

Asteraceae: A review of hepatoprotective plant principles

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ABSTRACT

Liver disease is one of the major causes for morbidity and mortality, which affect humans of all ages from time immortal. Plants remain an important source of new drugs, new drug leads, and new chemical entities. Herbal plants such as *Silybum marianum*, *Taraxacum officinale*, and *Spilanthes ciliate* are belonged to Asteraceae family which have been utilized as medicines for thousands of years for the treatment of various liver diseases. To perform a literature review on hepatoprotective plant, principles belong to the family of Asteraceae or Compositae. Due to their effectiveness, herbal plants have been used in the treatment of liver diseases for a long time. A number of medicinal plants belonging to the family of Asteraceae exhibit antioxidants and hepatoprotective effects and are currently available in the market for the treatment of various hepatic ailments. Undoubtedly, these plant principles have been reported to work as antioxidants, scavenging free radicals, and stabilizing properties. Hence, the present review is aimed to discuss about various anti-hepatotoxic potentials of these medicinal plants that have been tested against various experimentally induced hepatotoxicity models. The aim is to perform a literature review on hepatoprotective plant principles belonging to the family of Asteraceae or Compositae.

KEY WORDS: Antioxidants, Asteraceae, Compositae, Hepatoprotection, Liver, *Silybum marianum*

INTRODUCTION

Liver disease is one of the major causes for morbidity and mortality, which affects humans of all ages from time immortal. The World Health Organization in its recent report has pointed out that, globally, around 150 million people are affected by certain forms of chronic liver injuries.^[1] Plants remain an important source of new drugs, new drug leads, and new chemical entities. Plants have been utilized as medicines for thousands of years.^[2] Currently, there is no Food and Drug Administration approved drug or efficacious treatment for liver disease due to an incomplete understanding of the underlying pathogenesis.^[3] In search of better treatment options, many patients have turned to alternative medicines in the hopes of identifying “natural” substances with less toxicity but equal effectiveness. Herbal plants have been used for a long time due to their effectiveness in the treatment of various liver diseases.

A number of medicinal plants belonging to the family Asteraceae or Compositae exhibit antioxidants and

hepatoprotective effects and are currently available in the market for the treatment of various hepatic ailments. Undoubtedly, these plant principles have been reported to work as an antioxidant, free radicals scavenging, inhibiting lipid peroxidation, anti-inflammatory, anticarcinogenic, anti-fibrotic, and/or membrane stabilizing properties. Hence, this review summarizes some of the important hepatoprotective herbal plants of Asteraceae family, i.e., *Silybum marianum*, *Taraxacum officinale*, and *Spilanthes ciliate*.

S. MARIANUM

S. marianum (Family: *Compositae*) is commonly called “Milk Thistle.” Milk thistle has been used medicinally in Europe since the 1st Century. Pliny the Elder claimed that it was helpful in improving bile flow. It was also mentioned in the writings of Dioscorides, Jacobus Theodorus, and Culpepper.^[4] Silymarin (SIL) is a standardized extract of milk thistle fruits and seeds containing at least seven flavonolignans including silibinin (SBN), isosilibinin, silychristin, isosilychristin, and silydianin and a flavonoid, i.e., taxifolin. SBN is the predominant compound in SIL, composing 50–70%. SBN exists as a 1:1 mixture of two diastereoisomeric

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compounds, silybin A and silybin B. SBN is not only the predominant ingredient in SIL but it also is considered to be the primary active ingredient.^[5]

It has been said that the terms milk thistle, SIL, and SBN are generally used interchangeably^[6,7] although numerous pieces of knowledge of many medicinal plants have been forgotten in the Dark Ages and later reinvented, the use of milk thistle has been systematically mentioned in all important medicinal herbaria, for example, by abbess Hildegarda von Bingen (1098–1179), Hieronymus Bock (1593), Jacobus Theodorus (1664), Mattioli (1626), Valentini (1719), Von Haller (1755), and many others until the present time.

Recently, Loguercio and Festi (2011)^[6] reported that, in the past 10 years, about 12,000 scientific papers have been published on SBN and SIL and used as antioxidants, chemopreventives, and anticancer agents, especially as hepatoprotectants. SIL and SBN are powerful antioxidants as a consequence of their polyphenolic structure.^[8] SIL has been found to upregulate the activities of superoxide dismutase and glutathione (GSH) in human red blood cells,^[9] recover the immunoactivity in the lymphocytes in patients with alcoholic cirrhosis,^[10] protect blood vessels, and stabilize the membranes through the inhibition to lipid peroxidation. In addition, SBN has been found to have an effect on free iron-induced tissue damage as an ion chelator.^[11] SBN has been accepted as a potent scavenger of most free radicals, such as hydroxyl and peroxy radicals and hypochlorite ion existing neutrophils.^[12,13] In animal experiments, SIL and SBN have been shown to protect rat or mouse liver against the toxic effect of alcohol, carbon tetrachloride (CCl₄), thallium, and phenylhydrazine.^[14]

Pharmacological and therapeutic studies have shown that SBN and SIL are not toxic even at high doses, they are well tolerated and free of adverse effects, and hence, it is safe for human use.^[15,16] In European countries, SIL is widely used for protection against various hepatobiliary problems such as hepatitis, cholestasis, gallstones, cirrhosis, and jaundice.^[4,17] The German Commission E recommends it for the treatment of dyspeptic complaints, toxin-induced liver damage, liver cirrhosis, and supportive therapy for chronic inflammatory conditions of the liver.^[18]

T. OFFICINALE

T. officinale, commonly called dandelion, is a medicinal plant of the family Asteraceae (Compositae). These plants are widely distributed in the warmer temperate zones of the Northern Hemisphere and have long been used as medicinal herbs. Conventionally, root and herb from *T. officinale* Weber ex Wiggers have been used for the treatment of various hepatic ailments.^[19] Phytochemical investigations of dandelion root showed

the presence of various classes of natural compounds, phenolics, sesquiterpenes, triterpenes, and phytosterols. Intraperitoneal administration of dandelion herb and root extracts in mice showed the median lethal dose 50 of 28.8 and 36.6 g/kg body weight, respectively.^[20] Thus, the toxicity of dandelion was found to be low. Root water–ethanol extract of *T. officinale* is reported to protect the CCl₄-induced hepatic fibrosis in mice. *T. officinale* decreased the hepatic fibrinous deposits, restored histological architecture, and modulated the expression of fibrosis markers such as glial fibrillary acidic protein and alpha-smooth muscle actin.^[21] It has been reported that the antioxidant potential of *T. officinale* *in vivo* and *in vitro*. Aqueous root extract has been reported to possess the free radical scavenging activity against ethanol-induced oxidative stress in mice.^[22] Moreover, *in vitro* studies, this extract decreased the Hep G2 cell viability by 26% and significantly increased the tumor necrosis factor- α and interleukin-1 α production and induced apoptosis of these cells which indicate the anti-hepatocarcinoma potentials of this extract.^[23] Therefore, the development of dietary supplementation using *T. officinale* could be helpful to protect against alcoholic liver damage mediated by oxidative stress, and the further study with human subjects should be performed for the safe administration with potent efficacy.

GENUS SPILANTHES

S. ciliata H.B.K. (Asteraceae) is a closely related species, widely occurring in wet and marshy places in South India. It is substituted for *Spilanthes acmella*, due to its easier availability, in the treatment of liver diseases in tribal medicine. The major phytochemicals reported to present are saturated and unsaturated alkyl ketones, alkaloids, hydrocarbons, acetylenes, lactones, alkaloids, terpenoids, flavonoids, and coumarins. These phytochemical constituents are believed to be responsible for the pharmacological activity.^[24] *S. ciliata* was found to be effective against hepatic injury induced by paracetamol and CCl₄. It has been reported that therapeutic use of this plant has been effective in tribal medicine for liver ailments. Probable mechanism of the action of *S. ciliata* appears to be its effect as a free radical scavenger and inhibitor of lipid peroxidation of liver plasma membrane.^[25] Oral administration of an *S. ciliata* ethanol extract to rats before aflatoxins B1 treatment was shown to provide significant protection against toxin-induced liver damage as evidenced by a significant lowering of the activity of the hepatotoxic marker enzymes in serum and enhanced hepatic-reduced GSH level.^[26]

CONCLUSION

In light of this review, it has been confirmed that the herbal plants from the family of Asteraceae possess

immense anti-hepatotoxic potentials. In light of this review, it has been confirmed that the herbal plants from the family of Asteraceae possess immense anti-hepatotoxic potentials and the plants in the family of Asteraceae *S. marianum* and *T. officinale* has promising hepatoprotective effects by virtue of its antioxidant, membrane stabilizing and free radical scavenging activities. Hence, these plants were extensively studied for their anti-hepatotoxic potentials against various drug and chemical-induced hepatotoxicity in animal models and came out promising results. The exact mechanism for the hepatoprotective action behind these plants are remain unknown, hence further studies are warranted on these lines. Hence, further studies are warranted on these lines.

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