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## Review Article

## Prevention and to stop the progression of fatty liver diseases: Evidence of ayurveda in hand

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## ABSTRACT

Fatty liver disease is a spectrum of liver disease, from a "bland" fatty infiltration to chronic hepatitis (steatohepatitis or NASH), that can result in cirrhosis, hepato cellular carcinoma and organ failure. The prevalence of fatty liver in India is 9-32% with an average of 25% in general population in India. There is no pharmacological agent being officially approved. Therefore, prevention and stop the progression of fatty liver by life style modification and Ayurveda medication are very acceptable by people now a day. Ayurveda treatment involves diet, yogic intervention, Panchakarma therapy and drug therapy. Ayurveda medication can improve the hepatic lipid metabolism, stop hepatic lipogenesis, regulate the mitochondrial dysfunction, modulate lipid metabolism by bile synthesis, modulate the hepatic inflammation through apoptosis and autophagy, correction of gut bacterial composition. The few evidences suggested to practice and generate more data for prevention and arrest the progression of fatty liver diseases.

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## 1. Introduction

Liver diseases are fast growing and being recognized as public health priorities in India. The prevalence of Fatty Liver of Alcohol(ALD) and Non-Alcohol (NAFLD) are above the burden of viral hepatitis. Although a National NAFLD control program has just been launched in 2021 that integrate liver disease control more broadly into another non communicable diseases control program.<sup>1</sup> No specific treatment of Fatty liver and only life style intervention attract the use of Ayurveda medicine and herbal supplement Worldwide. Many times Ayurveda systems are criticized by many scholars of modern medicine due to lack of evidences for safety, efficacy and standardization of herbal compounds. Still Ayurveda has high acceptance for its

unique metabolic theory (Ama), eccentric action ( block fibro genesis and hepatic regeneration ) safe and effective in many areas of hepatology.<sup>2</sup>

Fatty liver disease (steatosis) is a common condition caused by too much fat in liver. A healthy liver contains a small amount of fat. It becomes a problem when fat reaches 5% to 10% of your liver's weight. Fatty liver disease doesn't cause any serious problems or it can be preventable or arrest the progression if little efforts in lifestyle rectification and medication. The prevalence of fatty liver in India is 9-32% with an average of 25% in general population.<sup>3</sup> Nearly 6-30% cases liver inflamed (Stetohepatitis), scar tissues formed where hepatocytes damaged (Fibrosis). The genesis of scar tissues is more and replace the healthy liver tissue (Cirrhosis) and liver cannot function normally (Liver failure) and liver cancer. The burden of hepatocellular carcinoma (HCC) progressed from Cirrhosis, non-alcoholic

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fatty liver disease (NAFLD) and non-alcoholic steatohepatitis (NASH) is increasing in last decade. NAFLD-associated HCC is increasing which occurred in the absence of cirrhosis. It is commonly associated with Metabolic Syndrome, obesity, diabetes, and hyperlipidaemia. This fatty liver also associated with High blood pressure, Kidney diseases, and heart diseases.<sup>4</sup> Therefore, prevention and arrest the progress of fatty liver in highly required.

Commonly evidence based treatment is empowered clinicians and researcher's decision making in clinical practice but personalised medicine approach of Ayurveda which deals with constitutional analysis is healthy lifestyle, health promotion and sustenance, disease prevention, diagnosis and treatment are beyond the arena of Evidence based approach.<sup>5</sup> The holistic concepts of Ayurveda give emphasis to health promotion, disease prevention, early diagnosis and personalized treatment even in Liver care. Various Scholar tried to establish the Ayurveda nomenclature and treatment of liver diseases in scientific approach through evidence based procedures.<sup>6</sup>

Fatty liver is a metabolic disorders involves hormonal, nutritional, and genetic factor. Gut derived hormones, the adipose derived hormones leptin and adiponectin are suspected to play a vital role in fatty liver. High saturated fat, low fiber and carbohydrate-rich diets have been known as risk diet in Fatty liver. But diet rich in fructose and sucrose are also steogenesis. The primary sensor of GI tract (Microbata) and diet modulate the gut bacterial composition. Alcohol and some allopathic drug destroy the bacterial compositions. Some genes are identified which are involved in fatty liver independent of obesity and alcohol use.<sup>7</sup>

Central Council for Research in Ayurveda Sciences established dedicated Institute for Hepatobiliary disorders at Bhubaneswar, Odisha for more fundamental and clinical research. Ayurveda. It has entered a Memorandum of Understanding (MoUs) with JawaharLal Nehru University (JNU) and Institute of Liver and Biliary Sciences (ILBS) for more research in liver. The recent inauguration of WHO Global center for Traditional medicine at Jamnagar, India will hardness the safety and efficacy of Ayurveda in wellness, prevention, promotion and treatment.

## 2. Fatty Liver: Ayurvedic Prospective

Fatty Liver corresponds to the presence of fat in Liver, which refer as Meda(Fata) in Yakrit( Liver). So recent days authors termed as Medaja Yakrit roga.<sup>8</sup> There is a significant increase in size in fatty liver so some authors termed as Kaphaja Yakridalludara.<sup>9</sup> It is well know that fatty liver is a spectrum of diseases, so the symptoms resembles with Kaphaja Udararoga, then Pittaja and Tridoja Udara roga.

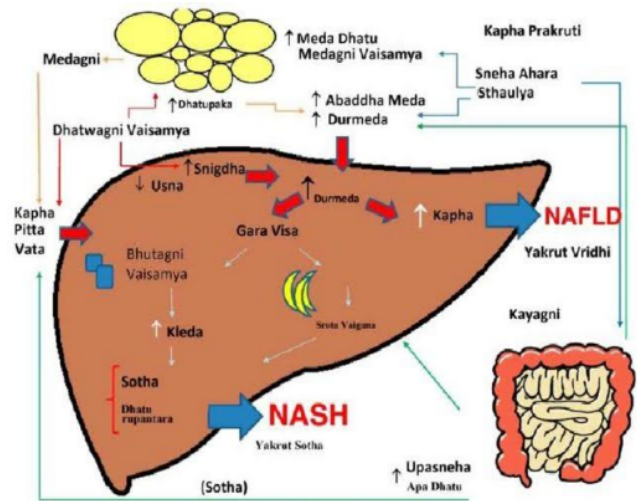
Ayurveda Scholars established the samprapti (pathophysiology) of medaja Yakrit roga which reveals that Dosha

Dhatu and Mala as basic component of body and their balanced and imbalanced state of are known as health and disease respectively. Vata, Pitta and Kapha are three humors (Tridosha) which functional aspect of living things. Dhatus are seven in number which are structural entity of body. Malas (Body waste) are waste product of Ahara (diet) and Dhatu and their proper excretion is very vital for homeostasis. Dhatvagni Paka (component responsible for tissue metabolism) is a process in which convert the Dhatu to Poshakadhatu (immobile and storage part) and Poshya Dhatu (mobile part). This Poshya Dhatu which is the moveable part circulate in its own Srotas for the nutrition of successive Dhatu whereas Poshaka part act as storage and in emergence condition can be utilized as Poshya Dhatu. Again Bhutagni Paka carried out inside the cell for various nutrients utilised for cellular function. They maintained homeostasis in the principle of Svabhava Satmya (immunity), Samanya and Vishsha (theory of homologous and analogous).The Bio energy (Bala) is important aspect in Ayurveda for the pathogenesis of any diseases. It provides strength to all Dhatu, protect them and Kostanga (organ) from Krimi (Infection) and Aghata (injury) and provide stability of different organ. It works as immune surveillance and maintain homeostasis. Dhatu Paka is a condition of suppuration or destruction of Dhatu due to excess Agni (heat) or Srotarodha (Block of passage) or Kshaya (malnutrition). The cardinal sign of Dhatupaka are Nidranasha (sleeplessness), Hrudistambha (heaviness / discomfort of chest), Vistabha (constipation), Gaurabha (heaviness of body), Aruchi (Anorexia), Arati (Anxiety or dullness) and Balahani (Loss of strength/immunity). *Dhatu Rupantara* (Change of architecture of tissues) is a stage where one Dhatu is changed to another Dhatu, Upadhatu or Mala, example - Mamsa Dhatu changed to Meda Dhatu or Mamsa Dhatu changed to Kandara. Meda is the fourth Dhatu as per Ayurveda doctrine and resemble with the adipose tissue. If the Meda Dhatvagni (Digestive power/ adipokines) deregulated than there is a disharmony of distribution of Baddha Meda (store in particular site) and Abaddha Meda (circulating fat). This Baddha Meda can be termed as Visceral fat and Abaddha Meda can be understood as circulating lipids. Durmeda is another term found in Ayurvedic literature which is nothing but Ama of Meda. Durmeda can be understood as free fatty acid. Excess Abadhha Meda / Durmeda are responsible for accumulation in any Dhatu, Srotas, Kostanga, Sira, Granthi etc. and form Gara Visha (lipotoxicity) and disease process initiated. Meda Dhatu is nourished from Sneha (fatty food) as per Madhava Nidana. Its distribution in Mamsa Dhatu as Vasa (subcutaneous fat) Updhatu and in small bones as Sarakta Meda (red bone marrow). The different components of Meda and their function are described and found all are directly or indirectly responsible for Yakrit Roga. Form this phenomena it can

be concluded that Meda can create not only as Sthyaulya (Obesity) but also organ specific disorders like - Medaja Granthi, Medaja Masurika, Medaja Galaganda, Medaja Vridhi etc. But Medaja Yakritdalludara or Yakrit Vikara is not enumerated in classical Ayurvedic literature. Strong evidence suggested that accumulation of lipids in non-adipose tissues can contribute to cellular dysfunction and cell death, a phenomenon that is called lipotoxicity. Like that due to hypo function of Jatharagni and Medodhatwagni leads to more production of Abaddha Meda and Durmeda leading to accumulation in all Srotas including Raktavaha, Mamsavaha and Medovaha Srotas. Sneha Guna in liver will increase due to accumulation of Meda as Pitta and Meda have Sneha Guna. Therefore there is deregulation of Pitta production as triggered by Sneha Guna. Another events are that more Kleda production is initiated due to reduced Ushna and more influx of Rasadhatu. Pitta is not excreted out properly due to Srotorodha (obstruction of channels). This primary situation leads to accumulation of Durmeda in Yakrit known as Medaja Yakrit Dalludara (fatty liver). The further development of the disease involves a variety of mechanisms, including Sneha Ahara, hypo function of Jatharagni, Dhatvagni, Bhutagni, Durmeda Visha (endotoxins and lipotoxicity), Sthaulya (obesity) and Kapha Prakruiti (genetic predispositions) for Dhatu Paka (necrosis of hepatocyte) and Dhatu Rupantara (Fibrosis). As Yakrit is chief organ of Raktavaha Srotas and intake of the Vidahi, Snigdha and Ushna Annapaana along with exposure to excessive sunlight and air lead to Raktavaha Srotodushti. Again it exposed to various threats of Krimi (infection) as it is a Raktakshaya and various nutrients of Ahara Rasa as literature supports that Ahara Rasa is first received by Jyotisthana (Liver) which further nourishes the whole body. Therefore Bala (Immunity) played a key role in the pathogenesis of Yakrit Vikara. The Bala of different components of Meda, its Bhautic compositions and its strength are stated. As Meda and Prakruta Kapha are same and similar properties, so they have definite role in formation of Bala. It is also found that tissue resident macrophages are serving as immune sentinels and they interact with parenchyma cells to boost immunologic well being. Adipokine released from fat cells have a definite role on regulatory T cell population, hypertrophy and hyperplasia of adipose tissue.

### 3. Hypothesis of Samprapti of Medaja Yakrit roga (Fatty Liver)

Yakrit Dalludara is the commonest complication of Udara Roga (abdominal diseases) where Yakrit (Liver) is clearly palpable due to its increase in size. Deposition of Meda / Yakritmeda is said to be one of cause of Yakrit Dalludara.



**Fig. 1:** Multiple factors hit hypothesis for samprapti pathogenesis of medaja yakrut roga

Nonalcoholic fatty liver disease (NAFLD) encompasses a spectrum of diseases that from simple steatosis (pure NAFLD) can progress to nonalcoholic steatohepatitis (NASH), cirrhosis and hepato-cellular carcinoma. NAFLD progression seems to involve the occurrence of "parallel, multiple-hit" injuries, such as oxidative stress induced mitochondrial dysfunction, endoplasmic reticulum stress, endotoxin-induced, TLR4-dependent release of inflammatory cytokines, and iron overload, among many others. These deleterious factors are responsible for the triggering of a number of signaling cascades leading to inflammation, cell death, and fibrosis, the hallmarks of NASH. Hamza El Hadi et al. published a multiple parallel hit hypothesis of NAFLD and its progression in figure which is well representation of the pathophysiology of modern medicine. In the same way the samprapti (pathophysiology) hypothesis of Medaja Yakrit Roga can be enumerate and explainable. Generally Kaphaja Prakriti (A type of genetic and epigenetic factor) person are more inclined towards excess intake of fat diet and progressively developed Sthaula (obesity). Sthaula (obesity) together with Sneha Ahara (Fatty dietary habit) and less physical exercise leads to increase Abaddha Meda (blood lipid) and vitiate the Kayagni first instant then Medagni Vaisamyam (alteration of fat metabolism). Dysfunction of Kayagni produce more Durmeda (FFA) and decrease the power of Medagni. It affects the Dhatwagni and all three Doshas are aggravated and get localized in liver. so Yakrit Vikara are Tridosaja. There is an increase of Snigdha Guna and decrease of Ushna Guna triggered to produce more Kapha inside Liver. The deposition of Kapha and Durmeda leads to Yakrut Vridhi in first instance where all symptom of Kapha are seen and our Acharya described as Kaphaja Udara so called steatosis (pure NAFLD). Further accumulation

of Durmeda leads to produce Kleda. That Kleda along with Yakrimeda<sup>10</sup> (hepatic FFA) produce Sopha (hepatic inflammation) in Yakrit and Dhatu Rupantara (Parenchymal change to hepatic stellate cells) takes place after Dhatu Paka. This condition is relatable to NASH (nonalcoholic steatohepatitis) (Figure 1). Yakrimeda (Hepatic FFA) directly block the Srotas and Srotamula of Yakrit, therefore portal hypertension and cholangitis takes place. As a result there is a blockage of intra and extra hepatic duct leads to accumulation of bile and Jaundice. If more Pitta accumulated, then *Ushna* (Heat) and *Drava* (Liquid) properties of Pitta triggered further for Dhatu Rupantara (Fibrosis) then Yakrit Kshaya (Cirrhosis) takes place in one way and Yakrutdalludara (Hepato cellular carcinoma) in other ways or both. Ayurveda literature says all Udara Roga (Hepato biliary disorders) converted to Jalaodara. If all Srotas are involved then various complication like - Portal hypertension, Variceal bleeding, Hepatic encephalopathy, hepato renal syndrome, Ascites etc. takes place.

#### 4. Diagnosis and Assessment

Diagnosis of fatty liver is based on a combination of clinical factors and liver imaging. Clinical assessment involves a detailed alcohol consumption history, examination of personal and family metabolic risk factors, medication history (including supplements) and serologic testing. Serologic tests and biomarker panels, ultrasound transient elastography (TE), and MRI elastography (MRE) can be used to stage fatty liver. The most validated biomarker panel is the liver Fibrosis Score (NFS) which calculates probability of advanced fibrosis based on readily available clinical data: age, BMI, AST, ALT, platelets, albumin, and presence or absence of impaired fasting glucose. Liver biopsy is the gold standard diagnostic tool and assessment of Fatty liver.<sup>11</sup>

#### 5. Prevention and stop the progression of Fatty liver diseases

The mortality and morbidity of Fatty liver diseases is strongly related to Obesity but metabolic syndrome and insulin resistance play an important role, which involves intrahepatic triglyceride accumulation and inflammation. Fatty liver is a consequence of genetic predisposition interacting with environmental and behavioural factors. the exact mechanism of hepatic fat accumulation and the progression to non-alcoholic steatohepatitis (NASH) is not completely understood but reduction of intrahepatic lipid (IHL) content can arrest the progression of fatty liver. Lifestyle interventions involving both diet and physical activity can reduce the IHL upto 40% within three months. Ayurveda is a holistic care which define health is the balance of body, mind and spirit. Ayurveda includes rejuvenation, regeneration, reversible of age and diseases and self-

realization through *Panchakkarma* (detoxification), herbs, minerals, diets, exercises, yoga, pranayama( breath control or breathing exercise ) and meditation.

Digestion power (Agni) and Prakriti(constitution) is important components of Ayurveda for diet plan to prevent and cure liver diseases. Patient whose digestive power is less than they should go for liver function test and initially take *deepana*(Carminative) and *pachan* ( Digestive). The common digestive and carminative herbs are illustrated can be used for keep liver healthy. The *Kapha prakriti* people susceptible to fatty liver whereas *Pitta prakriti* people susceptible to Alcoholic Liver diseases. Stress is the subjective experience of negative emotional states coupled with physiological activation that often produces uncomfortable physical sensations, including muscle tension, elevated heart rate and blood pressure, and gastrointestinal distress and abnormal liver function test.

##### 5.1. Panchakarma Or Therapeutic detoxification

Human body produces harmful substances like- urea, carbon dioxide, ammonia, aldehydes through oxidation, reduction, conjugation and eliminates the toxins from cells or tissues through breathing process, urine, sweat and stool by the process of natural detoxification. There are ample evidences of deposition of persistence bio-accumulative toxicants (PBT) in biological fluids (Blood, urine, breast milk, adipose tissues) due to release of environmental pollutants like-xenobiotic, synthetic chemicals, heavy metals, pesticides to soil, water, air, dust and food. The term Detoxification or detox is very popular in new generation. Patients have been self-motivated for detox therapy in recent years for recovery of addiction, weight loss, liver diseases out of excess intake of alcohol and thought panacea for numerous Non communicable disorders of psycho somatic origin. The other indications of detox therapy are G.I. disorders, Auto immune disorders, chronic fatigue syndrome, endocrine disorders, liver and renal disorders. Detoxification or detox is a process of conversion of toxic parent's compounds to nontoxic metabolic or eliminate of toxin without produce any harm or injury to the patients. Panchakarma are Ayurveda procedures which expels the harmful substances through *Snehana* (oleation), *Swedana* (sweating), *Vamana*(Vomiting) *Virechana* (purgation), *Vasti* (Enema). Sometimes *Rakta mokshyana* (Bloodletting) is also practised in Panchakarma in enlargement of liver. Panchakarma can modulate the Gut bacterial composition and modulate the lipid metabolism by bile acid synthesis.<sup>12</sup>

##### 5.2. Ahara (Diet plan for Liver diseases)

Diet is one of the three pillars of body other two are nidra ( Adequate sleep) and maithuna( safe sexual practices). The different types of food components divided into three groups as per Ayurveda. The Satvika ahara ( Holy food )

is pure vegetarian food items with less spices are good for healthy food for liver. The *Rajasika* (food that stimulates the mind but also causes imbalances between the mind-body equilibrium), and *Tamasika* (food that causes laziness and is not good for body and mind) are not good for health liver. The processing methods ( Samskara or Paka)of food and food combination are very important considerations for Healthy liver. It was found that increased intake of fruits, legumes, vegetables, nuts, whole grains, eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and reduction in red meat and trans-fat, was associated with lower risk of steatosis.<sup>11</sup> Mellte rich diet can reduce the Intra hepatic Lipid in fatty liver diseases. Ayurveda Pathya( wholesome diet ) and Apathya (Unwholesome diet ) for Liver are described in recent days.<sup>13,14</sup> Mono saturated fat, high fibre and low carbohydrate- diets are advised to take whereas diet rich in fructose and sucrose are also avoided(Table 1)<sup>15</sup>

### 5.3. Yoga, Dhyana and Vyayama( Yogic posture, meditation and physical exercise

Pranayama (breathing exercise), Asana (yogic posture), and dhyana (meditation) are very popular in clinical medicine for Non-pharmacological approaches in many non-communicable diseases in past one decade. Yoga therapy has proven efficacy in obesity, pre-diabetic and correct liver function. The efficacy of Surya namaskar (sun salutation) on NAFLD is well studied with inconclusive result. The efficacy of other yogic practices like- *Kapalabhati Pranayama, Ardha matsyendrasana, Gomukhasana, Dhanurasana, Balasana* and *Dhyana* (Meditation) very useful NAFLD as well as NASH.<sup>16</sup>

Meditation is the art of efficient and adaptive management of neurobehavioral energy, with total engagement or disengagement of conscious mental processes and sensory awareness. Practice meditation over a time (minimum 12 weeks) can change perception, attention and cognition with an increase of positive attitude and energy by means of deep relaxation. It was observed that long term practice of meditation (minimum 12 weeks) decrease craving for alcohol and nicotine, decrease peer pressure and reduce physical symptoms of withdrawal. So practice of Yoga and *dhyana* can prevent the Liver disease or prevent the progression of Liver diseases.

Physical exercise in moderate intensity more than 200min per week can reduce fatty liver index, intrahepatic fat and reduce NASH.

## 6. Behavioural Changes

To promote successful lifestyle behavior change, greater emphasis is being placed on the use of evidence-informed behavior change techniques and/or brief motivational techniques. These techniques are used to increase motivation (i.e., address common misconceptions, identify

personal reasons for change and ways in which patients can successfully change their lifestyle behaviors to increase intention) and support volition (i.e., promotion of practical strategies that patients can use such as goal setting and barrier identification to plan behavioral changes and maintain changes over time). The habits of Smoking, Alcohol intake and beverages can be stopped for good result.<sup>17</sup>

## 7. Single Herb Therapy

Ayurveda herbs and products having defined biochemical active component can protect liver from oxidative stress, promote virus elimination, block fibro genesis, anti-inflammatory, immune-modulating, liver regenerating and inhibit tumour growth *in vitro* and *in vivo* studies. The important herbs are described in Tables 2 and 3 for the therapeutic uses under the supervision of Ayurveda physician as certain herbs are also hepatotoxicity.<sup>17-19</sup>

## 8. Evidence Based Classical Ayurveda classical Formulation

Numerous Ayurveda formulation are narrated in Ayurveda for Liver diseases but very less numbers are studied either in case form of fatty liver diseases. More than ten clinical trials are registered in CTRI but the Table 4 create some evidences.

## 9. Discussion

Although more than ten clinical trial are registered but few data in form of case series, cases study, pilot clinical trial. Ayurveda medication can improve the hepatic lipid metabolism, stop hepatic lipogenesis, regulate the mitochondrial dysfunction, modulate lipid metabolism by bile synthesis, modulate the hepatic inflammation through apoptosis and autophagy, correction of gut bacterial composition.

## 10. Summary

There is no pharmacological agent being officially approved. Therefore, prevention and stop the progression of fatty liver by life style modification and Ayurveda medication are very acceptable by people now a day. Ayurveda treatment involves diet, yogic intervention, Panchakarma therapy and drug therapy. More practice and data publication are the need of the year.

## 11. Source of Funding

None.

## 12. Conflict of Interest

None.

**Table 1:** Pathya( wholesome diet ) and Apathya (Unwholesome diet ) for Liver

Food items	Pathya( wholesome diet )	Apathya (Unwholesome diet )
Cereals	Rice, wheat, Mellte , Oats , Barley	New rice, rice flour,
Pulses	Green gram, Red gram, Lentil	Sesame, Chick pea, Kidney beans, black Lentin
Spices	Onion, Garlic, Clove, Black peper, curry leaf , Cardamum	Extra salt, Mustard, cinnamon
Fruits	Draksha, casted apple, pomegranate, apple, Kiwi, Cherry, fig, papaya	Orange, lemon, mango, watermelon, Castor apple, Mango, banana
Vegetables	Potala, snake guard, beans, Moringa, brinjal, potato, Jeevanti, punnanova, Radish, Onion, Tomato, calabash,Ivy gourd, Ash gourd, Carrot, Shalgam , beet root, Tapioca	chilly, bitter guard, pickle, pumpkin, all leafy green vegetables (Saka), sweet potato, potato, cabbage
Milk product	Ghee( Emulsified fat), Butter milk, milk( 250 -500ml), cheese,	Curd, sugar mixed milk products, paneer,
Beverages	Gomuta -30ml, Water upto 1500ml, Mutton soup,	Soda, cold drinks, salted water

**Table 2:** Common medicinal plants for prevention of fatty liver

Common Medicinal plants	Latin name	Parts use
Ajwain ( Carom seeds)	Trachyspermum ammi	seeds
Pudina (Garden mint)	Menthe spicata	leaf
Dhaniya( coriander)	Coriandrum sativum	Seed and leaf
Jeera(Cumin Seeds)	Cuminum cyminum L	seeds
Hingu (Asafetida)	Ferula asafetida	Gum or resin
Haladi (Turmeric)	Curcuma longa	root
Pana Madhuri (Fennel seeds)	Carum carvi	seeds
Rasuna (Garlic)	Allium sativum	Stem
Adraka(Zinger)	Zingiber officinale	Root
Maricha ( Piper)	Piper nigrum	Seeds

**Table 3:** Evidence based herbs in Fatty liver

Medicinal Plant	Bioactive molecule	Pharmacological effect on liver
Glycyrrhiza glabraa (Jasti madhu )	Glycyrrhizin	Anti viral, anti-inflammatory, liver protective, Anti fibrotic , anti-tumor
Bhumi Amla (Phyllanthus niruri)	phyllanthin and hypophyllanthin	Hepato-protective, antioxidant and antiviral
<i>Andrographis paniculata</i> (Kirata tikta)	andrographolide	Anti viral, anti-inflammatory, liver protective
Curcuma longa (Haridra)	Curcumin	Anti viral, anti-inflammatory, liver protective, anti cancer
Picrorrhiza kurroa (Katuki)	Kutkoside, Picroliva	Liver protective, anti cancer
<i>Tinospora cordifolia</i> (guduchi)	diterpenoid lactones, glycosides, steroids, sesquiterpenoid, phenolics	Anti fibrotic , anti-tumor, Immuno modulator, excess can induce liver injury
Swertia chirayita( Chireeta)	Ophelic acid, Amarogentin, chiratin	Anti viral, anti-inflammatory, liver protective, Anti fibrotic , anti-tumor
Berberis aristata ( Daruharidra)	Berberin	Stop progression of NASH

**Table 4:** Ayurveda formulations in Fatty liver

SN	Ayurveda formulation	Evidence source	
1.	Argyavardhini vati & Phalatrikadi Kasaya	Case series	20
2.	Potala Katu rohinjadi kasya	Case study	9
3.	<i>Ārogyavardhinī vaṭi</i> and <i>Triphalā Guggulu</i>	Clinical trial	21
4.	Sharapankhadi churna	Clinical trial	22
5.	Katukyadi churna	Clinical trial	23

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