



“Emerging Strategies for Liver Health through Functional Support, Disease Control, and Natural Therapies”

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Abstract

The liver is a vital organ in the human body, responsible for many essential functions such as digestion, energy production, detoxification, nutrient storage, and helping the body fight infections. However, liver-related problems like fatty liver, hepatitis, and cirrhosis are becoming increasingly common due to unhealthy food habits, alcohol consumption, lack of exercise, and environmental pollution. There is a growing need for better approaches to prevent and manage liver diseases.

This article focuses on new and effective strategies to protect and support liver health. It highlights the importance of maintaining good body functions, early detection of liver issues, and the role of natural treatments in keeping the liver strong. Key preventive measures include consuming a balanced diet, engaging in regular physical activity, and avoiding harmful habits.

Natural remedies, especially herbal medicines and medicinal plants, are discussed for their proven benefits in supporting liver health and aiding recovery. The article explains how liver diseases develop, how they can be detected early, and how they can be controlled or treated through natural methods. Emphasis is placed on plants with hepatoprotective (liver-protecting) properties, drawing from both traditional systems like Ayurveda and evidence-based scientific research. By combining ancient wisdom with modern medical insights, this work aims to provide simple, safe, and effective ways to care for the liver. The goal is to promote healthier living by protecting this essential organ through mindful diet choices, lifestyle improvements, and the use of natural remedies.

Keywords: Liver health, Hepatoprotective, Liver diseases, Fatty liver, Hepatitis, Cirrhosis, Natural remedies, Medicinal plants, Functional support, and Detoxification

1. Introduction to the Liver Importance:

The liver is one of the most crucial organs in the human body, performing over 500 vital functions. It is in the upper right-hand portion of the abdominal cavity, beneath the diaphragm, and above the stomach, right kidney, and intestines. Shaped like a cone and weighing approximately 3 pounds, the liver plays a central role in maintaining overall health.

Blood Regulation: The liver is responsible for regulating many chemical levels in the blood, including glucose, amino acids, and fats. It holds about 13% of the body's blood supply at any given time, and all blood from the stomach and intestines passes through the liver for processing. The liver processes this blood, breaking down and balancing nutrients, while metabolizing drugs into safer forms for the body.

Bile Production: The liver produces bile, which helps break down fats in the small intestine during digestion. Bile also assists in the removal of waste products from the liver, making it essential for both digestion and detoxification.

Nutrient Conversion and Storage: The liver converts excess glucose into glycogen for storage and releases it as glucose when the body needs energy. It also stores vitamins and minerals like iron and releases them when needed. Additionally, the liver regulates the levels of amino acids, the building blocks of proteins.

Detoxification: One of the liver's most important functions is detoxifying harmful substances. It processes and breaks down toxins, drugs, and other chemicals, making them easier for the body to eliminate through bile or urine. It also converts poisonous ammonia into urea, which is excreted in the urine.

Blood Clotting: The liver produces proteins essential for blood clotting, which helps in wound healing and prevents excessive bleeding.

Immune Support: The liver plays a role in the immune system by producing immune factors and clearing bacteria from the bloodstream. It helps defend the body against infections and supports overall immunity.

Haemoglobin Processing: The liver processes haemoglobin from old red blood cells to extract iron, which is stored for later use in making new red blood cells.

Bilirubin Clearance: The liver clears bilirubin, a by-product of red blood cell breakdown. If the liver is not functioning properly, bilirubin accumulates in the bloodstream, causing yellowing of the skin and eyes (jaundice). The liver is a vital organ that supports many essential bodily functions, including digestion, metabolism, detoxification, immune defence, and blood regulation. Without a healthy liver, the body cannot function properly, making it crucial to maintain liver health through a balanced diet, regular physical activity, and avoiding harmful habits. Understanding the importance of the liver helps emphasize the need for preventive care and early detection of liver diseases.

1.2 Additional Points on the Importance of the Liver:

Regulation of Cholesterol Levels: The liver is responsible for producing cholesterol, which is essential for building cell membranes, producing hormones, and synthesizing vitamin D. However, it also regulates cholesterol levels by breaking down excess cholesterol to prevent heart disease and other cardiovascular issues.

Synthesis of Plasma Proteins: The liver produces a variety of plasma proteins, including albumin, which helps maintain blood volume and pressure by preventing fluid from leaking out of blood vessels. The liver also produces globulins, which play a role in immune defence.

Carbohydrate Metabolism and Glucose Regulation: In addition to storing excess glucose as glycogen, the liver is involved in maintaining stable blood sugar levels. When blood sugar

levels are low, the liver releases glucose from its glycogen stores. It can also create glucose from non-carbohydrate sources through a process called gluconeogenesis, ensuring that the body has a constant supply of energy.

Regulation of Hormones: The liver plays a significant role in hormone regulation. It helps break down excess hormones, including insulin, estrogen, and thyroid hormones, thereby maintaining hormonal balance within the body.

Fat Metabolism: The liver is involved in the breakdown of fatty acids and synthesizes triglycerides and lipoproteins that transport fat throughout the body. It also plays a role in converting fats into energy when necessary.

Liver's Role in Drug Metabolism: The liver is the primary organ responsible for metabolizing and detoxifying drugs and chemicals. It alters the chemical structure of substances to make them easier to excrete from the body, playing a vital role in the effectiveness and safety of medications.

Liver Regeneration: The liver is one of the few organs in the body that can regenerate itself after injury or damage. It has an extraordinary ability to repair and regrow damaged tissue, but this capacity is limited when subjected to chronic injury or disease, such as cirrhosis.

Bile Acid Synthesis and Detoxification: The liver not only produces bile for digestion but also synthesizes bile acids from cholesterol. These acids are essential for the emulsification and digestion of fats. Additionally, bile acids play a role in eliminating toxins and waste products from the liver.

Involvement in Metabolic Diseases: Dysfunction of the liver is often linked to several metabolic diseases, such as diabetes, obesity, and fatty liver disease. The liver's inability to regulate glucose or fat can lead to these conditions, underlining its role in maintaining metabolic balance.

Liver's Role in Nutrient Absorption: The liver works closely with the small intestine to absorb and metabolize nutrients from food, such as vitamins, minerals, and fatty acids. By processing and distributing these nutrients, the liver ensures that the body gets the nutrients it needs for energy and growth.

1.3 Additional Importance of the Liver in Human Physiology:

Hormone Regulation: The liver helps regulate hormone levels by breaking down excess hormones, such as insulin and estrogen, contributing to the balance and proper functioning of the body's endocrine system.

Drug Metabolism: The liver is the primary site for the metabolism of drugs, converting them into forms that are easier for the body to use or excrete, thus helping to regulate their effectiveness and safety.

Fat Metabolism and Energy Production: The liver converts excess glucose into glycogen for storage and can also convert fats into energy when the body needs it, helping to maintain energy balance.

Cholesterol Management: The liver produces and regulates cholesterol levels, which are crucial for building cell membranes, producing hormones, and synthesizing vitamin D.

Liver Regeneration: The liver has a unique ability to regenerate itself after injury or damage. This regenerative capacity helps the liver recover from acute damage, although it is limited in cases of chronic disease.

Nutrient Absorption Support: The liver works in tandem with the intestines to process nutrients from food. It stores and distributes vitamins and minerals to ensure that the body gets the nutrients it needs for energy, growth, and repair.

Metabolic Disease Prevention: The liver plays an important role in preventing and managing metabolic diseases, such as diabetes, obesity, and fatty liver disease, by regulating blood sugar, fat

storage, and energy utilization. These points collectively demonstrate how the liver is not only a vital organ but also integral to maintaining the body's overall health and function. Its diverse roles in detoxification, metabolism, immune support, and tissue repair make it crucial for sustaining life.

1.4 Global Concerns about Liver Diseases: A Rising Health Threat

Liver diseases are becoming a significant global concern due to increasing risk factors like rising obesity rates and alcohol consumption. These factors contribute to the growing prevalence of **non-alcoholic fatty liver disease (NAFLD)** and **alcohol-related liver disease (ALD)**, which are both major causes of **cirrhosis** and **liver cancer**. According to various health organizations, these liver conditions are leading to a substantial burden in terms of mortality, morbidity, and economic costs. Alongside lifestyle factors, **viral hepatitis**, especially **Hepatitis B and C**, continues to be a significant global threat with high infection rates in several parts of the world.

Key Concerns and Contributing Factors:

Increasing Prevalence of NAFLD and ALD:

The rise in obesity and excessive alcohol consumption are key drivers behind the increasing prevalence of **NAFLD** and **ALD**. Both conditions lead to serious liver complications such as **cirrhosis** and **liver cancer** if left untreated. **NAFLD**, often linked with metabolic disorders like diabetes and high cholesterol, is now the most common cause of liver disease in many parts of the world, including North America and Europe (Nature, 2022). Similarly, heavy alcohol consumption remains the leading cause of **ALD**, particularly in regions such as Eastern Europe and West Africa (ScienceDirect, 2021).

Viral Hepatitis: Hepatitis B and C remain major causes of chronic liver disease and death, especially in regions like **the Middle East, Northern Africa, and Asia**, where the burden of these infections is high. According to the **International Journal of Preventive and**

Clinical Applications (IJPCA, 2020), these viruses can lead to **cirrhosis** and **liver cancer** if not effectively treated.

Drug-Induced Liver Injury: The widespread use of medications, particularly in older populations, has led to an increase in **drug-induced liver injuries**, which can cause acute hepatitis and contribute to chronic liver damage.

Global Burden: Liver diseases are now one of the leading causes of death worldwide. **Cirrhosis** and **liver cancer**, including **hepatocellular carcinoma (HCC)**, contribute to a significant percentage of the global mortality rate, especially in countries such as **China, India, Japan, and Korea**, where liver cancer rates are among the highest in the world (ScienceDirect, 2021).

Limited Access to Treatment: While **liver transplantation** has shown promise in saving lives, access to specialized treatments remains limited, particularly in low-resource settings. This limits the ability to manage chronic liver diseases effectively, exacerbating the health crisis in poorer regions.

1.5 Specific Examples of Liver Diseases:

- **Non-Alcoholic Fatty Liver Disease (NAFLD):** NAFLD is linked to **obesity** and **metabolic disorders** such as insulin resistance, hypertension, and hyperlipidemia. It is the most common cause of cirrhosis in the Americas (Nature, 2022).
- **Alcohol-Associated Liver Disease (ALD):** Chronic heavy drinking contributes to **ALD**, which is a major cause of cirrhosis in regions such as **Eastern Europe, West Africa, and Central Asia** (ScienceDirect, 2021).
- **Viral Hepatitis (B and C):** Chronic infections with **Hepatitis B and C** are major causes of liver cirrhosis and liver cancer, especially in sub-Saharan Africa, Southeast Asia, and the Pacific Islands (IJPCA, 2020).

- **Hepatocellular Carcinoma (HCC):** HCC, a type of liver cancer, is a leading cause of death in people with chronic liver disease, especially in **China, Korea, India, and Japan** (ScienceDirect, 2021).

Need for Integrated Strategies for Prevention and Care:

To effectively address the rising global burden of liver diseases, **integrated strategies** for prevention, diagnosis, and treatment must be adopted. This includes a holistic approach that combines **lifestyle modifications, early screening, public health education, and innovative medical treatments**. Governments should focus on developing **national liver disease prevention programs**, while healthcare providers can work to improve awareness and early diagnosis, ensuring that individuals with liver disease receive timely and effective care. **Global partnerships and research collaboration** are key to advancing the fight against liver disease, focusing on preventive measures, affordable treatments, and access to life-saving interventions, particularly in underprivileged regions.

Growing Liver Health Problems: Liver diseases such as **fatty liver, hepatitis, and cirrhosis** are becoming more common worldwide. This increase is mainly due to changes in modern lifestyles and unhealthy habits. Today, many people consume high-fat and high-sugar diets, live sedentary lives, and are exposed to pollution and harmful substances, all of which can damage the liver (Younossi *et al.*, 2016; Zhang *et al.*, 2022).

One major concern is **Non-Alcoholic Fatty Liver Disease (NAFLD)**, which is closely linked to obesity, diabetes, and poor dietary habits. It is now the most common chronic liver disease in many countries (Younossi *et al.*, 2016). At the same time, **Alcoholic Liver Disease (ALD)** remains a significant threat, especially in areas with high alcohol consumption (WHO, 2018). Long-term alcohol use can cause liver inflammation, fibrosis, and eventually **cirrhosis**,

a condition where the liver is scarred and no longer works properly (Asrani *et al.*, 2019).

Viral hepatitis, particularly **Hepatitis B and C**, also continues to affect millions of people, especially in regions like Asia and Africa. These viruses can silently damage the liver for years before symptoms appear, leading to liver cancer or cirrhosis if untreated (WHO, 2021).

Environmental pollution, including air pollutants and industrial chemicals, is another growing cause of liver injury. Toxins in the environment can damage liver cells and contribute to chronic liver disease (Zhang *et al.*, 2022). Liver health problems are rising rapidly due to a combination of poor lifestyle choices, substance abuse, infections, and environmental factors. This highlights the urgent need for public health action and preventive strategies.

2. Purpose of the Review:

The purpose of this review is to examine and highlight effective strategies for maintaining and improving liver health. As liver diseases such as non-alcoholic fatty liver disease (NAFLD), alcoholic liver disease (ALD), hepatitis, and cirrhosis continue to rise globally, there is an urgent need to explore integrated approaches for liver protection and care. This review focuses on promoting liver health through three main aspects: supporting proper body functions (like metabolism and detoxification), encouraging early detection of liver disorders, and utilizing natural therapies, including herbal and dietary interventions.

The review aims to connect traditional knowledge with current scientific findings to offer a broad and holistic approach to liver care. It emphasizes the role of lifestyle choices such as a healthy diet, regular physical activity, and avoiding harmful substances like alcohol and processed foods. Furthermore, it reviews natural treatments, particularly medicinal plants with hepatoprotective (liver-protecting) properties, which are increasingly being studied and

validated by modern research (Banales *et al.*, 2020; Ahmed *et al.*, 2022).

By combining insights from modern medicine, traditional systems like Ayurveda, and public health strategies, this review seeks to guide both individuals and healthcare professionals toward sustainable and accessible ways of preventing and managing liver diseases.

3. Key Strategies for Liver Health:

Taking care of the liver is essential for overall health. The liver plays a major role in digestion, energy production, and removing harmful substances from the body. To keep the liver strong and healthy, the following strategies are very important:

a. Balanced Diet: Eating a healthy and balanced diet helps protect the liver. Foods like fresh vegetables, fruits, whole grains, and lean proteins provide the nutrients needed for liver function. Avoiding processed foods, excess sugar, and unhealthy fats can prevent fat build-up in the

liver. A diet rich in antioxidants and dietary fiber also supports liver detoxification and healing. For example, leafy greens, berries, garlic, and turmeric are known for their liver-friendly properties.

b. Physical Activity: Regular exercise helps maintain a healthy weight and reduces the risk of fatty liver disease. Physical activity improves blood circulation and metabolism, which supports liver function. Even 30 minutes of walking or moderate activity per day can help prevent liver damage.

c. Avoid Harmful Habits: Avoiding alcohol, smoking, and junk food is crucial. Alcohol is a major cause of liver damage and can lead to alcoholic liver disease (ALD) and cirrhosis. Smoking adds toxins that burden the liver, while unhealthy foods can lead to obesity and non-alcoholic fatty liver disease (NAFLD). By following these steps, people can protect their liver and reduce the risk of serious liver diseases (Table-1).

Table 1: Strategies for Liver Health

Strategy	Details and Examples
Balanced Diet	Fresh fruits, vegetables, whole grains, lean proteins, garlic, turmeric, green tea, reduce sugar/fats.
Physical Activity	30 mins of daily exercise (walking, cycling), supports metabolism, reduces liver fat.
Avoid Harmful Habits	No alcohol, no smoking, avoid junk food, check drug safety, limit chemical exposure.
Regular Checkups	Liver function tests (LFTs), early diagnosis of hepatitis, NAFLD, or liver damage.
Vaccination & Hygiene	Hepatitis A & B vaccines, clean water, hand hygiene to prevent infections.

4. Use of Herbal Medicines:

Many plants and herbs are known to support liver health and protect it from damage. These plants are called **hepatoprotective** because they have properties that can help prevent liver damage and

promote healing. The use of herbal medicines for liver health has been practiced for centuries in various traditional medicine systems, and modern research has confirmed their beneficial effects (Table-2).

- **Milk Thistle (*Silybum marianum*):** Milk thistle is renowned for its hepatoprotective effects, especially due to the compound **silymarin**, which has been shown to help in the regeneration of liver cells and reduce liver inflammation (Ali *et al.*, 2008).
- **Turmeric (*Curcuma longa*):** Turmeric's active compound, **curcumin**, is highly regarded for its anti-inflammatory and antioxidant properties. Research suggests it may play a role in reducing liver inflammation and promoting detoxification (Banerjee *et al.*, 2021).
- **Dandelion (*Taraxacum officinale*):** Dandelion is traditionally used to improve liver function by stimulating bile production, which aids in digestion and liver detoxification (Saeed *et al.*, 2018).
- **Andrographis (*Andrographis paniculata*):** This herb is valued for its anti-inflammatory and immune-boosting properties, making it beneficial for liver protection against damage caused by viruses and chemicals (Jadhav & Jadhav, 2017).
- **Artichoke (*Cynara scolymus*):** Artichoke promotes liver health by stimulating bile production, which enhances fat metabolism in the liver. This is particularly beneficial for conditions like fatty liver disease (Saeed *et al.*, 2018).

Table 2: Herbal Medicines for Liver Health

Herb (Scientific Name)	Active Compound(s)	Key Liver Benefits	Reference
<i>Boerhavia diffusa</i> (Punarnava)	Punarnavine, lignans	Diuretic, reduces liver inflammation, used in jaundice and ascites	Singh <i>et al.</i> , 2011
<i>Phyllanthus niruri</i> (Bhumyamalaki)	Lignans (phyllanthin, hypophyllanthin)	Antiviral (Hepatitis B), regulates liver enzymes, antioxidant effects	Patel <i>et al.</i> , 2011
<i>Glycyrrhiza glabra</i> (Licorice)	Glycyrrhizin	Anti-inflammatory, protects against chemical-induced liver damage	Asl & Hosseinzadeh, 2008
<i>Tinospora cordifolia</i> (Guduchi)	Tinosporaside, cordifolioside	Boosts immunity, detoxifies liver, used in treating hepatitis and liver disorders	Sharma <i>et al.</i> , 2012
<i>Picrorhiza kurroa</i> (Kutki)	Kutkin, picroside I & II	Stimulates bile flow, prevents fatty liver, supports liver detoxification	Dwivedi & Rastogi, 1993
<i>Embllica officinalis</i> (Amla)	Ascorbic acid, tannins	Potent antioxidant, supports liver regeneration, reduces oxidative stress	Poltanov <i>et al.</i> , 2009

How These Herbs Work

- **Antioxidant Properties:** Many hepatoprotective herbs are rich in antioxidants, which help neutralize harmful free radicals in the liver. This reduces oxidative stress, a major cause of liver damage.
- **Anti-inflammatory Effects:** Herbs like milk thistle and turmeric reduce inflammation, which can prevent further liver damage in conditions like hepatitis and fatty liver.
- **Liver Regeneration:** Certain herbs promote liver cell regeneration, helping the liver recover from damage caused by toxins, alcohol, or viruses.

5. Early Diagnosis and Prevention:

Detecting liver diseases at an early stage is very important to prevent serious health problems. Conditions like **fatty liver disease**, **hepatitis**, and **cirrhosis** often develop slowly without obvious symptoms. By the time signs appear, the liver may already be damaged. Therefore, **regular medical check-ups** are essential. Tests such as **liver function tests (LFTs)**, **abdominal ultrasounds**, and **screening for hepatitis B and C viruses** can help find problems early, when treatment is more effective.

Taking steps to prevent liver disease is just as important. These steps include:

- Getting **vaccinated against Hepatitis A and B**
- **Managing diabetes, obesity, and high cholesterol**
- **Avoiding harmful medications** or using them only under medical supervision

Early diagnosis and prevention reduce the risk of complications like **liver failure**, **liver cancer**, or the need for a **liver transplant**. They also lower medical costs and improve long-term health outcomes (Younossi *et al.*, 2019).

Spreading **public awareness** and offering **routine screenings**—especially for people at higher risk, such as those with **obesity**, **diabetes**, or a **family history of liver disease**—can greatly reduce deaths caused by liver conditions (WHO, 2022).

6. Combining Traditional and Modern Approaches

Combining traditional medical systems like **Ayurveda**, **Unani**, and **traditional Chinese medicine** with **modern scientific research** offers effective and safe ways to support and protect liver health. Traditional medicine has used **herbal remedies** for centuries to treat liver problems. Plants like *Phyllanthus niruri* (**Bhumyamalaki**), *Picrorhiza kurroa* (**Kutki**), and *Andrographis paniculata* (**Kalmegh**) are well-known in Ayurveda for their **hepatoprotective** (liver-protecting) properties.

Modern science has validated many of these traditional practices. Clinical and laboratory studies have shown that these herbs can **reduce liver inflammation**, **protect liver cells from damage**, and even **improve liver function** (Acharya *et al.*, 2022). For example, **silymarin**, extracted from **milk thistle** (*Silybum marianum*), is now widely used in modern medicine to treat liver conditions due to its antioxidant and liver-regenerating effects (Abenavoli *et al.*, 2018).

This integrated approach using **evidence-based traditional remedies** alongside **modern diagnostics and treatment** can offer a **holistic solution** to liver care. It allows people to benefit from **natural therapies** while also making use of **modern technologies** like liver function tests, imaging, and antiviral treatments. When combined properly under medical guidance, this method ensures safety, effectiveness, and a broader range of care options.

7. Conclusion:

The liver plays a vital role in maintaining overall health and protecting it should be a key priority in healthcare. As liver diseases become increasingly common due to poor diet, sedentary lifestyles, alcohol use, and environmental toxins, the need for preventive strategies has never been more urgent. A balanced diet rich in fruits, vegetables, and whole grains, regular physical activity, and avoiding harmful habits like smoking and alcohol can significantly reduce liver-related risks.

Furthermore, the integration of **natural remedies** and **traditional herbal medicines**, supported by modern research, offers promising, safe, and affordable ways to support liver health. Plants with **hepatoprotective** properties, such as *Phyllanthus niruri*, *Andrographis paniculata*, and *Silybum marianum* (milk thistle), can aid in preventing or managing liver diseases when used responsibly.

Regular screening, early diagnosis, and public awareness are equally important in reducing the global burden of liver disease. By combining traditional knowledge with modern science, individuals and healthcare systems can better prevent, detect, and manage liver disorders—ultimately leading to healthier lives and stronger communities.

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