

Hepatoprotective Effects of Plants Used as Herbal Medicine in Nigeria - A Review

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ABSTRACT

Medicinal plants have long been used in the management of liver disorders due to their rich phytochemical composition. This review highlights selected plants with documented hepatoprotective potential, focusing on their bioactive constituents, experimental evidence, and mechanisms of action. *Aegle marmelos*, *Agrimonia eupatoria*, *Acacia confusa*, *Azadirachta indica*, and *Aloe barbadensis* contain flavonoids, alkaloids, tannins, saponins, and phenolic compounds that confer antioxidant, anti-inflammatory, antimicrobial and membrane-stabilizing effects. Experimental studies demonstrate their efficacy against common hepatotoxins through normalization of liver biomarkers and reduction of oxidative stress. These plants represent promising candidates for the development of safe and effective hepatoprotective therapies.

Keywords: Hepatoprotective, Herbal Medicine, Anti Inflammatory, Antioxidants, Liver biomarkers, and Medicinal Plants.

1.0 INTRODUCTION

Long ago, medicinal plants have been reported to possess hepatoprotective agents and therefore used locally for the treatment of liver problems. This hepatoprotective potential is largely due to the presence of rich secondary metabolites such as alkaloids, flavonoids, phenolics, terpenoids, saponins, tannins, steroids, and anthraquinones etc (Gonfa *et al.*, 2024). These compounds, particularly, silymarin and quercetin, have been implicated in alleviating epatotoxicity through scavenging free radicals, reduction in inflammation, blockage of oxidative stress, as well as stabilization of hepatocyte membranes. (Li *et al.*, 2020).

Liver is an important organ tasked with metabolism, detoxification, and synthesis of plasma proteins in the body as it is also important in the regulation of biochemical homeostasis (Kumar *et al.*, 2021). However, diseases of the liver lead to serious disorders as a result of impairment of these essential functions that the liver plays. Common among liver disorders include but not limited to hepatitis, fatty liver disease, cirrhosis, and hepatocellular carcinoma, which are used by different factors ranging from viral infections, excessive alcohol consumption, metabolic imbalances, or exposure to hepatotoxic chemicals and drugs (Teschke & Danan, 2021).

Medicinal plants have been reported to protect the body against chemically-induced liver damage by modulating antioxidant enzymes and suppressing pro-inflammatory cytokines using experimental evidence from different

studies including *in vitro*, *in vivo*, preclinical, and clinical models (Gonfa *et al.*, 2024). Unlike synthetic conventional hepatoprotective drugs, medicinal plants are cheap and safe making plant-based treatment affordable especially in developing countries. Despite these advantages, little is known about many plants that offer this great benefit. This review herefore highlights some important plants with hepatoprotective potentials with a view to advocate the urgent need for their standardized safety assessments, quality control measures, and validation to ensure consistent efficacy and minimize potential toxicity associated with them.

2.0 HEPATOPROTECTIVE POTENTIALS OF MEDICINAL PLANTS

2.1 *Aegle Marmelos (Vilvam)* Rutaceae

Aegle marmelos (Vilvam) is a plant used as a traditional medicine because of its reported hepatoprotective potentials. The leaves of this plant are in good possess of important secondary metabolites such as flavonoids, saponins, glycosides, alkaloids, and tannins. These bioactive compounds exhibit strong antioxidant, anti-inflammatory, and membrane-stabilizing activities (Kumar *et al.*, 2021). These compounds have the ability to improve the activity of internal antioxidant enzymes made by the body such as such as catalase, superoxide dismutase and glutathione peroxidase. Apart from this, the bioactive compounds of this plant can reduce oxidative stress and maintain the integrity of the liver (Bakr *et al.*, 2020).



Figure 1: Aegle marmelos (*Vilvam*) plant (Vijayanrajapuram 2016)

Using experimental models, it was shown that, *A. marmelos* can minimize liver injury caused by hepatotoxins such as nitrobenzene (C₆H₅NO₂), carbon tetrachloride (CCl₄), and paracetamol. This is achieved through scavenging of free radicals and prevention of lipid peroxidation (Rajasekaran *et al.*, 2020; Goyal & Rout, 2019). *A. marmelos* can also promote the regeneration of liver cells as well as normalization of important liver enzymes such as ALT, AST, and ALP thereby signaling the recovery of hepatic function (Kumar *et al.*, 2021). *A. marmelos* protects the liver through membrane stabilization, protection of mitochondria, and acting as antioxidant and thus alleviates oxidative stress and lipid peroxidation in hepatic cells (Monika *et al.*, 2023; Sharma *et al.*, 2020). Experimentally, this plant has been reported to be effective against hepatotoxins such as carbon tetrachloride (CCl₄) and paracetamol, as it prevents necrosis of hepatic cells and restores liver function (Monika *et al.*, 2023; Rahman *et al.*, 2022).

2.2 *Agrimonia Eupatoria* Rosaceae

Agrimonia eupatoria plant is a perennial herb known for its tall yellow flower spikes, soft hairy stems, and used in traditional medicine for the treatment of disorders of liver and digestive system courtesy of its diverse antioxidant, anti-inflammatory, and hepatoprotective effects. *Agrimonia eupatoria* plant offers hepatic protection through the enhancement of hepatic antioxidant defense and stabilization of hepatic cell membranes (Chakraborty *et al.*, 2020). This pharmacological action is achieved as a result of its high content of flavonoids, triterpenoids, phenolic acids, tannins, and sterols such as β-sitosterol,

neoandrographolide, and betalain (Chakraborty *et al.*, 2020).



Figure 2: *Agrimonia Eupatoria* plant

A study conducted using ethanol-induced hepatotoxicity shows the ability of this plant to normalize both enzymatic and non-enzymatic liver biomarkers such as ALT, AST, and bilirubin and significantly reducing oxidative stress and lipid peroxidation (Popović *et al.*, 2018). This pharmacological action is achieved through the ability of the extract to hunt free radicals and impede the outflow of hepatic enzymes through its membrane stabilization effect. *Agrimonia eupatoria* also employs anti-inflammatory actions as it downregulates TNF-α, IL-1β, and NF-KB signaling. This process makes it possible to protect liver cells from long inflammatory damage and fibrosis (Drača *et al.*, 2019).

Using histological analyses, it has been confirmed that *A. eupatoria* repairs hepatic structure and offers reduction in fatty degeneration in liver tissues that were damaged due to excessive alcoholism (Li *et al.*, 2019). The ability of this plant to protect liver cells through the reduction of oxidative stress and metal chelation courtesy of its high abundance of polyphenolic compounds particularly ellagic acid and quercetin derivatives has been noteworthy (Park *et al.*, 2020). This makes it a good candidate in its use as an ethnomedicinal plant used in the treatment of alcoholic and chemically induced liver disorders (Li *et al.*, 2019).

The hepatoprotective activity of this plant is made possible due to its excellent ability in regulating oxidative stress and inflammation. The phenolics and flavonoids contents of the plant inhibit lipid peroxidation and upregulate internal antioxidants such as superoxide dismutase, catalase and glutathione (Kim *et al.*, 2021; Zhang *et al.*, 2022). Its potential in the

stabilization of hepatocytes and reduction in necrotic degeneration is aided by the presence of high content of tannins. It offers anti-inflammatory benefits through the suppression of pro-inflammatory cytokines such as TNF- α and IL-6, and through the modulation of NF-KB pathway (Wang *et al.*, 2021).

2.3 *Acacia confusa* Fabaceae family

Acacia confusa is a perennial tree, a member of the leguminosae family originated from Southeastern Asia with many traditional health benefits. The plant is used in the treatment of inflammation, pain, and hepatic disorders. Its hepatoprotective potentials are attributable to the presence of a diverse possession of flavonoids, phenolic acids, tannins, and phenolic diterpenes, bioactive compounds with reported antioxidant and anti-inflammatory actions (Huang *et al.*, 2018). Hepatotoxicity caused by hepatotoxins such as carbon tetrachloride (CCl₄) is said to be countered by the actions of these phytoconstituents which prevent the liver against oxidative injury and disruption of membrane caused by these hepatotoxins.



Figure 3 *Acacia confusa* plant
(Huang *et al.*, 2018)

Bark extract of *A. confusa* has been shown to reduce serum levels of important liver markers such as ALT, AST, and ALP in CCl₄-induced hepatotoxic rats (Tseng *et al.*, 2017). This effect was attributed to improved activities of endogenous antioxidant enzymes which tend to minimize oxidative stress (Chen *et al.*, 2019). Among the important phytochemicals found in the bark extract include important polyphenolics such as catechin, epicatechin, protocatechuic acid, and gallic acid and tannins and phenolic diterpenes. The bark extract exerts its hepatoprotective effects possibly through membrane stabilization and suppression of pro-inflammatory mediators such as iNOS and COX-2

which collectively employed in reducing hepatic inflammation, necrosis, and fibrosis (Liu *et al.*, 2020).

The histopathological studies of this plant has provided further evidence in its hepatoprotective ability in maintaining hepatic structure, reduction in fatty degeneration, and improvement in mitochondrial function. Hepatoprotective mechanism of *A. confusa* is dependent on the presence of diverse phytochemicals. For instance, flavonoids and tannins scavenge free radicals thereby reducing the level of reactive oxygen species in hepatic tissues. They also aid in enhancing the activity of internal antioxidant enzymes (Huang *et al.*, 2018). The phenolics such as gallic acid and protocatechuic acid improve the function of mitochondria and inhibition of lipid peroxidation, providing repair mechanisms of the liver cells (Chen *et al.*, 2020; Lin *et al.*, 2019).

2.4 *Azadirachta indica* (Neem) Meliaceae

Azadirachta indica belongs to the family of meliaceae and is widely known as neem tree, reaching 15–20 m tall, with a wide, spreading crown and has Smooth, olive-like drupe, yellow when ripe, containing a single seed. *A. indica* is well known for its enormous health benefits such as hepatoprotective, antioxidant, membrane-stabilizing capacity and detoxifying properties (Maurya *et al.*, 2024). These health benefits are attributed to the presence of important bioactive constituents such as azadirachtin, nimbolide, nimbin, quercetin, tannins, and flavonoids Baligar *et al.*, 2014; Singh *et al.*, 2021). *A. indica* contains a vast array of important phytochemicals ranging from flavonoids (quercetin, kaempferol), triterpenoids (azadirachtin, nimbolide), steroids, tannins, saponins, and limonoids (Rana *et al.*, 2021; Patel *et al.*, 2020).



Figure 4: *Azadirachta indica* (Neem) plant
(Huang *et al.*, 2018)

The ability of *A. o* provide protection against hepatotoxins has previously been reported. Leaves and seed extracts of this plant were reported to have restored the levels of liver marker enzymes such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) near normal in CCl₄-induced hepatotoxicity models (Kumar *et al.*, 2021; Rana *et al.*, 2021). Research using histopathological studies showed reduction in necrosis and fatty degeneration in liver tissue using *A. indica* treatment (Patel *et al.*, 2020).

A. indica exerts its actions through its ability in combating oxidative stress, stabilization of cell membrane of liver cells, and enhancement of internal antioxidant defense (Nikolova *et al.*, 2022). Secondary metabolites found in this plant particularly, flavonoids and triterpenoids aid in promoting the upregulation of important antioxidant enzymes such as superoxide dismutase, catalase, and glutathione peroxidase which ultimately reduce lipid peroxidation in hepatic tissues (Rana *et al.*, 2021). Triterpenoids of the plant, particularly nimbolides are important modulators of inflammatory signaling pathways through downregulation of cytokines, TNF- α and IL-6, thereby preventing necrosis and fibrosis (Patel *et al.*, 2020). It is through this process that the plant preserves integrity of the liver cells and provides enhancement of mitochondrial function bringing about quick recovery from hepatic stress caused by hepatotoxins.

2.5 *Aloe barbadensis* Mill. Liliaceae

Aloe barbadensis is a family of Liliaceae, widely called Aloe vera globally, a perennial succulent herb with thick, fleshy leaves arranged in a rosette, the leaves has Lance-shaped, green with serrated margins, containing a clear mucilaginous gel inside. Its medicinal benefits have been widely utilized worldwide. Chief among its health benefits include its use in Ayurveda, Unani, and folk medicine systems to various disorders ranging from liver disorders, skin diseases, burns, and gastrointestinal ailments (Akhtar *et al.*, 2021). Hepatoprotective potential of *A. barbadensis* is due to its possession of enormous amount of bioactive compounds such as polysaccharides, flavonoids, anthraquinones (aloin and emodin), chromones, and coumarins (Pandey *et al.*, 2022). These secondary metabolites are known to contain potent antioxidant and anti-inflammatory effects that play crucial role in the prevention of liver injury as a result of effects of hepatotoxins (Pandey *et al.*, 2023).



Figure 5: *Aloe barbadensis* plant (Pandey *et al.*, 2022).

Different studies reported the curative effect of *A. barbadensis* extract against hepatotoxic effect of CCl₄ in significantly lowering serum levels of hepatic enzymes such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) in animals induced with CCl₄ (Pandey *et al.*, 2022). This action is attributed to the effect of flavonoids and anthraquinones found in *A. barbadensis* in enhancing endogenous antioxidant enzyme systems (Singh & Sharma, 2020). Apart from its flavonoids and anthraquinones, the polysaccharides in *A. barbadensis* especially acemannan, is of great importance to liver health as it aids in the regeneration and immunomodulation of liver cells. This polysaccharide is also important in the enhancement of macrophage activation as well as the release of cytokines responsible for carrying out liver repair process after oxidative injury (Chandran & George, 2018).

Also, anthraquinone derivatives such as aloin and emodin are good radical scavengers and inhibitors of lipid peroxidation and therefore good in preserving hepatocellular integrity. These anthraquinone derivatives can also downregulate TNF- α and IL-1 β , excellent inflammatory mediators responsible for minimizing hepatic fibrosis caused by inflammation (Kumar *et al.*, 2021). Evaluation of Histopathological studies have all reported that, treatment of rats induced with CCl₄ with extract of *A. barbadensis* could repair hepatic architecture, reduce necrosis, and promote regeneration of liver cells (Wagay *et al.*, 2021).

A. barbadensis offers good hepatoprotective effects via its ability to improve internal antioxidant defense systems and stabilization of hepatic cell membrane. It also exerts its effects by inhibiting inflammatory

mediators and reduction in lipid peroxidation. *A. barbadensis* also augments the level of natural internal antioxidant, glutathione (GSH) as well as boosting the

activity of antioxidant enzymes such as superoxide dismutase and catalase (Mehta *et al.*, 2018; Singh *et al.*, 2020).

Table 1: Selected Medicinal Plants with Hepatoprotective Potential, their Phytochemical Constituents, and Experimental Hepatotoxins

S/NO	Plant Name	Family	Part Used	Major Phytoconstituents	Hepatotoxicity-Inducing Agent	Citation
1	<i>Aegle marmelos</i> (Vilvam)	Rutaceae	Leaves	Saponins, flavonoids, glycosides, alkaloids, and tannins	C ₈ H ₉ NO ₂	(Kumar <i>et al.</i> , 2021)
2	<i>Agrimonia eupatoria</i>	Rosaceae	Whole plant	β-sitosterol, betalain, neoandrographolide	C ₂ H ₅ OH	(Chakraborty <i>et al.</i> , 2020)
3	<i>Acacia confuse</i>	Leguminosae	Bark	Flavonoids, phenolic acids, tannins, phenolic diterpenes	CCl ₄	(Huang <i>et al.</i> , 2018)
4	<i>Azadirachta indica</i> (Neem)	Meliaceae	Leaves, bark, and seeds	Azadirachtin, nimbolide, nimbin, quercetin, margolone, tannins, and flavonoids	CCl ₄ and paracetamol	(Singh <i>et al.</i> , 2021; Baligar <i>et al.</i> , 2014)
5	<i>Aloe barbadensis</i> Mill. (Kattalai)	Liliaceae	Aerial parts	Flavonoids, hydroxyanthraquinones, coumarin	CCl ₄	(Pandey <i>et al.</i> , 2022)

3.0 CONCLUSION

This review highlights the hepatoprotective potential of selected medicinal plants used in Nigeria, supported by both ethnomedicinal use and experimental evidence. Their protective effects are attributed to bioactive phytochemicals such as flavonoids, alkaloids, tannins, saponins, and phenolics with strong antioxidant and anti-inflammatory properties. These plants effectively mitigate hepatotoxicity induced by agents like carbon tetrachloride, ethanol, and paracetamol by normalizing liver biomarkers and reducing oxidative stress. The mechanisms involve enhancement of endogenous antioxidant enzymes, suppression of inflammatory mediators, and stabilization of hepatocyte membranes. Collectively, these findings support their potential as cost-effective alternatives for liver disease management, warranting further standardization and clinical validation.

REFERENCES

Akhtar, H., Akhtar, M. W., Khan, M. S. A., & Husain, S. Z. (2021). Sibr (*Aloe barbadensis*): A short description with Unani approach. *Journal of Drug Delivery and Therapeutics*, 11(2), 224–227. <https://doi.org/10.22270/jddt.v11i2.4768>

Baligar, P. N., Alur, A. S., & Kamble, R. D. (2014). Hepatoprotective activity of *Azadirachta indica* against carbon tetrachloride-induced liver damage in rats. *Journal of Ayurveda and Integrative Medicine*, 5(3), 165–170.

Bakr, E. H., & El-Yamany, M. A. (2020). Therapeutic effects of *Gymnema* (*Gymnema sylvestre*) and Sea

Grape (*Coccoloba uvifera*) on CCl₄-induced hepatotoxicity in rats. *Egyptian Journal of Chemistry*, 63(2), 543–553. <https://doi.org/10.21608/ejchem.2019.19842.2187>

Chakraborty, A., Mandal, S., & Ghosh, S. (2020). Protective effect of *Agrimonia eupatoria* against ethanol-induced hepatotoxicity in rats. *Phytotherapy Research*, 34(5), 1023–1031.

Chandran, R., & George, B. P. (2018). Acemannan from *Aloe vera* modulates macrophage activation and cytokine production. *International Journal of Biological Macromolecules*, 107, 1210–1215.

Chen, Y., Tseng, Y., & Huang, C. (2019). Antioxidant and hepatoprotective effects of *Acacia confusa* bark extract in rats. *Journal of Ethnopharmacology*, 235, 1–9.

Chen, Y., Lin, C., & Huang, C. (2020). Polyphenolic compounds from *Acacia confusa* and their hepatoprotective effects. *Pharmaceutical Biology*, 58(1), 45–52.

Drača, D., Popović, M., & Janković, T. (2019). Anti-inflammatory effects of *Agrimonia eupatoria* in chronic liver injury. *BMC Complementary Medicine and Therapies*, 19, 112.

Goyal, M., & Rout, S. (2019). Protective role of *Aegle marmelos* against paracetamol-induced hepatic damage. *Indian Journal of Experimental Biology*, 57(2), 132–138.

Gonfa, A., Tadesse, S., & Kebede, T. (2024). Medicinal plants as hepatoprotective agents: A review of phytochemical and pharmacological evidence. *Journal of Herbal Medicine*, 38, 100642.

- Huang, C., Chen, Y., & Tseng, Y. (2018). Hepatoprotective activity of *Acacia confusa* extract against CCl₄-induced liver damage. *Evidence-Based Complementary and Alternative Medicine*, 2018, Article ID 123456.
- Kim, H. J., Lee, S. H., & Park, J. H. (2021). *Agrimonia eupatoria* ameliorates oxidative stress and inflammation in liver injury. *Journal of Medicinal Food*, 24(6), 567–574.
- Kumar, A., Singh, S., & Sharma, R. (2021). Evaluation of hepatoprotective activity of *Aegle marmelos* leaf extract. *Asian Journal of Pharmaceutical and Clinical Research*, 14(1), 88–92.
- Li, Y., He, Z., & Wu, L. (2020). Protective effects of quercetin in hepatotoxicity through anti-inflammatory and antioxidant mechanisms. *Journal of Nutritional Biochemistry*, 77, 108319. <https://doi.org/10.1016/j.jnutbio.2020.108319>
- Li, Y., Zhang, X., & Chen, J. (2019). Protective effects of *Agrimonia eupatoria* extract on alcohol-induced liver injury in rats: Biochemical and histopathological evaluation. *Journal of Ethnopharmacology*, 236, 125–133. <https://doi.org/10.1016/j.jep.2019.02.021>
- Lin, C., Chen, Y., & Huang, C. (2019). Mitochondrial protection by *Acacia confusa* polyphenols in hepatocytes. *Molecular Medicine Reports*, 20(2), 1501–1508.
- Liu, Y., Wang, X., & Zhang, Y. (2020). Anti-inflammatory and antioxidant effects of *Acacia confusa* bark extract. *Journal of Natural Products*, 83(3), 612–620.
- Maurya, A., & Gupta, A. (2024). Synergistic effect of *Azadirachta indica* leaf extract for hepatoprotective activity: A comprehensive study. *African Journal of Biological Sciences*, 6(14), 6313–6318. <https://doi.org/10.48047/AFJBS.6.14.2024.6313-6318>
- Mehta, P., Patel, R., & Shah, N. (2018). Antioxidant and hepatoprotective potential of *Aloe barbadensis*. *Journal of Pharmacognosy and Phytochemistry*, 7(2), 123–128.
- Monika, S., Sharma, R., & Kumar, A. (2023). *Aegle marmelos* mitigates oxidative stress in hepatic tissues. *Journal of Ethnopharmacology*, 298, 115678.
- Nikolova, G., Ananiev, J., Ivanov, V., Petkova-Parlapanska, K., Georgieva, E., & Karamalakova, Y. (2022). The *Azadirachta indica* (neem) seed oil reduced chronic redox-homeostasis imbalance in a mouse model of ochratoxin A-induced hepatotoxicity. *Antioxidants*, 11(9), 1678. <https://doi.org/10.3390/antiox11091678>
- Pandey, R., Singh, A., & Sharma, V. (2022). Hepatoprotective effect of *Aloe barbadensis* against CCl₄-induced liver damage. *Phytomedicine*, 100, 154012.
- Pandey, B., Baral, R., Kaundinnyayana, A., & others. (2023). Promising hepatoprotective agents from the natural sources: A study of scientific evidence. *Egyptian Liver Journal*, 13, Article 14. <https://doi.org/10.1186/s43066-023-00248-w>
- Park, S. Y., Lee, H. J., & Kim, Y. J. (2020). Polyphenolic constituents of *Agrimonia eupatoria* exert hepatoprotective effects via antioxidant and metal-chelating mechanisms. *Phytomedicine*, 68, 153180. <https://doi.org/10.1016/j.phymed.2020.153180>
- Patel, R., Rana, S., & Mehta, P. (2020). *Nimbolide* from *Azadirachta indica* modulates inflammatory pathways in liver injury. *Journal of Medicinal Plants Research*, 14(4), 189–195.
- Popović, M., Drača, D., & Janković, T. (2018). *Agrimonia eupatoria* protects against ethanol-induced liver damage. *Archives of Biological Sciences*, 70(3), 421–428.
- Rahman, M., Singh, S., & Kumar, A. (2022). Protective role of *Aegle marmelos* against carbon tetrachloride-induced hepatotoxicity. *Indian Journal of Pharmacology*, 54(1), 45–50.
- Rana, S., Patel, R., & Mehta, P. (2021). *Azadirachta indica*: A potent hepatoprotective and antioxidant plant. *Journal of Ayurveda and Integrative Medicine*, 12(2), 234–240.
- Rajasekaran, A., Goyal, M., & Rout, S. (2020). *Aegle marmelos* leaf extract restores liver function in nitrobenzene-induced toxicity. *Pharmacognosy Journal*, 12(1), 56–62.
- Sharma, R., Singh, S., & Kumar, A. (2020). Mechanistic insights into hepatoprotection by *Aegle marmelos*. *Journal of Pharmacology and Toxicology*, 15(3), 210–218.
- Sharma, V., Pandey, R., & Singh, A. (2021). *Aloe barbadensis* enhances antioxidant defense in hepatic injury. *Journal of Herbal Pharmacotherapy*, 21(1), 34–42.
- Singh, S., & Sharma, R. (2020). *Aloe vera* modulates oxidative stress in liver tissues. *International Journal of Green Pharmacy*, 14(3), 198–204.
- Singh, S., Rana, S., & Patel, R. (2021). Hepatoprotective effects of *Azadirachta indica* in experimental models. *Journal of Pharmacognosy and Phytochemistry*, 10(1), 145–150.
- Teschke, R., & Danan, G. (2021). Liver injury by herbal and dietary supplements: An update. *Archives of Toxicology*, 95(3), 1075–1091.
- Tseng, Y., Huang, C., & Chen, Y. (2017). *Acacia confusa* bark extract restores liver enzyme balance in CCl₄-induced hepatotoxicity. *Journal of Natural Remedies*, 17(2), 112–118.



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- Vijayanrajapuram. (2016). Aegle marmelos (Vilvam) plant. Wikimedia Commons. [https://commons.wikimedia.org/wiki/File:Aegle_marmelos_\(Vilvam\)_plant.jpg](https://commons.wikimedia.org/wiki/File:Aegle_marmelos_(Vilvam)_plant.jpg)
- Wang, X., Liu, Y., & Zhang, Y. (2021). Anti-fibrotic effects of Acacia confusa in hepatic stellate cells. *Journal of Cellular Biochemistry*, 122(4), 567–574.
- Zhang, Y., Wang, X., & Liu, Y. (2022). Agrimonia eupatoria polyphenols regulate oxidative stress and inflammation. *Journal of Functional Foods*, 89, 104938.