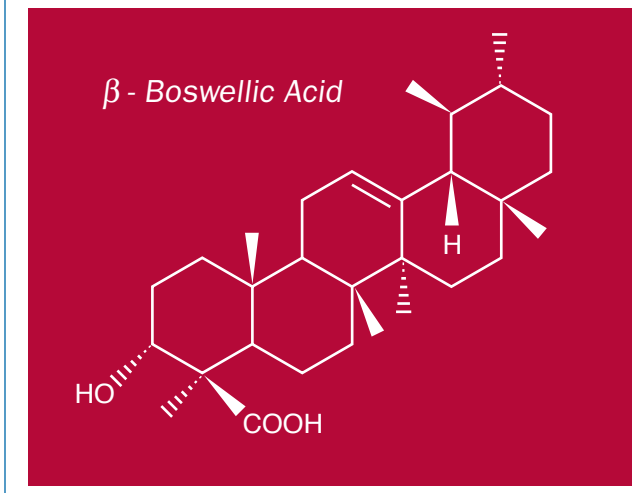
Monograph

Boswellia serrata



Description

Boswellia serrata (frankincense) is a moderate-to-large branching tree (growing to a height of 12 feet) found in India, Northern Africa, and the Middle East. Strips of Boswellia bark are peeled away, yielding a gummy oleo-resin. Extracts of this gummy exudate have been traditionally used in the Ayurvedic system of medicine as an anti-arthritic, astringent, stimulant, expectorant, and antiseptic.

Active Constituents

Boswellia contains oils, terpenoids, sugars, and volatile oils. Up to 16 percent of the resin is essential oil, the majority being alpha-thujene and p-cymene. Four pentacyclic triterpene acids are also present, with beta-boswellic acid being the major constituent.

Mechanisms of Action

Animal studies performed in India show ingestion of a defatted alcoholic extract of Boswellia decreased polymorphonuclear leukocyte infiltration and migration, decreased primary antibody synthesis,[1,2] and almost totally inhibited the classical complement pathway.[3] In an *in vitro* study of the effects of beta-boswellic acid on the complement system, the extract demonstrated a marked inhibitory effect on both the classical and alternate complement pathways.[4] An investigation of Boswellia's analgesic and psychopharmacological effects noted marked sedative and analgesic effects in animal models.[5]

In vitro testing reveals boswellic acids, isolated from the gum resin of Boswellia, in a dose-dependent manner block the synthesis of proinflammatory 5-lipoxygenase products, including 5-hydroxyeicosatetraenoic acid (5-HETE) and leukotriene B4 (LTB4),[6] which cause bronchoconstriction, chemotaxis, and increased vascular permeability.[7] Other anti-inflammatory plant constituents, such as quercetin, also block this enzyme, but they do so in a more general fashion, as an antioxidant; whereas, boswellic acids seem to be specific inhibitors of 5-lipoxygenase.[8,9]

Boswellia inhibits human leukocyte elastase (HLE), which may be involved in the pathogenesis of emphysema. HLE also stimulates mucus secretion and thus may play a role in cystic fibrosis, chronic bronchitis, and acute respiratory distress syndrome.[10,11] Boswellic acids and triterpenoids from *Boswellia serrata* also have an inhibitory and apoptotic effect against the cellular growth of leukemia HL-60 cells.[12-14]

Nonsteroidal anti-inflammatory drugs (NSAIDs) can cause a disruption of glycosaminoglycan synthesis, accelerating articular damage in arthritic conditions.[15-18] An *in vivo* animal study examined Boswellia extract and ketoprofen for effects on glycosaminoglycan metabolism. Boswellia significantly reduced the degradation of glycosaminoglycans compared to controls; whereas, ketoprofen caused a decrease in total tissue glycosaminoglycan content.[19]

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Clinical Indications

Inflammatory Bowel Disease

Ileitis

An animal study was conducted to determine the efficacy of Boswellia extract and one of its constituents, acetyl-11-keto-β-boswellic acid (AKBA), on leukocyte-endothelial cell interactions in inflammatory bowel disease.[20] Ileitis was induced in Sprague-Dawley rats via subcutaneous injection of indomethacin. The animals were then given either Boswellia or AKBA at two different doses (low or high) or placebo. It was observed that Boswellia extract and both potencies of AKBA decreased rolling (up to 90%) and adherent leukocytes (up to 98%), attenuated tissue injury scores, and significantly reduced macroscopic and microscopic inflammation of the gut mucosa.

Ulcerative Colitis

Leukotrienes are believed to play a role in the inflammatory process of ulcerative colitis. Boswellia extract (350 mg three times daily) was compared to sulfasalazine (1 g three times daily) in ulcerative colitis patients. Patients on the Boswellia extract showed better improvements than patients on sulfasalazine; 82 percent of Boswellia patients went into remission compared with 75 percent on sulfasalazine.[21]

A follow-up study of chronic colitis patients taking gum resin of Boswellia (900 mg daily in three divided doses for six weeks) and sulfasalazine (3 g daily in three divided doses for six weeks) again showed similar improvements. Furthermore, 14 of 20 patients (70%) treated with *Boswellia serrata* gum resin went into remission compared to 4 of 10 patients (40%) treated with sulfasalazine.[22]

Crohn's Disease

Chemical mediators of inflammation were addressed in a clinical trial comparing a *Boswellia serrata* extract with mesalazine in the treatment of acute Crohn's disease. The protocol population included 44 patients treated with Boswellia extract and 39 patients treated with mesalazine. Between enrollment and end of therapy, the Crohn's Disease Activity Index decreased significantly with both Boswellia extract and mesalazine. Although the difference between the two treatments was not statistically significant, the Boswellia extract proved to be as effective as the pharmaceutical.[23]

Asthma

In a 1998 study of Boswellia's effects on bronchial asthma, 40 patients took 300 mg of a Boswellia preparation three times daily for six weeks, while another 40 patients took a placebo. Seventy percent of patients taking Boswellia demonstrated significant disease improvement, measured by symptomatology and objective measures of lung and immune function; only 27 percent of patients taking a placebo improved.[24]

Arthritis

In a double-blind, placebo-controlled trial, Boswellia demonstrated beneficial effect on knee osteoarthritis. Thirty patients were given either 1,000 mg Boswellia daily or placebo in three divided doses for eight weeks. Patients in the Boswellia group experienced a significant decrease in pain and swelling and increase in range of motion compared to placebo ($p < 0.001$).[25]

In a double-blind, placebo-controlled, crossover study, Boswellia in combination with ashwagandha, turmeric, and zinc was studied in osteoarthritis patients.[26] Forty-two patients received either the herbal-mineral formulation or placebo for three months, then switched to the other protocol after a 15-day washout period for another three months. The treatment group experienced significant decreases in pain severity ($p<0.001$) and disability scores ($p<0.05$) compared to placebo. Radiological evaluation found no significant changes in either group.

A placebo (n=19) versus Boswellia (n=18) study in rheumatoid arthritis patients found no significant differences between the two groups in any measured parameters. NSAID dosage, however, decreased 5.8 percent in the treatment group and 3.1 percent in the placebo group.[27] The researchers concluded that controlled studies including a greater number of subjects are warranted.

Side Effects and Toxicity

Toxicity studies of Boswellia in rats and primates showed no pathological changes in hematological, biochemical, or histological parameters at doses up to 1,000 mg/kg. The LD_{50} has been established at >2 g/kg.[28]

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Dosage

For inflammatory or asthmatic conditions, 300-400 mg of a standardized extract (containing 60% boswellic acids) three times daily is suggested.

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