aimed to analyze the available scientific evidence from preclinical and clinical trials, seeking to deepen the understanding of the therapeutic potential of myricetin in liver health and provide a comprehensive overview of the possible beneficial effects of this nutraceutical.

2 METHODOLOGY

2.1 DATABASE SEARCH AND INCLUSION AND EXCLUSION CRITERIA

The searches were conducted using the PubMed, Scopus, and Web of Science databases. The following keywords were used as search strategy: "myricetin AND liver", "myricetin AND hepatic", and "myricetin AND liver health".

Only original articles addressing the role of myricetin in liver health were included in the analysis. Documents such as review articles, book chapters, undergraduate monographs, master's dissertations, doctoral theses, e-books, and abstracts published in conference proceedings were excluded.

2.2 DATA SCREENING AND INFORMATION CATEGORIZATION

The initial search in the databases resulted in a set of 227 scientific articles. After a preliminary assessment, 129 articles were excluded due to duplications. Additionally, 13 articles whose titles and abstracts did not align with the scope of this review were excluded. Subsequently, a total of 85 articles underwent a thorough analysis, including screening based on their titles, abstracts, and specific information present in the full texts. Finally, a conclusive selection of 20 articles, containing details about the action of the nutraceutical myricetin in liver health, was incorporated into this study (Figure 1).
3 RESULTS AND DISCUSSION

3.1 ORIGIN, CHEMICAL COMPOSITION, AND NUTRACEUTICAL PROPERTIES OF MYRICETIN

The nutraceutical compound Myricetin (3,5,7-trihydroxy-2-(3,4,5-trihydroxyphenyl)chromen-4-one) (Figure 2) is a flavonoid found in various red fruits, vegetables, and tea leaves. It serves as an active ingredient and important additive in many food products, in addition to being employed as a dietary supplement\(^3\). The compound was initially isolated from the stem bark of the plant species Myrica rubra (Lour.) Siebold & Zucc
(Myricaceae) (Jones et al., 2011). Apart from the Myricaceae family, myricetin can be found in plant species from the Primulaceae, Anacardiaceae, Polygonaceae, and Pinaceae families. Apart from the Myricaceae family, myricetin can be found in plant species from the Primulaceae, Anacardiaceae, Polygonaceae, and Pinaceae families.

Myricetin can be found in various food sources, with fruits and vegetables being the most common. In dark fruits, myricetin levels varied between 14 and 142 mg/kg (Taheri et al., 2020). Table 1 lists the myricetin content in various food sources based on the USDA food database (Bhagwat et al., 2014). Among the foods with high levels of myricetin, fresh parsley and sweet potato leaves stand out, with concentrations of 14,840 mg/100 g and 4,400 mg/100 g, respectively (Table 1).

Table 1. Myricetin content in different food sources

<table>
<thead>
<tr>
<th>Food Source</th>
<th>Myricetin Content (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swiss Chard, raw</td>
<td>1.350</td>
</tr>
<tr>
<td>Garlic</td>
<td>1.600</td>
</tr>
<tr>
<td>Blackberry</td>
<td>0.700</td>
</tr>
<tr>
<td>Cashew</td>
<td>1.930</td>
</tr>
<tr>
<td>Onion, raw</td>
<td>1.070</td>
</tr>
<tr>
<td>Spinach, raw</td>
<td>0.350</td>
</tr>
<tr>
<td>Fava Beans, immature seeds</td>
<td>2.600</td>
</tr>
<tr>
<td>Cowpea</td>
<td>2.600</td>
</tr>
<tr>
<td>Sweet Potato Leaves</td>
<td>4.400</td>
</tr>
<tr>
<td>Lemon</td>
<td>0.500</td>
</tr>
<tr>
<td>Fresh Oregano</td>
<td>2.100</td>
</tr>
<tr>
<td>Peppers, green chili</td>
<td>1.200</td>
</tr>
<tr>
<td>Surinam Cherry</td>
<td>3.360</td>
</tr>
<tr>
<td>Fresh Parsley</td>
<td>14.840</td>
</tr>
<tr>
<td>Grapes, white or green, raw</td>
<td>0.220</td>
</tr>
</tbody>
</table>

Source: USDA, 2016.
The average intake of myricetin varies considerably among different populations, as demonstrated by scientific studies. According to Mullie et al. (2007) the Flemish Dietetic Association reported that the average daily intake of myricetin is 2.2 ± 2.5 mg. Meanwhile, Vogiatzoglou et al. (2015) observed that the average myricetin intake in adults in the European Union, aged 18 to 64 years, is 2 mg per day, with variations between 1 and 4 mg per day. On the other hand, Jun et al. (2016) estimated uma média de ingestão diária de 0,8 mg de miricetina em uma população de adultos coreanos, estimated an average daily intake of 0.8 mg of myricetin in a population of Korean adults. Understanding the habitual consumption of flavonoids such as myricetin is essential for assessing their potential impact on human health. This is because the amount of flavonoids regularly ingested through diet plays a significant role in health (3).

Myricetin has been widely recognized for its nutraceutical qualities and for exhibiting various biological activities, including antioxidant action (Ekstrand et al., 2015), anti-inflammatory properties (Jang et al., 2020), anticancer properties (10,17), antiviral effects (Pasetto et al., 2014), cardioprotective effects (Qiu et al., 2017) and therapeutic activities in disorders of the hepatic system (4–7).

3.2 EFFECTS OF MYRICETIN ON LIVER HEALTH

Myricetin has demonstrated various benefits for liver health in preclinical in vitro and in vivo studies. These effects include improvements in Non-Alcoholic Fatty Liver Disease (NAFLD) (8,21,22) and hepatic steatosis (Xia et al., 2019), treatment of toxin-induced liver disease (5–7), antioxidant and anticancer properties (10,17,23), as well as attenuation of liver injuries and damages (7,9,24–31). Table 2 presents the preclinical studies included in the research, highlighting the research method adopted, the animal species or cells involved, and the main conclusion of each study. It is important to note that no clinical studies were found in the literature regarding the potential of the nutraceutical myricetin on liver health.
Table 2. Preclinical Studies Included in the Work on the Effect of Myricetin on Liver Health

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Model (Method)</th>
<th>Species/Cells</th>
<th>Main Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahmad et al. (2022)</td>
<td>In vivo</td>
<td>Wistar Rats</td>
<td>Myricetin reduced levels of liver enzymes (ALT, AST, and ALP), inflammation, and oxidative stress in rat liver, indicating its potential in preventing ethanol-induced liver damage.</td>
</tr>
<tr>
<td>Berköz et al. (2021)</td>
<td>In vivo</td>
<td>Mice</td>
<td>Myricetin restored impaired liver structure during LPS exposure, reducing rates of liver damage, oxidative stress, and inflammation.</td>
</tr>
<tr>
<td>Choi, Shin e Kim (2021)</td>
<td>In vivo</td>
<td>ob/ob Mice</td>
<td>Myricetin showed positive effects in treating Non-Alcoholic Fatty Liver Disease (NAFLD), influencing the regulation of hepatic lipid metabolism transcription factors, suggesting its potential in managing this condition.</td>
</tr>
<tr>
<td>Ekinci-Akdemir et al. (2018)</td>
<td>In vivo</td>
<td>Male Wistar Rats</td>
<td>Myricetin demonstrated significant therapeutic effects on rat liver, reducing liver lesions resulting from reactive oxygen species (ROS) production.</td>
</tr>
<tr>
<td>Ekstrand et al. (2015)</td>
<td>In vitro</td>
<td>Male and Female Pigs</td>
<td>Myricetin exhibited antioxidant effect protecting normal liver cells against oxidative damage, along with selective anticancer activity against HepG2 cells.</td>
</tr>
<tr>
<td>Gao et al. (2021)</td>
<td>In vitro</td>
<td>Human L02 and HepG2 cells</td>
<td>Myricetin showed strong antioxidant activity and anticancer effects in HepG2 cells, inducing apoptosis through the Bcl-2/Caspase pathway.</td>
</tr>
<tr>
<td>Geng et al. (2017)</td>
<td>In vivo</td>
<td>Rats</td>
<td>Myricetin attenuated hepatic fibrosis by inhibiting PDGF and TGF-β1, suggesting its potential as an antifibrotic agent.</td>
</tr>
<tr>
<td>Guo et al. (2015)</td>
<td>In vivo</td>
<td>Mice</td>
<td>Myricetin demonstrated protective effect against choline-induced vascular dysfunction and resulting liver injuries in mice.</td>
</tr>
<tr>
<td>Hongming Lv et al. (2020)</td>
<td>In vivo</td>
<td>Rats</td>
<td>Myricetin showed efficacy in attenuating hepatocyte necrosis, inflammation, and oxidative stress during Lipopolysaccharide/D-galactosamine (LPS/D-GalN) induced hepatic steatosis (FH) in rats.</td>
</tr>
<tr>
<td>Huang et al. (2020)</td>
<td>In vivo</td>
<td>BALB/c Mice</td>
<td>Myricetin attenuated hepatic fibrosis in mice infected with Schistosoma japonicum, inhibiting expression of fibrosis-associated proteins.</td>
</tr>
<tr>
<td>Matić et al. (2013)</td>
<td>In vivo</td>
<td>Male Wistar Albino Rats</td>
<td>Myricetin restored liver function, reduced serum levels of liver enzymes and total bilirubin induced by pyrogallol, suggesting its role in hepatic protection against pyrogallol-induced toxicity.</td>
</tr>
<tr>
<td>Oh et al. (2023)</td>
<td>In vivo</td>
<td>Mice</td>
<td>Myricetin plays a significant role in promoting liver regeneration, acting to reduce chemokine signaling pathway, providing support for potential future clinical trials.</td>
</tr>
<tr>
<td>Rostami et al. (2023)</td>
<td>In vivo</td>
<td>C57BL/6 Mice</td>
<td>Myricetin reduced animal mortality, improved pathological changes in the liver, and normalized serum levels of total bilirubin, 8-OH-dG, ALT, AST, and ALP, suggesting its role in mitigating acute liver injuries induced by LPS/D-GalN in mice.</td>
</tr>
</tbody>
</table>
Seydi et al. (2016) | *In vivo* Mice | Myricetin demonstrated the ability to selectively induce apoptosis in cancerous hepatocytes, resulting in cytotoxicity in cancer cells, without affecting healthy cells. This suggests its therapeutic potential against liver cancer.

Sun et al. (2021) | *In vivo* Male Wistar Rats | Myricetin reduced lipid synthesis, hepatic inflammation, improved insulin sensitivity, and oxidative stress in the livers of rats with NAFLD.

Wang et al. (2023) | *In vivo* Mice | Myricetin reduced hepatic fibrosis in mice infected with Schistosoma japonicum, inhibiting parasite egg formation and modulating TGFβ1 and Akt signaling pathways.

Wang et al. (2023) | *In vivo* Mice | Myricetin demonstrated a protective effect against acute liver injury induced by LPS/D-GalN, reducing liver damage, decreasing hepatic enzymes ALT and AST, reducing expression of inflammatory cytokines, and attenuating oxidative stress.

Xia et al. (2016) | *In vivo* C57BL/6 Mice | Myricetin demonstrated regenerative effects on the livers of mice with high-fat diet-induced hepatic steatosis, reducing hepatic steatosis, increasing antioxidant activity, and reducing oxidative stress.

Xia et al. (2019) | *In vivo* C57BL/6J Mice | Myricetin attenuated hepatic steatosis by regulating microRNAs and genes related to lipid metabolism controlled by thyroid hormone, suggesting its potential for treating Non-Alcoholic Fatty Liver Disease (NAFLD).

Yao et al. (2020) | *in vitro* and *in vivo* C57BL/6J Male Mice and murine RAW264.7 cells | Myricetin attenuated hepatic steatosis, reduced inflammation and hepatic fibrosis in mice fed with high-fat and low-choline diet (CDAHFD).

3.2.1 Treatment of Non-Alcoholic Fatty Liver Disease (NAFLD) and hepatic steatosis

The study by Xia et al. (2019) investigated the effects of myricetin in mice subjected to a high-fat diet, focusing on hepatic steatosis (accumulation of fat in the liver) associated with this condition. The results revealed that myricetin attenuated hepatic steatosis by regulating microRNAs and genes related to lipid metabolism controlled by thyroid hormone, suggesting its potential for the treatment of non-alcoholic fatty liver disease (NAFLD).

In the study conducted by Yao et al. (2020), the beneficial effects of myricetin were investigated in a model of non-alcoholic fatty liver disease (NAFLD) induced by diet. The results revealed that myricetin played a significant role in improving hepatic steatosis, reducing inflammation, and suppressing macrophage infiltration in the livers of mice fed a high-fat, choline-deficient diet (CDAHFD). Additionally, myricetin demonstrated the ability to inhibit hepatic fibrosis and activation of hepatic stellate cells (HSCs). These findings suggest that myricetin has significant potential to attenuate NASH and hepatic fibrosis in a CDAHFD diet-induced mouse model.

According to Choi, Shin, and Kim (2021), myricetin demonstrated positive effects in the treatment of Non-Alcoholic Fatty Liver Disease (NAFLD), influencing the regulation of transcription factors related to hepatic lipid metabolism. This substance presents beneficial potential in mitigating NAFLD in obese mouse models, suggesting a promising role in managing this condition.

The study conducted by Sun et al. (2021) investigated the effects of myricetin supplementation in rats with non-alcoholic fatty liver disease (NAFLD). The results showed that myricetin reduced lipid synthesis and hepatic inflammation, as well as improved insulin sensitivity, lipid profile, and oxidative stress in the livers of rats with NAFLD. The authors suggested that myricetin demonstrates potential as a treatment for NAFLD.

3.2.2 Hepatoprotection against toxicant-induced liver damage

Matić et al. (2013) investigated the hepatoprotective potential of myricetin in rats exposed to the hepatotoxic compound pyrogallol. Myricetin demonstrated effective restoration of liver function, significantly reducing serum levels of liver enzymes and total bilirubin induced by pyrogallol. Additionally, DNA damage in the liver was attenuated. The results suggest that Akt activation and STAT3 protein expression play crucial roles in liver protection, and myricetin
played a key role in its antigenotoxic and hepatoprotective properties against pyrogallol-induced toxicity.

Ahmad et al. (2022) evaluated the impact of myricetin on protection against ethanol-induced liver damage in Wistar rats. The results highlighted that myricetin significantly decreased the levels of liver enzymes, such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP), which serve as indicators of liver damage. Additionally, myricetin reduced liver inflammation and oxidative stress. Therefore, myricetin represents a promising option in preventing liver damage caused by ethanol consumption.opção na prevenção de danos hepáticos causados pelo consumo de etanol.

Rostami et al. (2023) conducted a study to assess the hepatoprotective effect of myricetin in a model of acute liver injury (ALI) induced by lipopolysaccharide/D-galactosamine (LPS/D-GalN) in C57BL/6 mice. The results revealed that myricetin reduced the mortality rate of the animals, improved pathological changes in the liver, and normalized serum levels of total bilirubin, 8-OH-dG, ALT, AST, and ALP. Additionally, myricetin decreased factors associated with apoptosis, oxidative stress, and inflammation, such as NOX, NLRP3, caspase 3, and MPO, while increasing antioxidant levels. There was also an improvement in hepatic activity of sirtuin 1 and correction of parameters related to autophagy, including LC3 II, Beclin 1, and P62. These results highlight the potential of myricetin as a hepatoprotective agent and suggest its role in mitigating acute liver injuries induced by LPS/D-GalN in mice.

3.2.3 Antioxidant and anticancer effects

According to Ekstrand et al. (2015) myricetin demonstrated a powerful antioxidant effect, protecting normal pig liver cells (L02) against oxidative damage induced by H2O2 (hydrogen peroxide). Additionally, it exhibited selective anticancer activity against HepG2 liver cancer cells, inducing apoptosis through the regulation of the Bcl-2/Caspase pathway. Myricetin also influenced the activity of the CYP1A and CYP3A enzyme families in a sex-dependent manner, competitively inhibiting CYP1A in both sexes and CYP3A only in males.

Seydi et al. (2016) investigated the effect of myricetin on mice with cancerous hepatocytes. Myricetin demonstrated the ability to selectively induce apoptosis in cancerous hepatocytes, targeting their mitochondria. This resulted in cytotoxicity only in cancer cells without affecting healthy cells. Myricetin increased the production of reactive oxygen species
(ROS), mitochondrial swelling, and the release of cytochrome c in the cancer cell mitochondria, activating caspase-3 and inducing apoptosis. These findings suggest that myricetin has therapeutic potential against liver cancer, highlighting it for future research.

In the study by Gao et al. (2021), myricetin demonstrated strong antioxidant properties, effectively protecting normal liver cells against oxidative damage caused by H2O2. Additionally, it exhibited selective anticancer activity, promoting apoptosis in liver cancer cells through the regulation of the Bcl-2/Caspase pathway. These findings emphasize the potential of myricetin as a promising candidate for treating various liver disorders and contributing to the development of functional foods.

3.2.4 Attenuation of liver injury and damage

In the study by Guo et al. (2015), the protective effect of myricetin against vascular dysfunction induced by choline and resulting liver damage in mice was investigated, yielding promising results. According to the authors, these findings suggest that myricetin may be explored as a potential natural compound and dietary supplement, with potential health benefits, especially in preventing vascular and hepatic diseases.

In the study conducted by Xia et al. (2016) myricetin demonstrated regenerative effects on the livers of mice with hepatic steatosis induced by a high-fat diet. Pretreatment with myricetin significantly reduced hepatic steatosis in mice on a high-fat diet. Additionally, myricetin increased antioxidant activity and reduced oxidative stress in the livers of mice. These results indicate that myricetin has the potential to serve as a therapy for high-fat diet-induced hepatic steatosis.

Geng et al. (2017) demonstrated in their studies the attenuating effect of myricetin on hepatic fibrosis in rats. This effect is achieved through the inhibition of two potent stimuli of hepatic fibrosis, platelet-derived growth factor (PDGF), and transforming growth factor-beta 1 (TGF-β1). The authors suggest that myricetin may be developed as a potential antifibrotic agent, presenting a new therapeutic approach for the treatment of hepatic fibrosis.

According to the study conducted by Ekinci-Akdemir et al. (2018), myricetin demonstrates significant therapeutic effects on the livers of rats. According to the authors, these benefits can be attributed to myricetin's ability to combat free radicals and alleviate liver injuries resulting from the production of reactive oxygen species (ROS).
In the research conducted by Hongming Lv et al. (2020), myricetin demonstrated efficacy in attenuating hepatocyte necrosis, inflammation, and oxidative stress during hepatic steatosis induced by lipopolysaccharide/D-galactosamine (LPS/D-GalN) in rats.

According to the study by Huang et al. (28), myricetin demonstrated a considerable impact on attenuating hepatic fibrosis in mice infected with Schistosoma japonicum. Myricetin also inhibited the expression of different proteins, including TGFβ1, Smad2, phospho-Smad2, Smad3, phospho-Smad3, ERK, phospho-ERK, Akt, and phospho-Akt in the livers of infected mice. The authors suggested that myricetin attenuated hepatic fibrosis in mice via modulation of the TGFβ1 and Akt signaling pathways.

In Wang et al.’s studies (2023), myricetin reduced hepatic fibrosis and improved liver condition in mice infected with Schistosoma japonicum. It acted by inhibiting the formation of parasite eggs in the liver and reducing hepatic fibrosis. Additionally, myricetin modulated the TGFβ1 and Akt signaling pathways and promoted a favorable balance between Th1 and Th2 responses, suggesting its potential for treating liver diseases.

According to the research conducted by Berköz et al. (2021), myricetin exhibited hepatoprotective properties in mice with acute liver injury induced by lipopolysaccharide (LPS). Myricetin improved hepatic parameters and reduced inflammation, suggesting that myricetin possesses hepatoprotective properties.

According to Oh et al. (2023), myricetin plays a significant role in promoting liver regeneration by acting to reduce the chemokine signaling pathway. These results provide valuable scientific support for potential future clinical trials.

In the study by Wang et al. (2023), myricetin demonstrated a protective effect against acute liver injury induced by LPS/D-GalN (lipopolysaccharide/D-galactosamine) in mice. Pretreatment with myricetin reduced liver damage, decreased the hepatic enzymes ALT (Alanine Aminotransferase) and AST (Aspartate Aminotransferase) in the blood, reduced the expression of inflammatory cytokines, and attenuated oxidative stress. According to the authors, these results indicate that myricetin has the potential to protect against acute liver injury by reducing inflammation and regulating oxidative stress.
4 CONCLUSIONS AND FUTURE PERSPECTIVES

Myricetin is a fundamental component in various foods, employed as a food additive due to its remarkable antioxidant action and ability to protect lipids against oxidation damage. The literature presents this compound as an important nutraceutical, and there is no doubt that this molecule has the potential to offer protection against different diseases, including disorders related to liver health, such as protection against damage induced by toxic agents, treatment of non-alcoholic fatty liver disease (NAFLD) and hepatic steatosis, antioxidant and anticancer properties, as well as attenuation of liver injury and damage. These results suggest that myricetin has a broad spectrum of therapeutic applications in the context of liver health.

However, it is important to note that, despite the scientific evidence supporting the beneficial properties of myricetin, there is still a deficit of clinical trials that fully explore its potential as a nutraceutical. Most of the research on myricetin is based on preclinical studies, such as animal or cell studies. Therefore, there is a significant space for future investigations in this field, including clinical studies to evaluate the efficacy of myricetin in humans.

Research on myricetin and its impact on liver health is evolving, with several promising areas to be explored. Conducting clinical trials is essential to translate the findings of preclinical studies into tangible benefits for patients with liver diseases, while understanding the mechanisms of action of myricetin, including signaling pathways and molecular markers, is fundamental to unravel its actions. It is also important to determine the ideal doses and long-term safety of myricetin, including possible side effects and drug interactions. Furthermore, the development of supplements and functional foods with myricetin may offer practical approaches to improve liver health. Individualizing treatment based on patients’ genetic and metabolic characteristics is also a promising strategy to optimize the efficacy of myricetin and minimize risks.
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