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Exploring the hepatoprotective roles of *kasni* (*Cichorium intybus*) and *behidana* (*Cydonia oblonga*) in non-alcoholic fatty liver disease: A traditional approach to a modern epidemic: A comprehensive review

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Abstract
Non-Alcoholic Fatty Liver Disease (NAFLD) is a rapidly growing global health concern characterized by excessive fat accumulation in the liver often associated with metabolic syndrome, obesity and diabetes. Conventional pharmacological treatments for NAFLD remain limited, prompting interest in traditional medicinal plants with hepatoprotective potential. This comprehensive review explores the roles of *Kasni* (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*)—two botanicals widely used in Unani and other traditional systems—in managing NAFLD. Preclinical and clinical evidence highlights their antioxidant, anti-inflammatory, lipid-lowering and insulin-sensitizing properties which collectively contribute to liver protection and metabolic improvement. Despite promising outcomes, challenges such as lack of standardized extracts, limited large-scale clinical trials and safety data hinder their wider clinical acceptance. Integrating traditional knowledge with modern hepatology, supported by rigorous research and digital health innovations, could pave the way for these botanicals as safe, effective adjunct therapies in NAFLD. This review discusses current scientific findings, clinical evidence and future research directions to facilitate evidence-based incorporation of *Kasni* and *Behidana* into contemporary liver disease management.

Keywords: Non-alcoholic fatty liver disease, *Kasni* (*Cichorium intybus*), *Behidana* (*Cydonia oblonga*), hepatoprotection, traditional medicine

Introduction
N.A.F.L.D is a growing global health problem that includes fat buildup in the liver (steatosis) and more serious conditions like non-alcoholic steatohepatitis (NASH), fibrosis and cirrhosis. It is linked to metabolic syndrome, obesity, insulin resistance and type 2 diabetes mellitus, causing illness and death worldwide [1, 2]. About 25% of people globally have NAFLD, affecting both poor and rich countries and creating challenges for health systems [3]. Treatments usually involve lifestyle changes and medicines but these may not always work well and can cause side effects. Because of this many people are interested in traditional herbal medicines that protect the liver and have fewer side effects [4, 5].

NAFLD happens when too much fat gathers in liver cells (hepatocytes) of people who drink little or no alcohol [6]. It develops from many causes, including genes, environment and metabolism problems like insulin resistance, oxidative stress, poor mitochondrial function and long-term mild inflammation [7]. The disease often grows quietly and is detected late when serious problems like cirrhosis or liver cancer appear [8]. NAFLD is the main cause of chronic liver disease worldwide, affecting 20-30% of people in Western countries and rising in Asia and India [9, 10]. No approved drug treats NAFLD yet, so new safe and effective medicines are needed.

Traditional plants like *Kasni* (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*) have been used in Indian Unani and Ayurvedic medicine to support liver health, digestion and body cleansing [11]. *Kasni* contains flavonoids, phenolic acids, inulin and sesquiterpene lactones that reduce oxidation, fight inflammation and control body fats [12]. Studies show *Kasni* lowers liver fat buildup, oxidative damage and regulates fat metabolism [13].

Behidana seeds have mucilage, polyphenols and tannins that calm inflammation and protect the liver, also helping stomach problems [14]. These plants balance the whole body, not just ease symptoms [15].

Modern science confirms their benefits by studying how these plants affect molecules like nuclear receptors (PPAR-α, FXR), reduce inflammatory chemicals (TNF-α, IL-6) and increase antioxidants (SOD, CAT, GPx) [16, 17]. Combining traditional knowledge with new research methods like ethnopharmacology, molecular science and clinical trials helps prove herbal safety and effectiveness [18, 19]. Advances in phytochemistry, metabolomics and systems biology reveal how plant compounds work together [20]. This is useful for NAFLD because these plants can target many disease causes at once, unlike some drugs [21].

There is rising interest in using traditional liver protectors alongside modern medicine to prevent disease and personalize treatment [22]. *Kasni* and *Behidana* are safe by long use and recent studies, making them good choices for NAFLD treatment [23]. However, research faces challenges due to variations in plant sources, extraction methods and chemical content, making consistent results hard [24]. Lack of standard formulas and strong clinical trials limits wider medical use [25]. NAFLD needs diverse research methods like genomics, metabolomics and clinical studies for full understanding [26].

New experimental models, such as animals with diet-induced NAFLD, cell studies and imaging techniques, help measure liver fat and inflammation better [27]. Digital health and artificial intelligence tools help analyze data, predict outcomes and create personalized herbal therapies, opening new opportunities for combining traditional medicine with modern liver care [28].

Objectives of the Review

In this detailed review, we want to do the following:

1. Look at how *Kasni* (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*) have been used before and what their medicine effects are for protecting the liver (hepatoprotective agents).
2. Study the recent experiments and medical tests that show how they help stop and treat NAFLD.
3. Find out how they work at the tiny molecular level to protect the liver, including fighting harmful substances (antioxidant), lowering swelling (anti-inflammatory) and controlling body processes (metabolic regulatory pathways).
4. Point out problems and missing information in current research and suggest ideas for using these old plants in new ways to treat NAFLD.

Table 1: Comparative Overview of *Kasni* and *Behidana* in the Management of NAFLD

Aspect	***Kasni* (*Cichorium intybus*)**	***Behidana* (*Cydonia oblonga*)**
Traditional Name	*Kasni* (Unani and Ayurvedic systems)	*Behidana* (Unani system)
Common Name	Chicory	Quince seed
Plant Part Used	Leaves, roots, seeds	Seeds
Major Bioactive Compounds	Inulin, flavonoids, phenolic acids, sesquiterpene lactones	Mucilage, polyphenols, tannins
Traditional Use	Liver tonic, digestive aid, anti-inflammatory	Liver support, gut soothing, demulcent
Primary Pharmacological Actions	Antioxidant, anti-inflammatory, hepatoprotective, lipid-lowering	Anti-inflammatory, antioxidant, hepatoprotective
Mechanism of Action (Modern Insight)	- Enhances antioxidant enzymes (SOD, CAT, GPx) - Regulates lipid metabolism via PPAR-α - Reduces TNF-α and IL-6	- Protects against oxidative stress - Stabilizes hepatocyte membranes - Reduces liver inflammation and steatosis
Experimental Evidence	- Reduces hepatic steatosis in NAFLD models - Lowers ALT, AST levels - Improves insulin sensitivity	- Protects against CCl_4-induced liver injury - Improves liver histopathology - Reduces liver enzyme elevation
Clinical Relevance in NAFLD	Promising multi-targeted approach for steatosis and inflammation	Potential adjunct therapy for liver inflammation and fibrosis
Safety Profile	Generally safe in traditional doses; some reports suggest good tolerance	Considered safe; traditional use supports tolerability
Research Gaps	Standardization, clinical trials, long-term safety	Clinical validation, dose-response studies, molecular pathway exploration

Traditional uses and pharmacological profile of *kasni* (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*)

Kasni (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*) have been used for a long time to keep the liver healthy and treat liver problems. They are important in Unani, Ayurveda and folk medicine because they help detoxify the body, protect the liver (hepatoprotective) and improve digestion. Their value is shown by their use in old medical books and many communities [29, 30]. *Kasni*, also called chicory, has a bitter taste (Murr) that helps the liver work and makes bile (Safra) which aids digestion and removes toxins [31]. People use *Kasni* leaves and roots as boiled drinks (decoctions or infusions) to treat jaundice, upset stomach (dyspepsia) and liver swelling [32]. *Kasni*'s cold and dry nature (Mizaj) helps cool heat and swelling in the liver [33]. It also helps with spleen issues and slow digestion [34]. *Behidana* or quince seed, is softening (demulcent) and reduces swelling (anti-inflammatory). Its sticky part calms the stomach and supports the liver by reducing irritation and helping detox [35]. It is used as powder or sticky extract for long-term liver diseases, stomach ulcers and swelling [36]. *Behidana*'s cold and moist nature works with *Kasni* to cool dry, hot liver problems [37].

Phytochemical constituents, evidence and safety

Kasni and *Behidana* have strong healing compounds. *Kasni* contains inulin (a prebiotic fiber), flavonoids like quercetin and kaempferol, chicoric acid (a phenolic acid) and sesquiterpene lactones that reduce oxidation and swelling, protecting the liver [38, 39]. *Behidana* seeds have polysaccharides, tannins and polyphenols that fight harmful free radicals and protect body cells [40]. Its sticky mucilage

protects the stomach lining and lowers liver stress from toxins [41]. Animal tests show *Kasni* extract lowers liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST) and reduces oxidative stress [42]. *Behidana* seed extract reduces liver damage by lowering fat damage (lipid peroxidation) and swelling [43]. Early human trials suggest *Kasni* may help people with NAFLD by improving liver function and blood fat levels [44]. Less is known about *Behidana* in humans, so more studies are needed [45]. Both plants are safe in correct amounts, with low short-term toxicity seen in animals [46]. Still, long-term safety studies and careful monitoring (pharmacovigilance) are needed before wide medical use [47].

Table 2: Traditional Uses and Pharmacological Profile of *Kasni* and *Behidana*

Aspect	*Kasni* (*Cichorium intybus*)	*Behidana* (*Cydonia oblonga*)
Traditional Uses	• Used in Unani, Ayurveda and folk medicine • Liver detoxification and support • Treats jaundice, dyspepsia, liver swelling • Improves bile (Safra) production and digestion • Also used for spleen issues and sluggish digestion	• Used traditionally in Unani and folk medicine • Calms stomach and supports liver detoxification • Treats long-term liver diseases, ulcers and inflammation
Nature (Mizaj)	Cold and dry	Cold and moist
Preparation Forms	Decoctions and infusions from leaves and roots	Powder and mucilage extract from seeds
Phytochemical Constituents	• Inulin (prebiotic fiber) • Flavonoids: quercetin, kaempferol • Chicoric acid, sesquiterpene lactones	• Polysaccharides • Tannins and polyphenols • Mucilage (soothing to mucous membranes)
Pharmacological Effects	• Antioxidant, anti-inflammatory, hepatoprotective • Reduces liver enzyme levels (ALT, AST) • Helps in NAFLD (N.A.F.L.D) in early human studies	• Antioxidant, demulcent, anti-inflammatory • Reduces lipid peroxidation and inflammation • Needs more human research
Safety Profile	• Low short-term toxicity in animal studies • Considered safe in correct amounts • Long-term human safety needs more research (pharmacovigilance recommended)	• Low short-term toxicity in animal studies • Considered safe in correct amounts • Long-term human safety needs more research (pharmacovigilance recommended)

Mechanisms of action of *Kasni* and *Behidana* in N.A.F.L.D

N.A.F.L.D is a condition where fat builds up in the liver, causing problems like insulin resistance, oxidative stress and mild long-term inflammation [48]. Because some medicines have limits or side effects, natural plants like *Kasni* (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*) are used to protect the liver. They act on important molecular parts connected to NAFLD, such as harmful molecule stress, inflammation, fat metabolism and insulin function [49].

Kasni contains antioxidants like chicoric acid, luteolin and esculetin that remove harmful free radicals and increase natural antioxidants in the body [51]. It boosts enzymes such as superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) which lower fat damage and protect the liver from injury caused by reactive oxygen species (ROS) [52]. *Behidana*'s sticky extract has tannins and polyphenols that also remove free radicals. It lowers malondialdehyde (MDA), a sign of fat damage and raises antioxidant enzymes in the liver [53]. These actions protect liver cells (hepatocytes) and keep mitochondria working well which is very important in NAFLD [54].

Long-term liver inflammation worsens NAFLD. *Kasni* and *Behidana* reduce inflammation by lowering molecules called cytokines like tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6) and nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) [55]. *Kasni* blocks NF-κB activation, lowering inflammation in liver cells [56] and reduces TNF-α and IL-1β in animals with better liver health [57]. *Behidana* lowers inflammation by reducing COX-2 and inducible nitric oxide synthase (iNOS) and stops inflammatory cells from entering the liver [58]. This reduces liver swelling and the chance of scarring (fibrosis) linked to NAFLD [59].

Regulation of lipids, insulin sensitivity and liver protection

NAFLD causes fat (triglycerides) to build up in liver cells due to more fat making and less fat burning. *Kasni* controls fat by changing genes involved in fat production and breakdown [60]. It activates peroxisome proliferator-activated receptor-alpha (PPAR-α), helping burn fat and lowering liver fat [61].

Kasni also lowers sterol regulatory element-binding protein-1c (SREBP-1c) which helps make triglycerides [62]. This improves blood fat levels, reducing cholesterol, LDL and triglycerides [63]. *Behidana* also lowers fat in animal studies, probably by reducing fat absorbed in the gut and improving fat removal from the liver [64, 65].

Insulin resistance causes problems in NAFLD. *Kasni* improves insulin sensitivity by activating AMP-activated protein kinase (AMPK) which helps cells use sugar and lowers sugar production in the liver [66]. It raises insulin receptor activity (IRS) and glucose transporter 4 (GLUT4), helping insulin work better in the liver and body [67]. This helps control blood sugar, reduces fat entering the liver and lowers fat buildup [68].

Behidana might help insulin function due to its antioxidant and anti-inflammatory effects that protect insulin receptors but more research is needed [69].

In later NAFLD stages, liver cells get damaged and scar tissue (fibrosis) forms. *Kasni* stops fibrosis by blocking liver stellate cell activation and lowering collagen buildup [70]. It lowers transforming growth factor-beta (TGF-β) which causes scarring [71]. *Behidana* protects liver cells and helps them repair. Studies show it keeps cells healthy, lowers cell death (necrosis) and supports liver cell growth by improving protein production and survival [72].

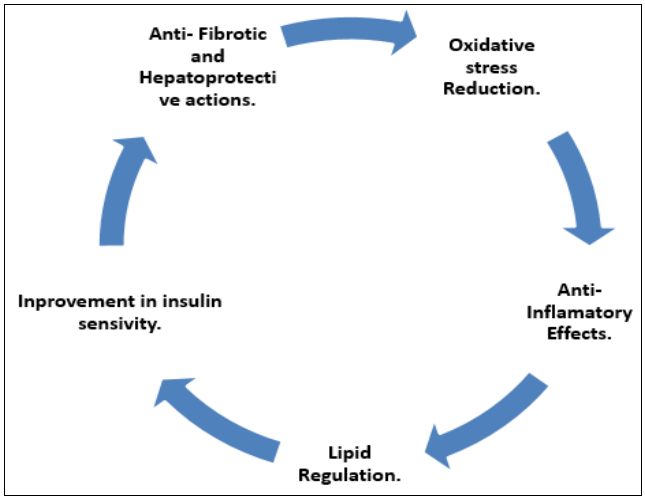

Fig 1: Mechanisms of Action of *Kasni* and *Behidana* in NAFLD

Clinical studies and evidence-based evaluation

Kasni (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*) have been used traditionally but scientific studies are needed to prove their effects on N.A.F.L.D (NAFLD). Some early clinical studies show that both plants help improve liver enzyme levels, blood fats and other health markers in NAFLD patients.

However, many studies had small numbers of people, different doses and no standard extract forms, so more strong and well-designed trials are needed [73-77]. Several studies on *Kasni* show it helps lower liver enzymes ALT and AST, reduces triglycerides and improves liver fat and general health. For example one study gave NAFLD patients 1,000 mg of *Kasni* extract daily for 8 weeks and found clear improvements compared to a placebo [73]. Another trial with 72 patients using 500 mg twice daily for 12 weeks showed better liver enzyme levels, cholesterol and blood sugar, without side effects [74]. A review of six studies also found *Kasni* helped liver health and weight loss [75].

For *Behidana*, fewer studies exist but results are encouraging. A small study gave patients quince seed syrup for 6 weeks and found lower ALT and AST levels and better digestion [76]. Another study showed *Behidana* worked well with the liver medicine Silymarin to improve liver enzymes [77]. Still, large, controlled trials are missing.

Safety and limitations of clinical research

Both *Kasni* and *Behidana* appear safe in the studies done so far. Most people did not have serious side effects. Some taking *Kasni* had mild stomach discomfort that went away on its own [78]. *Behidana* was well tolerated with no harmful effects on liver or kidneys during the studies [79]. However, we do not have enough long-term safety data or information on special groups like pregnant women or children.

The main problems in these studies include small patient groups, short study times (6 to 12 weeks) and differences in doses and types of herbal extracts used. Also many studies did not use placebos or proper blinding which can cause bias. Without standard extracts it is hard to know the best dose or how exactly these plants work [80].

To be sure *Kasni* and *Behidana* can be safely and effectively used for NAFLD, more big and well-planned studies are needed.

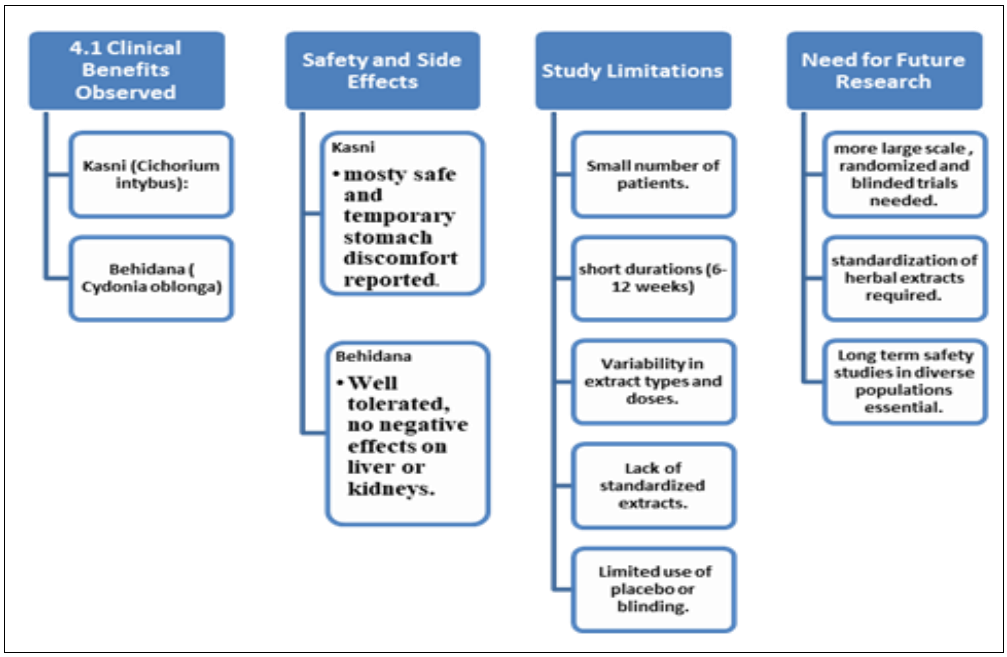

Fig 2: Clinical Studies and Evidence based Evaluation.

Integrative discussion and future directions

N.A.F.L.D is increasing worldwide, so people need safe and easy treatments. *Kasni* (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*) are traditional plants used for liver health in Unani and Ayurvedic medicine [81]. They help the liver by lowering enzyme levels, improving blood fats and controlling blood sugar which matches modern knowledge about NAFLD. *Kasni* is known as a "cooling" liver herb while *Behidana* is mucilaginous and anti-inflammatory. Both work on different parts of the disease: *Kasni* mainly helps with fat and insulin and *Behidana* protects the stomach lining and fights oxidation [82, 83]. Together, they may work better in combination, as used in traditional and modern medicine.

However, more proof is needed before doctors can fully accept these plants. Herbal medicines often have different amounts of active ingredients and unclear doses [84]. To fix this future research should use good manufacturing methods and standardized extracts that measure important compounds like chicoric acid or mucilage [85]. Large, well-designed clinical trials with many patients should test their effects on liver health, including liver tissue changes and quality of life [86]. Modern tests like liver elastography and blood markers (CK-18, FGF21) can check how well the treatment works [87]. It is also important to study if these herbs safely work with other medicines, especially in patients with diabetes or high blood pressure [88].

There is also growing interest in using *Kasni* and *Behidana* together with modern medicines like metformin or vitamin E to improve results and lower side effects. These plants could help mild NAFLD patients or those who cannot take regular drugs [89]. With the rise of nutraceuticals and healthy foods, products like chicory root powder or *Behidana* syrups could be used to prevent NAFLD and support healthy living [90]. These new forms must meet safety rules to be accepted by many people.

In countries where Unani medicine is popular, such as India and Iran, government health plans should support clinical research and safety checks. Digital tools like AI, telemedicine and apps can help track liver health and give personalized herbal advice based on patient temperament (Mizaj) and history [91]. Cooperation between research groups, herbal companies and universities will help make these traditional herbs accepted worldwide.

Future Research Directions

Future studies should compare traditional herbal drinks and modern extracts to find which works better. Using new technologies like genomics and metabolomics can find exactly how these plants work and who benefits most. Scientists should improve herbal formulas to help the body absorb important parts like polyphenols and mucilage. Long-term studies are needed to see if these herbs can stop NAFLD from getting worse or help heal liver scarring. Surveys of people who use these herbs can show how common their use is and how safe people think they are.

With careful research and rules, *Kasni* and *Behidana* can move from old home remedies to proven treatments that help fight the growing problem of NAFLD.

Conclusion and Recommendations

N.A.F.L.D is increasing worldwide, linked to problems like metabolic syndrome, obesity and diabetes. This shows the need for safe, affordable and multi-purpose treatments. Traditional Unani plants like *Kasni* (*Cichorium intybus*) and *Behidana* (*Cydonia oblonga*) offer hope by combining old knowledge with new scientific proof. Studies on cells, animals and early human trials show that *Kasni* and *Behidana* protect the liver, reduce oxidation and inflammation, lower blood fats and improve insulin use. *Kasni* is especially good at managing fat metabolism and insulin sensitivity while *Behidana* helps with antioxidants, soothing effects and protecting the stomach. Both also lower harmful inflammation and protect liver cells from damage and scarring.

However, these plants are not yet widely used in mainstream liver disease treatment because of several problems. There are few large clinical trials, unclear dosage and quality control, not enough long-term safety data and little study of how they work with regular medicines. Unani ideas like Mizaj (temperament) and Ilaj bil Dawa (drug therapy) support using these plants for long-term metabolic problems. Combining these old ideas with modern liver medicine could create new personalized liver care methods.

Key Recommendations

To improve trust and use of *Kasni* and *Behidana* in treating NAFLD, some steps are needed. First making standard extracts with known active parts like chicoric acid and mucilage and following good farming and manufacturing practices [92]. Second doing large, well-designed clinical trials with modern tools like FibroScan and blood tests to prove safety and effectiveness, including long-term follow-up for liver scarring and metabolism [93]. Third studying combinations of *Kasni* or *Behidana* with usual drugs like metformin or vitamin E and creating herbal mixes that work on many NAFLD causes. Fourth checking safety and possible interactions with other medicines, especially for patients taking many drugs [94]. Fifthusing digital tools and AI to personalize treatment based on patient data and Mizaj and tracking health with mobile apps. Lastly, supporting policies and education through AYUSH, WHO and medical schools and encouraging partnerships among traditional medicine groups, researchers and pharma companies.

By joining traditional wisdom with modern science, *Kasni* and *Behidana* can grow from local remedies into globally accepted liver treatments. Their future depends on strong research, smart integration and careful development offering a solution that respects culture and science for this serious chronic disease.

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