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NUTRITIONAL AND MEDICINAL IMPORTANCE OF *SONCHUS ASPER* (L.) HILL PLANT-A REVIEW

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Abstract

Medicinal plants have a long history of use in both crude and refined forms for treating various pathological infections and promoting human health. Among these, Sonchus asper (L.) Hill, a member of the Asteraceae family comprising approximately 1600 to 1700 genera, is particularly abundant in Pakistan, notably in regions like Balochistan, Khyber Pakhtunkhwa, Punjab, and Azad Jammu and Kashmir. This herb is valued for its medicinal properties due to its rich chemical composition, which includes alkaloids, flavonoids, quinones, phenols, terpenoids, saponins, tannins, and glycosides. These compounds confer upon it a range of health benefits, including antimicrobial, antioxidant, anti-inflammatory, and anti-cancer properties.

In addition to its chemical constituents, Sonchus asper contains essential minerals such as calcium, manganese, copper, iron, zinc, potassium, magnesium, phosphorus, and nitrogen. Furthermore, it is a source of valuable nutritional compounds, including omega-3 fatty acids and vitamin C. The plant is traditionally used in the treatment of various human diseases, with its applications spanning ailments related to the liver, kidney, bronchitis, asthma, cough, burns, wounds, heart dysfunction, diabetes, inflammation, gastrointestinal infections, cancer, and jaundice.

Keywords: *Anti-inflammatory, Antioxidant potential, Asteraceae, Pharmacological, Photochemical, Traditional medicine*

INTRODUCTION

Medicinal plants are the oldest form of drugs that have therapeutic potential and are being used in traditional medicines in many countries around the world (1). The World Health Organization (WHO) reported that eighty per cent of the world's population depends on traditional medicine (2). Plants contain various elements that can be used to cure diseases in humans and animals (3). These plants are a rich source of compounds that can be synthesized to bring improvement in pharmaceutical industries (4). Different parts are used such as flowers, barks, seeds, fruits, roots and even whole plants (5). Plant metabolites are organic compounds and are divided into primary and secondary metabolites. Primary metabolites are natural compounds beneficial to human growth and development, including glucose, starch, polysaccharides, proteins, lipids, and nucleic acids while the secondary metabolites include alkaloids, saponins, flavonoids, steroids, terpenes, glycosides, volatile oils, and tannins (6). These plants contain biologically active organic compounds, commonly called phytochemicals (7, 8). The curative power of plants is due to the fact that secondary metabolites can cure various disorders. Phytochemicals are pharmacologically active compounds including alkaloids with antispasmodic, antimalarial, and analgesic properties; terpenoids identified for their antibacterial, anticancer, anti-inflammatory, antimalarial, and antiviral properties; glycosides, which have been reported to have antifungal and antibacterial properties; flavonoids and phenols with antiallergic, antibacterial, and other characteristics. saponins are said to have antiviral, anti-inflammatory, and plant defence actions (9, 10).

Sonchus asper (L.) Hill belongs to the Asteraceae family. The Asteraceae are among the most diversified flora. It occurs effectively through the phylogeny of angiosperms in the family Asteraceae. There are approximately thirty-three thousand species known in the Asteraceae family. In addition, the Asteraceae family comprises "1600 to 1700" genera worldwide (11). Asteraceae are often called asters, daisies, or sunflowers. The name "Asteraceae" is derived from its parent genus, Aster (12). These species are frequently used as medicinal plants, indicating that Asteraceae species have great potential as bioactive products (13). Asteraceae are mostly found in arid and semi-arid subtropical climates, but they are distributed throughout the world (14). Sonchus asper is known as Dodak (Urdu) Machal, Kalamo (Balochistan), and Spiny Sowthistle (English). This plant is found in West Asia, East Asia, South Africa, North Africa, South America, North America, Europe, New Zealand (15), Australia (16), India, and Pakistan (17). This herb is most abundant in Pakistan (KPK, Punjab, AJK, and Balochistan) (18). Germination requirements for Sonchus asper can be germinated in compacted or uncompacted soil. Stratification of temperature, humidity, and light between 43°F and 77°F stimulates germination. Germination rates decreased with increasing seed burial depths; only five per cent of seeds germinated when buried under three centimeters of soil. Most seedlings appear in late spring, but some appear in the fall (19). Sonchus asper is used in Pakistan as a conventional ("folk") remedy for oxidative stress and hormonal imbalances (20). It is useful as a medicine, and it contains important chemical components which act as antimicrobials as they inhibit the growth of microbes (21). It is used in numerous human diseases including inflammation, bronchitis, asthma, cough, jaundice, heart dysfunction, cancer, gastrointestinal infections, diabetes, liver, kidney, human trauma, and burns treatment. It contains carotenoids, ascorbic acid, flavonoids, and glycosides, which have antioxidant, anti-inflammatory, and anticancer properties (22, 23).

CHARACTERISTICS

Sonchus asper is an annual and winter herb. They are 1.2 meter long; they excrete milky juice when it broken. Stems are 30 – 150cm tall, hollow, thick and unbranched. Leaves are 4 – 18cm long, many lobed and 0.5 – 5cm wide (24). It grow in variety of soils its include(brown clayey loam, white to grey sand, black sandy loam and nutrient-rich soils); it can grow in seasonally wet areas, lakes, slightly acid to alkaline soils (25).

PHYTOCHEMICALS

The word "phytochemicals is derived from the Greek word phyto, meaning plant, which means plants chemicals. Phytochemicals are biologically active compounds found in plants that are more beneficial to humans than macronutrients and micronutrients (19). All plants have specific phytochemicals, these are active components of medicinal and aromatic plant extracts and are present in the stems, bark, leaves, flowers, and roots (26). The analysis of nutritional values of *Sonchus asper* revealed the presence of phenolic compounds, flavonoids (4), carotenoids, ascorbic acid (27), vitamin C, and glycosides (24). According to Li and Yang (28), important compounds (phenols, quinones, terpenoids, alkaloids, tannins and saponins, glycosides, and flavonoids) are present in the different parts of plant (Fig. 1).

ANTIOXIDANT POTENTIAL

Antioxidant enzymes contain important role for removal of toxic in reactive oxygen species (ROS) and free radicals produced during exposure to toxic chemicals (20). Presence of the hydroxyl group and conjugated ring structures; many phenolic compounds have the capabilities to function as antioxidants by stabilizing free radicals involved in oxidative processes through hydrogenation they are stronger than vitamins E and C (29). The testing of the antioxidant potential of *Sonchus asper* extracts (Methanol, n- hexane, chloroform) were follow by DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging essay. All extract showing high antioxidant potential (30). The antioxidant properties of *Sonchus asper* are due to the presence of flavonoids and phenolic components that act as free radical terminators in antioxidant activity (6). Acetone and methanol extracts show higher content of total phenol and flavonoids (31). The report indicates that

descending order of % yield is methanol > chloroform > ethyl acetate > n-hexane, indicating that methanol contains more than % yield. Methanol extract had the highest phenolic content (4).

MINERAL

The *Sonchus asper* plant is rich in calcium, manganese, copper, iron, zinc, potassium and phosphorus; elements are 1903, 9.0 , 3.1, 29.8, 8.8, 5839 and 493 grams (28). The leaves of plant contained magnesium (88.9), potassium (2.366), phosphorus (0.297), copper (16), sodium (0.288), zinc (50) and manganese (117) mg/100 g, plant leaves also contained moisture content (89.87), crude fiber (18.33), protein (13.25), carbohydrates (41.92) and ash (18.75) values are shown in kcl/100g (32). Moreover, it also comprises apigenin-7-O-β-D-glucuronide ethyl ester, luteolin-7-O-β-D-glucoside, apigenin-7-O-β-D-glucopyranuronide, apigenin-7-O-β-D-glucuronide methyl ester, leutiolin, and germanicol acetate (25).

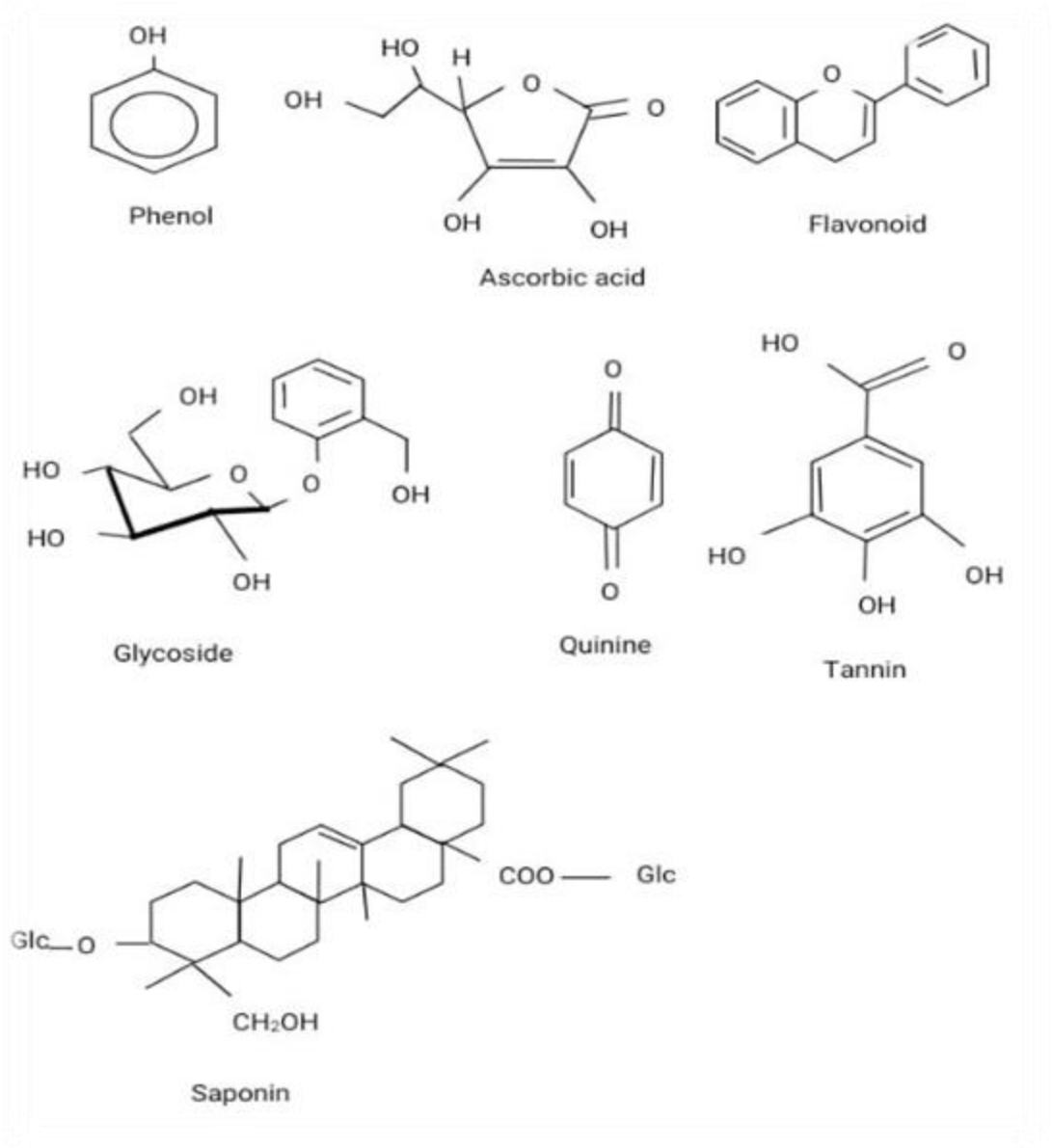

Fig. 1. Chemical structures of phytochemical compounds (28)

PHARMACOLOGY

Several pharmacological actions on the genus Sonchus have been reported (33). The leaves and seeds of the *Sonchus asper* have medicinal characteristics and are used in the development of many medicines (25). *Sonchus asper* is used for a variety of human diseases, including liver and kidney disease (34, 35); bronchitis, asthma, and cough (36, 37); burns and wounds (38-40); heart dysfunction, diabetes, inflammation, and gastrointestinal infection (41); reproductive diseases in humans (42); cancer (4, 43, 44) jaundice (45); antioxidant, antibacterial, antidepressant and blood purifying (46).

ANTIMICROBIAL ACTIVITY

Antimicrobial compounds that inhibit the growth or kill microbes such as bacteria, fungi, viruses, etc. Plants are rich sources of various secondary metabolites with curative properties (11).

ANTIBACTERIAL ACTIVITY

Several studies have been conducted showing that plant products have potent antibacterial activity. *Sonchus asper* is used in Pakistani ethno-pharmacology for various diseases (22). (33) reported Methanol and aqueous extracts of *Sonchus asper* leaves have antibacterial activity against *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Klebsiella pneumoniae*. Essential oil of *Sonchus asper* has good antibacterial properties. Different solvents of *Sonchus asper* (chloroform, methanol, and hexane) were analyzed for antibacterial activity. The antibacterial activity of *Sonchus asper* show against *Bacillus subtilis, Escherichia coli, Micrococcus luteus, Staphylococcus aureus, Klebsiella pneumonia,* and *Pseudomonas aeruginosa* was investigated using replicates (22). Aqueous leaf extract of *Sonchus asper*, exhibits good and potent antibacterial activity against bacteria potentially pathogenic to humans (47). Methanol extract of *Sonchus asper* can inhibit the growth of *Shigella flexneri, Staphylococcus aureus, Micrococcus,* and *Escherichia coli*. The methanolic extract of *Sonchus asper* had more potential to inhibit bacterial growth *Micrococcus sp., Staphylococcus aureus, Shigella flexneri*, and *Escherichia coli* (30). These chemical constituents of *Sonchus asper* show antibacterial potential by altering cell membrane permeability and inhibiting enzyme activity (27). Plant methanolic extract show high activity against *Escherichia coli, Staphylococcus aureus*, and *Pseudomonas aeruginosa.* Aqueous extract lass active against those bacteria and ethanol extract are not active (17, 22, 48).

ANTIFUNGAL ACTIVITY

Diseases caused by pathogenic fungi have been recognized as threats to public health. There are many natural and synthetic remedies used to treat fungal infections, but they are not always helpful (1) In addition, fungal resistance to most of the synthetic medicines has been noted for several years (15). Medicinal plants are also reported in traditional medicine for the treatment of fungal infections in animals and humans. The antifungal activity of the methanolic root extract of *Sonchus asper* was evaluated against *Rhizoctonia solani* (18). Previously (22) reported all parts of the plant (stem, seeds, roots, flowers, and leaves) and different extracts of plant were tested against fungi which inhibit the growth of *Aspergillus flavus, Aspergillus fumigatus, Aspergillus Niger,* and *Fusarium solani*. Butanol, aqueous and methanol extracts of *Sonchus asper* leaf show activity against *Fusarium solani* (5).

IMMUNITY AND ANTI-INFLAMMATORY EFFECT

Sonchus asper is commonly used for inflammation, as an anti-inflammatory and pain reliever. *Sonchus asper* leaf extract shows good potential against inflammatory conditions due to the presence of various flavonoids (6). Polyphenolic compounds have many properties; such as hydrolase inhibition, oxidase inhibition, free radical scavenging, and ant-inflammatory effects (25).

ANTICANCER POTENTIAL

Sonchus asper (L.) Hill methanol extract has been shown to have anticancer potential and is effective against carbon tetrachloride induced oxidative stress in the lungs (33). Hepatoprotective effect of methanolic extract of *Sonchus asper* on carbon tetrachloride (CCl4)-induced liver injury in rats. Methanol extracts reduced CCl4-induced liver injury by reducing hepatic glutathione and glutathione-S-transferase (GST), glutathione and catalase (CAT). It also restores hydrogen peroxide, nitrite, lipid peroxide, DNA fragmentation and gamma-glutamyl transferase activity to normal levels (49).

CONCLUSION

The present reports show that *Sonchus asper (L.)* Hill plants have phytochemical compounds. These phytochemicals are effective against antibacterial, antifungal, anti-inflammatory, bronchitis, asthma, cough, jaundice, heart dysfunction, cancer, gastrointestinal infections, and diabetes, liver, kidney, and burns

treatments. Different extracts of plant parts (stem, seeds, roots, flowers, and leaves) show activity against antifungal, antibacterial, anticancer, and anti-inflammatory agents.

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